Boulder County Purchasing
1325 Pearl Street
Boulder, CO 80302
purchasing@bouldercounty.org

INVITATION TO BID
COVER PAGE

BID Number:	**7305-22**
BID Title:	SE County Hub - Metal Stud Framing and Drywall
Pre-Bid Meeting (Optional):	February 7, 2022 – 9:00 a.m. 1755 S. Public Road, Lafayette, CO 80026
BID Questions Due:	February 14, 2022 – 2:00 p.m.
Submittal Due Date:	February 22, 2022 – 2:00 p.m.
Email Address:	purchasing@bouldercounty.org
Documents included in this package:	Bid Instructions Terms and Conditions Specifications Insurance and W-9 Requirements Submittal Checklist Bid Tab Section Signature Page Sample Contract Specifications & Drawings

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INSTRUCTIONS

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1. **Purpose/Background**

Boulder County Public Works, Building Services Division is seeking competitive proposals from qualified contractors to provide labor, material, and equipment to furnish and install metal stud framing, gypsum board and gypsum board finishing at the Boulder County SE County Hub. The building core and shell is complete, and this scope of work is for interior finishes. Work is expected to begin second quarter of 2022.

2. **Optional Pre-Proposal Meeting**

An Optional Pre-Proposal Meeting will be held at the site on **February 7, 2022 from 9:00 a.m. to 10:00 a.m.** We will meet outside the main entrance of the SE County Hub Facility located at 1755 S. Public Road, Lafayette, CO 80026. Please show up at least 10 minutes early to sign in and be ready to go directly after 9:00 a.m.

3. **Written Inquiries**

All inquiries regarding this BID will be submitted via email to the Boulder County Purchasing Office at purchasing@bouldercounty.org on or before 2:00 p.m. **February 14, 2022**. A response from the county to all inquiries will be posted and sent via email no later than **February 17, 2022.**

Please do not contact any other county department or personnel with questions or for information regarding this solicitation.

4. **Submittal Instructions**

BIDs are due at the email box only, listed below, for time and date recording on or before **2:00 p.m. Mountain Time on February 22, 2022**. A bid opening will be conducted at 3:00 p.m. via email by sending a copy of the bid tab to all who have submitted a bid.

Please note that email responses to this solicitation are limited to a maximum of 50MB capacity.

NO ZIP FILES OR LINKS TO EXTERNAL SITES WILL BE ACCEPTED. THIS INCLUDES GOOGLE DOCS AND SIMILAR SITES. ALL SUBMITTALS MUST BE RECEIVED AS AN ATTACHMENT (E.G. PDF, WORD, EXCEL).

Electronic Submittals must be received in the email box listed below. Submittals sent to any other box will NOT be forwarded or accepted. This email box is only accessed on the due date of your questions or proposals. Please use the Delivery Receipt option to verify receipt of your email. It is the sole responsibility of the proposer to ensure their documents are received before the deadline specified above. Boulder County does not accept responsibility under any circumstance for delayed or failed email or mailed submittals.

Email purchasing@bouldercounty.org**;** identified as **BID # 7305-22** in the subject line.

All BIDs must be received, and time and date recorded by authorized county staff by the above due date and time. Sole responsibility rests with the bidder to see that their BID response is received on time at the stated location(s). Any BIDs received after due date and time will be returned to the bidder.

The Board of County Commissioners reserves the right to reject any and all BIDs, to waive any informalities or irregularities therein, and to accept the proposal that, in the opinion of the Board, is in the best interest of the Board and of the County of Boulder, State of Colorado.

Contractors and their employees, subcontractors, and agents must comply with all federal, state, and local laws, regulations, ordinances, orders, and codes, as well as Boulder County policies, guidelines, and protocols.

Please be advised of the following contract term required for all Boulder County contracts effective 12/1/21:

COVID-19 Vaccine Requirement for Certain Contractors of County
On September 28, 2021, the Boulder County Board of Commissioners adopted a COVID-19 vaccine requirement policy that applies to, as relevant here, all employees of independent contractors of the County that perform county work in a county facility. For purposes of this policy, “perform work in a county facility” means any employee of an independent

contractor that routinely performs more than fifteen (15) hours per month of county work that takes place in or on a county facility/property. Under the County's COVID-19 vaccine requirement policy, these individuals are required to receive a COVID-19 vaccine unless a reasonable accommodation based on medical reasons or due to a sincerely held religious belief is requested and approved. The policy requires that, by December 1, 2021, all individuals to which the policy applies must be fully vaccinated and submit proof of vaccination or have an approved reasonable accommodation in place. Therefore, beginning December 1, 2021, any employees of Contractor that perform county work in a county facility must be in compliance with the County's vaccine requirement policy unless Contractor can show proof that it is in compliance with its own COVID-19 vaccine requirement policy or is required by local, state, or federal law or regulation to be compliant with a COVID-19 vaccine requirement policy.

Americans with Disabilities Act (ADA): If you need special services provided for under the Americans with Disabilities Act, contact the ADA Coordinator or the Human Resources office at (303) 441-3525 at least 48 hours before the scheduled event.

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TERMS AND CONDITIONS

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1. Bidders are expected to examine the drawing, specifications, schedule of delivery, and all instructions. Failure to do so will be at the bidder's risk.

2. Each bidder will furnish the information required in the Invitation to Bid.

3. The Contract/Purchase Order will be awarded to that responsible bidder whose submittal, conforming to the Invitation to Bid, will be most advantageous to the County of Boulder, based on best value not only price.

4. The County of Boulder reserves the right to reject any or all bids and to waive informalities and minor irregularities in bids received, and to accept any portion of or all items proposed if deemed in the best interest of the County of Boulder to do so.

5. No submittal will be withdrawn for a period of thirty (30) days subsequent to the opening of bids without the consent of the County Purchasing Agent or delegated representative.

6. A signed purchase order or contract furnished to the successful bidder results in a binding contract without further action by either party.

7. Late or unsigned bids will not be accepted or considered. It is the responsibility of bidders to ensure that the bid arrives at the Purchasing email address prior to the time indicated in the "Invitation to Bid."

8. The proposed price will be exclusive of any Federal or State taxes from which the County of Boulder is exempt by law.

9. Any interpretation, correction or change of the bid documents will be made by Addendum. Interpretations, corrections and changes of the bid documents made in any other manner will not be binding, and bidder will not rely upon such interpretations, corrections and changes. The County's Representative will not be responsible for oral clarification.

10. Confidential/Proprietary Information: Bids submitted in response to this "Invitation to Bid" and any resulting contract are subject to the provisions of the Colorado Open Records Act, 24-72-201 et seq., C.R.S., as amended. Any restrictions on the use or inspection of material contained within the bid or resulting contract will be clearly stated in the bid and contract itself. Confidential/proprietary information must be readily identified, marked and separated/packaged from the rest of the bid. Co-mingling of confidential/proprietary and other information is NOT acceptable. Bids that do not properly identify confidential/proprietary information may be released in their entirety. Pricing totals contained in a bid are not considered confidential.

    The Boulder County Attorney's Office retains sole authority for determining whether the Colorado Open Records Act requires or permits Boulder County to disclose proposal or bid documents, or any information contained therein, pursuant to an open records request.

11. Boulder County promotes the purchase/leasing of energy efficient, materials efficient and reduced toxic level products where availability, quality and budget constraints allow. Bidders are expected whenever possible to provide products that earn the ENERGY STAR and meet the ENERGY STAR specifications for energy efficiency with power management features enabled. Bidders are encouraged to offer products and equipment with post-consumer recycled-content materials. Products should be packaged and delivered with a minimum amount of recycled packaging that adequately protects the product, but is not excessive.

12. Pursuant to Colorado law (House Bill 1292), in any bidding process for public works in which a bid is received from a non-resident bidder who is from a state that provides a percentage bidding preference, a comparable percentage disadvantage will be applied to the bid of that bidder. Bidders may obtain additional information from the Department of Personnel's website: http://www.colorado.gov/dpa/.

13. Bid Security: Boulder County may require, at its discretion, bid security for construction contracts when the price is expected to exceed $50,000 and for any other contracts as determined by Boulder County to be in its best interest. Bid security provides assurance to Boulder County that the bidder will, upon award, fulfill its bonding and contracting obligations as required by the instructions to bidders. When bid security is required, as indicated in the instructions to bidders, the following terms apply:

    - Bid security must be for an amount equal to 5 percent of the amount bid, unless otherwise stipulated in the instructions to bidders.
    - Bid security must be in the form of a bond, issued by a surety company authorized to do business in Colorado, or a bank cashier's check made payable to Boulder County.

- Bidders should scan and submit a copy of the bid security instrument with their bid submittal AND mail to Boulder County the actual bid security instrument, postmarked no later than the date of the bid deadline.
- Bidder noncompliance with bid security requirements requires that the bid be rejected as nonresponsive.
- The bid security is submitted as a guarantee that the bid will be maintained in full force and effect for a period of thirty (30) days after the opening of the bids. Accordingly, after bids are opened, they shall be irrevocable for a period of thirty (30) days.
- If a bidder is permitted to withdraw his bid before award, at Boulder County's sole discretion, no action shall be had against the bidder or the bid security.
- Following award, if a contractor fails to deliver the required performance and payment bonds or refuses to enter into a contract with Boulder County under the terms of its winning bid, the contractor's bid shall be rejected and its bid security will be enforced by Boulder County to the extent of actual damages.

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SPECIFICATIONS

The framing contractor will be responsible for all metal stud framing, insulation, acoustical sealants, firestopping sealants (within own scope of work), drywall and drywall finishing per the project documents.

Unless otherwise specifically provided in the Contract Documents, the Contractor shall provide and pay for all labor, materials, equipment, tools, construction equipment and machinery, transportation, and other facilities and services necessary for the proper execution and completion of the Work whether or not incorporated or to be incorporated in the Work.

Plans and specifications included at the end of this document:

2007_BoCo P1-SE HUB_CD SPECIFICATIONS_11-19-2021
2007_BoCo P1-SE HUB_CD DRAWING SET_11-19-2021

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INSURANCE AND W-9 REQUIREMENTS

PAYMENT & PERFORMANCE BONDS

Both a payment and a performance bond are required for this project and must each equal 100% of the proposed cost. Please include the cost of this bonding into the total proposed cost.

INSURANCE REQUIREMENTS

Commercial General Liability

Coverage should be provided on an Occurrence form, ISO CG0001 or equivalent. The policy shall be endorsed to include Additional Insured Owners, Lessees or Contractors endorsements CG 2038 (or equivalent), Designated Construction Project(s) General Aggregate Endorsement CG2503 (or equivalent) and Additional Insured Completed Operations for Owners, Lessees or Contractors CG 2037 (or equivalent). Minimum limits required of $1,000,000 Each Occurrence, $2,000,000 General Aggregate and $2,000,000 Products/Completed Operations Aggregate. The County requires the Products/Completed Operations coverage to be provided 3 years after completion of construction. An endorsement must be included with the certificate.

Automobile Liability

Bodily Injury and Property Damage for any owned, hired, and non-owned vehicles used in the performance of the Contract. Minimum limits $1,000,000 Each Accident.

Workers' Compensation and Employer's Liability

Workers' Compensation must be maintained with the statutory limits. Employer's Liability is required for minimum limits of $100,000 Each Accident/$500,000 Disease-Policy Limit/$100,000 Disease-Each Employee.

Boulder County as Additional Insured: Boulder County shall be named as an additional insured for General Liability, Umbrella/Excess Liability, and Pollution Liability, as designated in this Contract. Additional insured shall be endorsed to the policy.

THE ADDITIONAL INSURED WORDING SHOULD BE AS FOLLOWS: *County of Boulder, State of Colorado, a body corporate and politic, is named as Additional Insureds*.

In regards to General Liability, Umbrella/Excess Liability, and Pollution Liability:
If any or all of these coverages are required above, additional insured status will be required at the time a contract is executed.

Note that the above insurance amounts are the minimum required for this project. Proof of current insurance must be provided with your proposal in the form of a sample certificate. You are NOT required to include additional insured status until the time a contract is executed.

If you require a waiver of insurance requirements you may request one in your response with an explanation.

W-9 REQUIREMENT

Provide a copy of your business's W-9 with your proposal.

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SUBMITTAL SECTION

The bidder's attention is especially called to the items listed below, which must be submitted in full as part of the BID. Failure to submit any of the documents listed below as a part of your BID, or failure to acknowledge any addendum in writing with your BID, or submitting a bid on any condition, limitation or provision not officially invited in this Invitation to Bid (BID) may be cause for rejection of the BID.

THIS CHECKLIST MUST BE SUBMITTED AS PART OF YOUR BID PACKAGE: Bidder will check each box indicating compliance:

INCLUDED	ITEM
	Name and Address of the Partners and Subcontractors if applicable
	A detailed project schedule with an all-inclusive total cost
	Information on the relevant experience of key personnel
	State your compliance with the Terms and Conditions in the Sample Contract contained in this BID. Specifically list any deviations and provide justification for each deviation.
	Submit three references for similar projects your company has completed within the last three years and contact information. Boulder County will review all contractor evaluation forms from previous County projects.
	Insurance Certificate
	W-9
	Signature Page
	Addendum Acknowledgement(s) (If Applicable)

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BID TAB

Provide a price for one and/or each item as listed below. Any alternates should be noted next to the Item below and any additional information shall be attached, following this page, reviewing the alternate pricing. Work shall be awarded based on the most responsible Bid that best satisfies the requirements of the project, not necessarily on the lowest price. Boulder County reserves the right to make the award on the basis of the Bid deemed most favorable to the County, to waive any informalities, or to reject any or all Bids.

All work described in the Drawings, Specifications and Addenda for this project:

ITEM #1: Metal Stud Framing, Sealants, Insulation, Drywall & Drywall Finishing:

_____dollars ($_____)

Duration_____ Working Days

Alternates: Provide a separate page for any proposed alternates, with description of alternate and impact to cost or timing of work.

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SIGNATURE PAGE

Contact Information	Response
Company Name including DBA	
List Type of Organization (Corporation, Partnership, etc.)	
Name, Title, and Email Address of Person Authorized to Contract with Boulder County	
Company Address	
Company Phone Number	
Company Website	

By signing below I certify that:
I am authorized to bid on my company's behalf.
I am not currently an employee of Boulder County.
None of my employees or agents is currently an employee of Boulder County.
I am not related to any Boulder County employee or Elected Official.
(Sole Proprietorships Only) I am not a Public Employees' Retirement Association (PERA) retiree.

_____ _____

Signature of Person Authorized to Bid on Company's Behalf **Date**

Note: If you cannot certify the above statements, please explain in a statement of explanation.

BOULDER COUNTY SAMPLE CONTRACT

THIS CONTRACT ("Contract") is entered into by and between the Board of County Commissioners on behalf of the County of Boulder, State of Colorado, a body corporate and politic, for the benefit of the [Department] ("County") and [Supplier] ("Contractor"). County and Contractor are each a "Party," and collectively the "Parties."

In consideration of the mutual covenants contained in this Contract, the receipt and sufficiency of which is hereby acknowledged, the Parties agree as follows:

1. Incorporation into Contract: The **Details Summary** is incorporated into this Contract. The **Contract Documents** are incorporated into this Contract by reference, except to the extent that the Proposal, if any is incorporated, contains any obligations placed upon County and not otherwise contained in this Contract.

2. Work to be Performed: Contractor will provide all labor and equipment and do all tasks necessary and incidental to performing the work as described in the **Details Summary** and **Contract Documents** (the "Work"). Contractor will perform the Work (a) in a good and workmanlike manner, (b) at its own cost and expense, (c) in accordance with recognized industry standards of care, skill and diligence for the type of work being performed, and (d) in strict accordance with the Contract.

3. Term of Contract: The **Contract Term** begins on the **Start Date** and expires on the **Expiration Date**, unless terminated sooner. All the Work must be performed during the **Contract Term**.

4. Payment for Work Performed: In consideration of the Work performed by Contractor, and subject to conditions contained in this Contract, County will pay an amount not to exceed the **Contract Amount** to Contractor in accordance with the **Contract Documents**.

5. Invoicing: Contractor will promptly provide a copy of its Form W-9 and invoice template to County upon request. Contractor must submit an invoice to the County by the fifteenth (15th) day of the month for completion of any Work performed in the prior calendar month. All invoices submitted require the following components: Contractor's name and address (submitted W-9 address must match remit address), detailed description of services, dates of services, itemization of labor and materials costs, "Bill to: Boulder County" language, payment remittance address, payer, name and address, date of invoice, unique invoice number, and total amount due. Contractor must send all completed invoices to the **Invoice Contact** in the **Details Summary**. County may require delivery of invoices by email. Failure to submit invoices in a timely manner and in accordance with the terms of this Contract may cause a delay in payment. County may recoup any damages incurred because of Contractor's failure to submit invoices pursuant to the terms of this paragraph. County's acceptance or payment of an invoice will not constitute acceptance of any Work performed under this Contract.

6. Extra Time to Complete the Work (Additional Time only): If Contractor cannot complete the Work by the **Expiration Date**, Contractor may request extra time to complete the Work. County, in its sole discretion, may grant Contractor additional time to complete the Work by sending a written notice of extension to Contractor. An extension of time to complete the Work does not entitle Contractor to additional compensation from County.

7. Extension of Contract Term (Additional Time and Work): Upon mutual agreement of the Parties, this Contract may be extended until the **Final End Date**. During any extended **Contract Term**, the terms of this Contract will remain in full force and effect, unless otherwise amended in writing by the Parties. Where the Contractor will provide additional services for additional compensation beyond the initial **Contract Amount**, the Parties must execute a written amendment before the then-current **Expiration**

Date. If necessary, the written amendment will incorporate an updated Scope of Work and updated Fee Schedule as exhibits. Contractor must provide a current Certificate of Insurance to the County that complies with the **Insurance Requirements** of this Contract, if any, prior to any extended **Contract Term**.

8. Schedule of Work: County may designate the hours (on a daily or weekly basis) during which Contractor may perform the Work, strictly for the purposes of minimizing inconvenience to the County and interference with County operations. Contractor will otherwise set its own work schedule.

9. Indemnity: Contractor will be liable for any damages to persons or property caused by or arising out of the actions, obligations, or omissions of Contractor, its employees, agents, representatives or other persons acting under Contractor's direction or control in performing or failing to perform the Work under this Contract. Contractor will indemnify and hold harmless County, its elected officials and appointed department heads, and its employees, agents and representatives (the "indemnified parties"), from any and all liability, claims, demands, actions, damages, losses, judgments, costs or expenses, including attorneys' fees, which may be made or brought or which may result against any of the indemnified parties as a result or on account of the actions or omissions of Contractor, its employees, agents or representatives, or other persons acting under Contractor's direction or control. This indemnification obligation will extend to claims based on Contractor's unauthorized use or disclosure of confidential information and intellectual property infringement. County will not be obligated to indemnify or defend Contractor under any circumstances. Contractor's obligations under this provision shall survive expiration or termination of this Contract. Nothing contained in this Contract or the **Contract Documents** is intended to limit or restrict the indemnification rights or obligations of any Party under this provision, or damages available for breaches of the obligations herein.

10. Nondiscrimination: Contractor will comply with the Colorado Anti-Discrimination Act, C.R.S. § 24-34-401, et seq., as amended, and all applicable local, State and Federal laws concerning discrimination and unfair employment practices. County prohibits unlawful discrimination on the basis of race, color, religion, gender, gender identity, national origin, age 40 and over, disability, socio-economic status, sexual orientation, genetic information, or any other status protected by applicable Federal, State or local law. Contractor must require that its subcontractors, if any, similarly comply with all applicable laws concerning discrimination and unfair employment practices.

11. Information and Reports: Contractor will provide to authorized County, State, and Federal government representatives all information and reports that may be required for any purpose authorized by law. Contractor will permit access to such representatives to Contractor's facilities, books, records, accounts, and any other relevant sources of information. Where information required by a representative is in the exclusive possession of a person or entity other than Contractor, Contractor must so certify to the County and explain what efforts it has made to obtain the information.

12. **Independent Contractor: Contractor is an independent contractor for all purposes in performing the Work. None of Contractor, its agents, personnel or subcontractors are employees of the County for any purpose, including the Federal Insurance Contribution Act, the Social Security Act, the Federal Unemployment Tax Act, the provisions of the Internal Revenue Code, the Colorado Workers' Compensation Act, the Colorado Unemployment Insurance Act, and the Public Employees Retirement Association. Accordingly, County will not withhold or pay any income tax, payroll tax, or retirement contribution of any kind on behalf of Contractor or Contractor's employees. As an independent contractor, Contractor is responsible for employing and directing such personnel and agents as it requires to perform the Work. Contractor will exercise complete authority over its personnel and agents and will be fully responsible for their actions.**

13. Termination

a. Breach: Either Party's failure to perform any of its material obligations under this Contract, in whole or in part or in a timely or satisfactory manner, will be a breach. The institution of proceedings under any bankruptcy, insolvency, reorganization or similar law, by or against Contractor, or the appointment of a receiver or similar officer for Contractor or any of its property, which is not vacated or fully stayed within thirty (30) days after the institution of such proceeding, will also constitute a breach. In the event of a breach, the non-breaching Party may provide written notice of the breach to the other Party. If the breaching Party does not cure the breach, at its sole expense, as reasonably determined by the non-breaching Party in its sole discretion, within thirty (30) days after delivery of notice, the non-breaching Party may exercise any of its remedies provided under this Contract or at law, including immediate termination of this Contract.

b. Non-Appropriation: The other provisions of this Contract notwithstanding, County is prohibited by law from making commitments beyond the current fiscal year. Payment to Contractor beyond the current fiscal year is contingent on the appropriation and continuing availability of funding in any subsequent year. County has reason to believe that sufficient funds will be available for the full **Contract Term**. Where, however, funds are not allocated for any fiscal period beyond the current fiscal year, County may terminate this Contract without penalty by providing seven (7) days' written notice to Contractor.

c. Convenience: In addition to any other right to terminate under this Section 13, County may terminate this Contract, in whole or in part, for any or no reason, upon seven (7) days' advance written notice to Contractor.

14. Contractor Obligations upon Termination or Expiration: By the **Expiration Date** or effective date of termination, if earlier, Contractor must (1) remove from County property all of its personnel, equipment, supplies, trash and any hazards created by Contractor, (2) protect any serviceable materials belonging to the County, and (3) take any other action necessary to leave a safe and healthful worksite. Any items remaining on County property after the Expiration Date or the effective date of termination, if earlier, will be deemed abandoned by Contractor.

15. Payable Costs in Event of Early Termination: If County terminates this Contract before the **Expiration Date**, Contractor's payments (and any damages associated with any lawsuit brought by Contractor) are limited to only (1) payment for Work satisfactorily executed and fully and finally completed, as determined by County in its sole discretion, prior to delivery of the notice to terminate, and (2) the reasonable and actual costs Contractor incurred in connection with performing the Work prior to delivery of the notice to terminate. Contractor explicitly waives all claims it may have against the County for any other compensation, such as anticipatory profits or any other consequential, special, incidental, punitive or indirect damages.

16. Remedies for Non-Performance: If Contractor fails to perform any of its obligations under this Contract, County may, at its sole discretion, exercise one or more of the following remedies (in addition to any other remedies provided by law or in this Contract), which shall survive expiration or termination of this Contract:

a. Suspend Performance: County may require that Contractor suspend performance of all or any portion of the Work pending necessary corrective action specified by the County and without entitling Contractor to an increase in compensation or extension of the performance schedule. Contractor must promptly stop performance and incurring costs upon delivery of a notice of suspension by the County.

b. Withhold Payment Pending Corrections: County may permit Contractor to correct any rejected Work at the County 's discretion. Upon County 's request, Contractor must correct rejected work

at Contractor's sole expense within the time frame established by the County. Upon full and final completion of the corrections satisfactory to the County, County will remit payment to Contractor.

c. Deny Payment: County may deny payment for any Work that does not comply with the requirements of the Contract or that Contractor otherwise fails to provide or fully and finally complete, as determined by the County in its sole discretion. Upon County request, Contractor will promptly refund any amounts prepaid by the County with respect to such non-compliant Work.

d. Removal: Upon County 's request, Contractor will remove any of its employees or agents from performance of the Work, if County, in its sole discretion, deems any such person to be incompetent, careless, unsuitable, or otherwise unacceptable.

17. Binding Arbitration Prohibited: County does not agree to binding arbitration by any extra-judicial body or person.

18. Conflicts of Interest: Contractor may not engage in any business or personal activities or practices or maintain any relationships that conflict in any way with the full performance of Contractor's obligations.

19. Notices: All notices provided under this Contract must be in writing and sent by Certified U.S. Mail (Return Receipt Requested), electronic mail, or hand-delivery to the other Party's **Contact** at the address specified in the **Details Summary**. For certified mailings, notice periods will begin to run on the day after the postmarked date of mailing. For electronic mail or hand-delivery, notice periods will begin to run on the date of delivery.

20. Statutory Requirements: This Contract is subject to all statutory requirements that are or may become applicable to counties or political subdivisions of the State of Colorado generally, including but not limited to: C.R.S. § 38-26-107, which requires withholding funds where the County receives a claim for payment from a supplier or subcontractor of Contractor upon notice of final settlement (required for public works contracts that exceed $150,000); C.R.S. § 8-17-101 et seq.; C.R.S. § 18-8-301, et seq.; and C.R.S. § 18-8-401, et seq.

21. Public Contracts for Services (C.R.S. §§ 8-17.5-101, et seq.): *The phrase "unauthorized worker" as used in this provision shall have the same and intended meaning as "illegal alien" as such phrase is used in C.R.S. §§ 8-17.5-101, et seq.* Contractor hereby certifies, warrants, and agrees that it does not knowingly employ or contract with an unauthorized worker who will perform work under this Contract and further certifies that it will confirm the employment eligibility of all employees who are newly hired for employment to perform work under this Contract by participating in the E-Verify Program established under Pub. L. 104-28 or the department verification program established under C.R.S. § 8-17.5-102(5)(c). Contractor (i) shall not knowingly employ or contract with an unauthorized worker to perform work under this Contract; (ii) shall not enter into a contract with a subcontractor that fails to certify to the contractor that the subcontractor shall not knowingly employ or contract with an unauthorized worker to perform work under this Contract; (iii) has confirmed the employment eligibility of all employees who are newly hired for employment to perform work under this Contract through participation in the E-Verify program or department program; (iv) is prohibited from using either the E-Verify program or department program procedures to undertake preemployment screening of job applicants while this Contract is being performed; and (v) shall comply with any reasonable request by the department made in the course of an investigation that the Colorado Department of Labor and Employment is undertaking pursuant to the authority established in C.R.S. § 8-17.5-102(5). If Contractor obtains actual knowledge that a subcontractor performing work under this Contract knowingly employs or contracts with an unauthorized worker, Contractor shall (a) notify the subcontractor and County within three (3) days that Contractor has actual knowledge that subcontractor is employing or contracting with an unauthorized worker; and (b) terminate the subcontract if, within three (3) days of receiving notice hereunder, subcontractor does not stop

employing or contracting with the unauthorized worker; except that Contractor shall not terminate the contract with the subcontractor if during such three (3) days the subcontractor provides information to establish that the subcontractor has not knowingly employed or contracted with an unauthorized worker. Contractor's violation of this provision will constitute a material breach of this Contract, entitling the County to terminate the contract for breach. If this Contract is so terminated, Contractor shall be liable for actual and consequential damages to the County.

22. Entire Agreement/Binding Effect/Amendments: This Contract represents the complete agreement between the Parties and is fully binding upon them and their successors, heirs, and assigns, if any. This Contract terminates any prior agreements, whether written or oral in whole or in part, between the Parties relating to the Work. This Contract may be amended only by a written agreement signed by both Parties.

23. Assignment/Subcontractors: This Contract may not be assigned or subcontracted by Contractor without the prior written consent of the County. If Contractor subcontracts any of its obligations under this Contract, Contractor will remain liable to the County for those obligations and will also be responsible for subcontractor's performance under, and compliance with, this Contract.

24. Governing Law/Venue: The laws of the State of Colorado govern the construction, interpretation, performance, and enforcement of this Contract. Any claim relating to this Contract or breach thereof may only be brought exclusively in the Courts of the 20th Judicial District of the State of Colorado and the applicable Colorado Appellate Courts.

25. Breach: The failure of either Party to exercise any of its rights under this Contract will not be deemed to be a waiver of such rights or a waiver of any breach of the Contract. All remedies available to a Party in this Contract are cumulative and in addition to every other remedy provided by law.

26. Severability: If any provision of this Contract becomes inoperable for any reason but the fundamental terms and conditions continue to be legal and enforceable, then the remainder of the Contract will continue to be operative and binding on the Parties.

27. Third-Party Beneficiary: Enforcement of the terms and conditions and all rights and obligations of this Contract are reserved to the Parties. Any other person receiving services or benefits under this Contract is an incidental beneficiary only and has no rights under this Contract. Notwithstanding, where the beneficiary **Department** is led by an Elected Official, such Elected Official shall be considered a third-party beneficiary.

28. Colorado Open Records Act: County may disclose any records that are subject to public release under the Colorado Open Records Act, C.R.S. § 24-72-200.1, et seq.

29. Conflict of Provisions: If there is any conflict between the terms of the main body of this Contract and the terms of any of the **Contract Documents**, the terms of the main body of the Contract will control.

30. Governmental Immunity: Nothing in this Contract shall be construed in any way to be a waiver of the County's immunity protection under the Colorado Governmental Immunity Act, C.R.S. § 24-10-101, et seq., as amended.

31. Representations and Warranties: Contractor represents and warrants the following:

a. Execution of this Contract and performance thereof is within Contractor's duly authorized powers;

b. The individual executing this Contract is authorized to do so by Contractor;

c. Contractor is authorized to do business in the State of Colorado and is properly licensed by all necessary governmental and public and quasi-public authorities having jurisdiction over the Work and the Contractor; and

d. Contractor and its subcontractors, if any, are financially solvent, able to pay all debts as they mature, and have sufficient working capital to complete the Work and perform all obligations under the Contract.

32. Legal Compliance: Contractor assumes full responsibility for obtaining and maintaining any permits and licenses required to perform the Work. Contractor is solely responsible for ensuring that its performance under this Contract and the Work itself will comply with all Federal, State, and local laws, regulations, ordinances and codes. County approval of the Work or any aspect of Contractor's performance, such as plans, designs, or other Contractor-drafted documents, shall not be interpreted to mean that Contractor has satisfied its obligations under this Section.

33. Litigation Reporting: Contractor is not currently involved in any action before a court or other administrative decision-making body that could affect Contractor's ability to perform the Work. Contractor will promptly notify the County if Contractor is served with a pleading or other document in connection with any such action.

34. Tax Exemption: County is exempt from payment of Federal, State, and local government taxes. Contractor shall collect no tax from the County, and the County shall not be liable to pay any taxes imposed on Contractor. County shall provide its tax exemption status information to Contractor upon request.

35. Delegation of Authority: The Parties acknowledge that the Board of County Commissioners has delegated authority to the Department Head or Elected Official that leads the beneficiary **Department** and their designees to act on behalf of the County under the terms of this Contract, including but not limited to the authority to terminate this Contract.

36. Ownership of Work Product: All work product, property, data, documentation, information or materials conceived, discovered, developed or created by Contractor pursuant to this Contract ("Work Product") will be owned exclusively by the County. To the extent possible, any Work Product will be deemed to be a work made for hire. Contractor unconditionally and irrevocably transfers and assigns to the County all right, title and interest in and to any Work Product.

37. Publicity Releases: Contractor will not refer to this Contract or the County in commercial advertising without prior written consent of the County. This provision shall survive expiration or termination of this Contract.

38. Execution by Counterparts; Electronic Signatures: This Contract may be executed in multiple counterparts, each of which will be deemed an original, but all of which will constitute one agreement. The Parties approve the use of electronic signatures, governed by the Uniform Electronic Transactions Act, C.R.S. §§ 24 71.3 101 to 121. The Parties will not deny the legal effect or enforceability of this Contract solely because it is in electronic form or because an electronic record was used in its creation. The Parties will not object to the admissibility of this Contract in the form of electronic record, or paper copy of an electronic document, or paper copy of a document bearing an electronic signature, because it is not in its original form or is not an original.

39. Limitation on Public Statements and Lobbying Activity. During the term of this Contract, Contractor may receive from the County its confidential data, work product, or other privileged or confidential information that is protected by law. To maintain the fact and appearance of absolute objectivity, Contractor shall not, without the prior written consent of the County, which shall not be unreasonably

withheld, do any of the following: (a) disclose information obtained because of this contractual relationship to any third party; (b) lobby any State or Federal agency on any pending matter while this Contract is effective; or (c) make any public statements or appear at any time to give testimony at any public meeting on the subject matters regarding which Contractor is or was retained by the County. County may set reasonable conditions on any disclosure authorized by the County under this provision. Notwithstanding, Contractor may make disclosures as required by law, and to law enforcement officials in connection with any criminal justice investigation.

40. Sustainability: County encourages Contractor to consider the procurement and use of environmentally preferable products and services while performing services under this Contract. "Environmentally preferable purchasing" means making purchasing choices for products and services that have a lesser or reduced adverse effect on human health and the environment when compared with competing products and services that serve the same purpose. Environmentally preferable purchasing is consistent with the County's commitment to protecting our air, water, soil, and climate for current and future generations. County encourages Contractor to incorporate the following actions into Contractor's performance of the Work: environmentally preferable supplies and services; conservation of water; efficient energy use; waste prevention; reuse and recycle construction and de-construction materials in a manner that maximizes reuse of materials; sustainable transportation choices, including consideration to business communication software such as Skype alternative to air travel and public transit or carpooling for in-person meetings; pollution prevention; low toxicity for public health & safety; and reduced emissions to address climate change.

41. Limitation of Liability: COUNTY SHALL NOT BE LIABLE TO CONTRACTOR FOR ANY SPECIAL, CONSEQUENTIAL, INCIDENTAL, PUNITIVE, OR INDIRECT DAMAGES ARISING FROM OR RELATING TO THIS CONTRACT, REGARDLESS OF ANY NOTICE OF THE POSSIBILITY OF SUCH DAMAGES. COUNTY'S AGGREGATE LIABILITY, IF ANY, ARISING FROM OR RELATED TO THIS CONTRACT, WHETHER IN CONTRACT, OR IN TORT, OR OTHERWISE, IS LIMITED TO, AND SHALL NOT EXCEED, THE AMOUNTS PAID OR PAYABLE HEREUNDER BY COUNTY TO CONTRACTOR. ANY CONTRACTUAL LANGUAGE LIMITING CONTRACTOR'S LIABILITY SHALL BE VOID.

42. Legal Interpretation. Each Party recognizes that this Contract is legally binding and acknowledges that it has had the opportunity to consult with legal counsel of its choice about this Contract. The rule of construction providing that any ambiguities are resolved against the drafting Party will not apply in interpreting the terms of this Contract.

43. No Suspension or Debarment: Contractor certifies, and warrants for the Contract Term, that neither it nor its principals nor any of its subcontractors are debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participation in this Contract by any Federal or State department or agency. Contractor shall comply, and shall require its subcontractors to comply, with subpart C of 2 C.F.R. § 180.

44. COVID-19 Vaccine Requirement for Certain Contractors/Vendors/Subrecipients of the County: On September 28, 2021, the Boulder County Board of Commissioners adopted a COVID-19 vaccine requirement policy that applies to, as relevant here, all employees of independent contractors of the county that perform county work in a county facility. For purposes of this policy, "perform work in a county facility" means any employee of an independent contractor that routinely performs more than fifteen (15) hours per month of county work that takes place in or on a county facility/property. Under the county's COVID-19 vaccine requirement policy, these individuals are required to receive a COVID-19 vaccine unless a reasonable accommodation based on medical reasons or due to a sincerely held religious belief is requested and approved. The policy requires that, by December 1, 2021, all individuals to which the policy applies must be fully vaccinated and submit proof of vaccination or have an approved

reasonable accommodation in place. Therefore, beginning December 1, 2021, any employees of Contractor/Vendor/Subrecipient that perform county work in a county facility must be in compliance with the County's vaccine requirement policy unless Contractor/Vendor/Subrecipient can show proof that it is in compliance with its own COVID-19 vaccine requirement policy or is required by local, state, or federal law or regulation to be compliant with a COVID-19 vaccine requirement policy.

45. Insurance: Prior to commencing the Work, Contractor will provide a Certificate of Insurance to the County demonstrating adequate insurance coverage as required by this Section. All policies evidencing coverage required by the Contract will be issued by insurance companies satisfactory to the County. Contractor will forward Certificates of Insurance directly to the **County Department** and **Contact** listed in the **Details Summary**.

a. Boulder County as Additional Insured: Boulder County shall be named as an additional insured for General Liability, Umbrella/Excess Liability, and Pollution Liability, as designated in this Contract. Additional insured shall be endorsed to the policy.

THE ADDITIONAL INSURED WORDING SHOULD BE AS FOLLOWS*: County of Boulder, State of Colorado, a body corporate and politic, is named as Additional Insured*.

b. Notice of Cancellation: Each insurance policy required by this Contract shall provide the required coverage and shall not be suspended, voided or canceled except after thirty (30) days' prior written notice has been given to the County except when cancellation is for non-payment of premium, then ten (10) days' prior notice may be given. If any insurance company refuses to provide the required notice, Contractor or its insurance broker shall notify the County any cancellation, suspension, or nonrenewal of any insurance policy within seven (7) days of receipt of insurers' notification to that effect.

c. Insurance Obligations of County: County is not required to maintain or procure any insurance coverage beyond the coverage maintained by the County in its standard course of business. Any insurance obligations placed on the County in any of the **Contract Documents** shall be null and void.

d. Deductible: Any and all deductibles contained in any insurance policy shall be assumed by and at the sole risk of Contractor.

e. Primacy of Coverage: Coverage required of Contractor and its subcontractors, if any, shall be primary over any insurance or self-insurance program carried by the County.

f. Subrogation Waiver: All insurance policies in any way related to this Contract secured or maintained by Contractor as required herein shall include clauses stating that each carrier shall waive all rights of recovery, under subrogation or otherwise, against County, its organizations, officers, agents, employees, and volunteers.

g. Requirements: For the entire duration of this Contract including any extended or renewed terms, and longer as may be required by this Contract, Contractor shall procure and maintain at its own expense, and without cost to the County, the following kinds and minimum amounts of insurance to insure the liability risks that Contractor has assumed under this Contract:

i. **Commercial General Liability**

Delete Instruction: Non-Construction contracts use the following language:

This coverage should be provided on an Occurrence Form, ISO CG001 or equivalent, with Minimum limits of $1,000,000 Each Occurrence, $2,000,000 General Aggregate and $2,000,000 Products Completed Operations Aggregate.

Delete Instruction: Construction Contracts only – include the following paragraph:

Coverage should be provided on an Occurrence form, ISO CG0001 or equivalent. The policy shall be endorsed to include Additional Insured Owners, Lessees or Contractors endorsements CG 2038 (or equivalent), Designated Construction Project(s) General Aggregate Endorsement CG2503 (or equivalent) and Additional Insured Completed Operations for Owners, Lessees or Contractors CG 2037 (or equivalent). Minimum limits required of $1,000,000 Each Occurrence, $2,000,000 General Aggregate and $2,000,000 Products/Completed Operations Aggregate. The County requires the Products/Completed Operations coverage to be provided 3 years after completion of construction. An endorsement must be included with the certificate.

ii. **Automobile Liability**

Bodily Injury and Property Damage for any owned, hired, and non-owned vehicles used in the performance of the Contract. Minimum limits $1,000,000 Each Accident.

Delete Instruction: This coverage may not be required if Contractor is not using a vehicle as part of its performance under the contract. Contact Risk Management with any questions.

iii. **Workers' Compensation and Employer's Liability**

Workers' Compensation must be maintained with the statutory limits. Employer's Liability is required for minimum limits of $100,000 Each Accident/$500,000 Disease-Policy Limit/$100,000 Disease-Each Employee.

Delete Instruction: This coverage may not be required if contractor is not mandated under State law to maintain this coverage. A waiver is available on the contracts routing website.

iv. **Umbrella / Excess Insurance**

Umbrella/Excess Liability insurance in the amount $[X],000,000.00, following form.

Delete Instruction: This insurance is a broad, high-limit policy, which acts more than the underlying primary insurance policy. This coverage is designed to provide additional liability limits beyond the primary insurance limits and is triggered upon the underlying limits becoming exhausted. Umbrella / Excess insurance is most commonly required when an exposure to the County could potentially create liabilities in excess of the basic insurance limits. The most common limits for these policies range from $2,000,000 to $5,000,000.

Delete Instruction: Please consult with Risk Management if you feel this coverage should be required.

Delete Instruction: IN ADDITION TO THE ABOVE, ONE OR MORE OF THE FOLLOWING FOUR (4) INSURANCE COVERAGES MAY BE REQUIRED. CONTACT RISK MANAGEMENT IF YOU HAVE QUESTIONS

ABOUT WHICH INSURANCE COVERAGE TO INCLUDE. DELETE THIS INSTRUCTION (AND ANY INAPPLICABLE INSURANCE PARAGRAPHS) WHEN FINALIZING THE CONTRACT:

v. **Professional Liability (Errors and Omissions)**

Delete Instruction: All contractors required to be professionally certified by the State of Colorado (i.e., architects, engineers, doctors, nurses, etc.) and/or any consultants whose errors in judgment, planning, design, etc. could result in economic loss to the* County *must provide proof of professional liability coverage. This also applies to anyone managing or overseeing construction.

Professional liability coverage with minimum limits of $1,000,000 Per Loss and $1,000,000 Aggregate. Professional Liability provisions indemnifying for loss and expense resulting from errors, omission, mistakes or malpractice is acceptable and may be written on a claims-made basis. The contractor warrants that any retroactive date under the policy shall precede the effective date of this Contract; and that either continuous coverage will be maintained or an extended discovery period will be exercised for a period of two (2) years beginning at the time work under this Contract is completed.

vi. **Pollution Liability**

Delete Instruction: This coverage is required whenever work under the contract involves pollution risk to the environment or losses caused by pollution conditions (including asbestos) that may arise from the operations of the Contractor described in the Contractor's scope of services.

Coverage pay for those sums the Contractor becomes legally obligated to pay as damages because of Bodily Injury, Property Damage or environmental Damage arising out of a pollution incident caused by the Contractor's work including Completed Operations. Coverage shall include emergency response expenses, pollution liability during transportation (if applicable) and at Non-Owned Waste Disposal Site (if applicable). The Minimum limits required are $1,000,000 Per Occurrence/Loss and $1,000,000 Policy Aggregate. If the coverage is written on a claims-made basis, the Contractor warrants that any retroactive date applicable to coverage under the policy precedes the effective date of this Contract; and that continuous coverage will be maintained or an extended discovery period will be exercised for a period of three (3) years beginning from the time that work under this contract is completed. County shall be named as an additional insured for ongoing operations and completed operations.

vii. **Third Party Commercial Crime Insurance / Third Party Fidelity Bond**

Delete Instruction: Crime / Third Party Fidelity covers the contractor and the contractor's employees when engaged in work for a client on behalf of the* County*. This coverage is for employee dishonesty, theft, embezzlement, forgery and alteration. Coverage is required when the contractor will be handling money or collecting fees on behalf of the* County *or when the contractor has access to client's personal property and/or documentation

The Crime limit shall be $1,000,000 Per Loss and include an endorsement for "Employee Theft of Client Property". In order to provide coverage to County during the course of this contract, Commercial Crime policies must be endorsed to cover Third Party Fidelity. Third party fidelity covers the vendor's employees when engaged in work for a client. In addition, the County will be listed as loss payee on the commercial crime coverage. This third-party coverage can also be provided by obtaining a third-party fidelity bond.

viii. **Privacy / Cyber Liability Insurance**

As a provider of a service which *may* require the knowledge and retention of personal identifiable information including but not limited to, names, dates of birth, social security numbers, usernames, and passwords, and/or HIPAA sensitive personal information of clients served, the following minimum insurance limits are required:

Contractors with 10 or fewer County clients:	$50,000
Contractors with 11 – 15 County clients:	$500,000
Contractors with more than 25 County clients:	$1,000,000

Delete Instruction: If the scope does not pertain to clients directly, contact Risk Management for appropriate language.

ix. **Sexual Abuse and Molestation Coverage**

As a provider of a service which has contact with individuals that are part of a sensitive population and are in a position of trust the following minimum insurance limits are required:

Contractors with 5 or fewer County clients:	$100,000
Contractors with 6-10 County clients:	$250,000
Contractors with 11-15 County clients:	$500,000
Contractors with 16 or more County clients:	$1,000,000

If the number of clients increases during the contract period, the required coverage limit will increase to correspond accordingly.

Delete Instruction: If the scope does not pertain to clients directly, contact Risk Management for appropriate language.

Delete Instruction: THE STATED INSURANCE LIMITS FOR ALL COVERAGES ARE MINIMUM AMOUNTS; DEPENDING ON THE CONTRACT, HIGHER LIMITS MAY BE REQUIRED OR ADVISABLE. CONTACT RISK MANAGEMENT IF YOU HAVE ANY QUESTIONS ABOUT MINIMUM LIMITS. DELETE THIS PARAGRAPH WHEN FINALIZING THE CONTRACT.

[Signature Page to Follow]

IN WITNESS WHEREOF, the Parties have executed and entered into this Contract as of the latter day and year indicated below.

SIGNED for and on behalf of Boulder County	**SIGNED for and on behalf of Contractor**
Signature:	Signature:
Name:	Name:
Title:	Title:
Date:	Date:

↓↓*For Board-signed documents only*↓↓	
Attest:	*Initials*
Attestor Name:	
Attestor Title:	

BOULDER COUNTY
SOUTHEAST COUNTY SERVICE HUB

SPECIFICATIONS

CONSTRUCTION DOCUMENTS
11.19.2021

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TABLE OF CONTENTS

DIVISION 22 – PLUMBING

DIVISION 23 – HVAC

DIVISION 26 – ELECTRICAL

END OF TABLE OF CONTENTS

SECTION 00 5000

CONTRACTING FORMS AND SUPPLEMENTS

PART 1 GENERAL

1.01 AGREEMENT AND CONDITIONS OF THE CONTRACT

A. The Agreement is based on AIA A133.

B. The General Conditions are based on AIA A201.

1.02 FORMS

A. Use the following forms for the specified purposes unless otherwise indicated elsewhere in Contract Documents.

B. Post-Award Certificates and Other Forms:
   1. Schedule of Values Form: AIA G703.
   2. Application for Payment Forms: AIA G702 with AIA G703 (for Contractors).

C. Clarification and Modification Forms:
   1. Request for Information/Interpretation Form: See Section 00 6000 - Project Forms.
   2. Substitution Request Form (During Construction): See Section 00 6000 - Project Forms.
   3. Supplemental Instruction Form: See Section 00 6000 - Project Forms.
   4. Construction Change Directive Form: See Section 00 6000 - Project Forms.
   5. Request for Proposal Form: See Section 00 6000 - Project Forms.
   6. Change Order Form: AIA G701.

D. Closeout Forms:
   1. Certificate of Substantial Completion Form: AIA G704.

1.03 REFERENCE STANDARDS

A. AIA A133 - Standard Form of Agreement Between Owner and Construction Manager as Constructor where the basis of payment is the Cost of the Work Plus a Fee with a Guaranteed Maximum Price.

B. AIA A201 - General Conditions of the Contract for Construction.

C. AIA G701 - Change Order.

D. AIA G702 - Application and Certificate for Payment.

E. AIA G703 - Continuation Sheet.

F. AIA G704 - Certificate of Substantial Completion.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 00 6000

PROJECT FORMS

PART 1 GENERAL

1.01 SUMMARY

A. Procedures for use of administrative forms.

B. Administrative forms.

1.02 RELATED SECTIONS

A. Section 01 2000 - Price and Payment Procedures: Contract modification procedures.

B. Section 01 2500 - Substitution Procedures.

1.03 PROCEDURES

A. Deliver or electronically transmit completed forms to Architect at the address listed on the cover of the Project Manual.

B. Use of forms included at end of this Section is required. Architect will provide electronic copies of the forms upon request.
   1. Use of Contractor's alternative forms is acceptable subject to approval of Architect, and provided that content of alternative forms is substantially equivalent to forms provided in this Section.

C. Complete applicable information on form. Indicate date transmitted and date of required response, as applicable. Attach supporting documentation and additional descriptive information as necessary to fully describe the request.

D. Use a single form for each separate request. Closely related items may be included in a single request only if acceptance of one item requires acceptance of all items in the request.

E. Comply with the requirements of Section 01 2500 for requests for substitution after execution of the Contract.

1.04 ARCHITECT'S ACTION

A. Architect will review each request, and return the form to Contractor with written response within 10 days of receipt, except when it must be held for coordination with pending submittals, and Contractor is so advised.

B. When requests are made within the time allowed for Architect's review, Architect will make reasonable effort to respond in a timely manner, but no claim for delay by Contractor will be allowed.

C. Substitution Requests: Architect's review is for general conformance with the Contract Documents only and does not relieve Contractor from full compliance with the Contract Documents and Contractor's representations specified in Section 01 2500.

1.05 FORMS

A. Request for Information: Number consecutively; include Architect's project number; clearly specify the document reference by specification Section number, article, paragraph, Drawing number, and detail numbers as applicable. Architect will complete the lower portion of the form as the written response.

B. Substitution Request: Number consecutively; complete all required information on the form; indicate applicable cost savings and time affect, if any. Architect will complete the lower portion of the form as the written response, and will attach further written response as necessary to explain the decision, if required. Forms submitted without all required information as indicated on the form may be returned for completion before review by Architect.

C. Proposal Request: Architect may submit a Proposal Request which may include detailed description(s) of proposed modification(s) with supplementary or revised drawings and specifications, the projected time for executing the modification with a stipulation of any overtime work required (if any), the period of time during which the requested price will be considered valid, and other pertinent information. Refer to Section 01 2000 for modification procedures.

D. Supplemental Instructions: Architect may issue a Supplemental Instruction which includes detailed description of proposed minor modification, with supplementary or revised drawings and specifications.

E. Construction Change Directive: Architect may issue a Construction Change Directive, signed by Owner and Architect, instructing Contractor to proceed with a modification to the Work, for subsequent inclusion in a Change Order. Construction Change Directive will describe changes in the Work, and will designate method of determining any change in Contract Sum or Contract Time.

F. Forms are on pages immediately following this Section.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

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SUBSTITUTION REQUEST

PROJECT: SUBSTITUTION REQUEST NO.: **001**

CONTRACTOR: PROJECT NO.:

Date Submitted: Date Response Required:

Specification Title:

Section Number: Page: Article/Paragraph:

PROPOSED SUBSTITUTION:

Manufacturer:
Trade Name/Model Number:
Installer:
History: [ ] New Product [ ] 2-5 years old [ ] 5-10 years old [ ] More than 10 years old

DIFFERENCES BETWEEN PROPOSED SUBSTITUTION AND SPECIFIED PRODUCT:

[ ] Point-by-point comparative data attached - **REQUIRED FOR ALL REQUESTS**

REASON FOR NOT PROVIDING SPECIFIED ITEM:

SIMILAR INSTALLATION:

Project: Architect:
Address: Owner:
Date Installed:

Proposed substitution affects other parts of the Work: [ ] No [ ] Yes; explanation attached

[ ] Response made during bidding/pricing phase - **NO COST EFFECT**.
[ ] Savings to Owner for accepting substitution: ($)
[ ] Proposed substitution changes Contract Time: [ ] No [ ] Yes; Add/Deduct ( ) days.

Architect's Action: [ ] Accepted [ ] Accepted with conditions (see attached) [ ] Rejected

ARCHITECT:

BY:

SIGNED: DATE:

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REQUEST FOR INFORMATION

PROJECT: REQUEST FOR INFORMATION NO.: **001**

CONTRACTOR: PROJECT NO.:

Date Submitted:

Document Reference:

INFORMATION REQUESTED:

Signed: Date Response Required:

ARCHITECT'S RESPONSE:

ARCHITECT:

BY:

SIGNED: DATE:

[ ] Response made during bidding/pricing phase – **NO COST EFFECT**.
[ ] Response may involve additional costs or time. If Contract Modification is warranted, advise immediately.
[ ] Response is provided on the presumption of no increase in Contract Sum or Contract Time.

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SUPPLEMENTAL INSTRUCTIONS

PROJECT:	SUPPLEMENTAL INSTRUCTION NO.: **001**
OWNER:	PROJECT NO.:
CONTRACTOR:	DATE OF ISSUANCE:

Perform the Work in accordance with the following supplemental instructions issued in accordance with the Contract Documents without change in Contract Sum or Contract Time. Prior to proceeding in accordance with these instructions, indicate acceptance of these instructions for minor change to the Work as consistent with the Contract Documents and return one copy to the Architect.

DESCRIPTION:

ATTACHMENTS:

ARCHITECT:	ACCEPTED:	
BY:	BY:	
SIGNED:	SIGNED:	DATE:

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CONSTRUCTION CHANGE DIRECTIVE

PROJECT:	CONSTRUCTION CHANGE DIRECTIVE NO.: **001**
OWNER:	PROJECT NO.:
CONTRACTOR:	DATE OF ISSUANCE:

You are hereby directed to make the following modification(s) in this Contract:

DESCRIPTION:

ATTACHMENTS:

PROPOSED ADJUSTMENTS

1. The proposed basis of adjustment to the [Contract Sum] [Guaranteed Maximum Price} is:
   - [ ] Lump Sum [increase] [decrease] of $[_____].
   - [ ] Unit Price of $[_____] per [_____].
   - [ ] as provided in the General Conditions.
   - [ ] as follows: [_____].

2. The Contract Time is proposed to [be adjusted] [remain unchanged]. The proposed adjustment is an increase of [___] days.

Signature by the Contractor indicates the Contractor's agreement with the proposed modifications set forth in this Construction Change Directive.

CONTRACTOR:

BY: SIGNED: DATE:

When signed by the Owner and Architect, and received by the Contractor, this document becomes effective IMMEDIATELY as a Construction Change Directive (CCD), and the Contractor shall proceed with the modifications described above.

ARCHITECT:	OWNER:
BY:	By:
SIGNED:	SIGNED: DATE:

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PROPOSAL REQUEST

PROJECT:	PROPOSAL REQUEST NO.: **001**
OWNER:	PROJECT NO.:
CONTRACTOR:	DATE OF ISSUANCE:

Submit an itemized quotation for changes in the Contract Sum and/or Contract Time incidental to proposed modifications to the Contract Documents described in this Proposal Request.

THIS IS NOT A CHANGE ORDER NOR A DIRECTION TO PROCEED WITH THE WORK DESCRIBED

DESCRIPTION:

ATTACHMENTS:

ARCHITECT:

BY:

SIGNED:

SECTION 01 1000

SUMMARY

PART 1 GENERAL

1.01 PROJECT

A. Project Name: Southeast County Service Hub.

B. Owner's Name: Boulder County.

C. Architect's Name: studiotrope Design Collective.

D. The Project consists of the renovation of the existing Southeast County Services Hub facility, and associated site improvements as more completely described in the Contract Documents.

1.02 CONTRACT DESCRIPTION

A. Contract Type: A single prime contract based on the Cost of the Work plus a fee with a Guaranteed Maximum Price as described in Document 00 5000 - Contracting Forms and Supplements.

1.03 DIVISION 01 SPECIFICATIONS

A. Division 01 General Requirements expand on the broad provisions of the Conditions of the Contract, and govern the execution of the work of all Sections of the specifications. Division 01 General Requirements specify administrative and procedural requirements relating to execution of the Work, and temporary facilities for use during the construction period.

1.04 PROJECT WARRANTY

A. Refer to General Conditions for warranty provisions applicable to this Contract.
   1. Project warranty period is governed by Colorado state statutes and other provisions of the Contract.

1.05 WORK BY OWNER

A. Items noted NIC (Not in Contract) will be supplied and installed by Owner after Substantial Completion. Some items include:
   1. Movable cabinets.
   2. Furnishings.
   3. Small equipment.
   4. Rugs.
   5. Artwork.
   6. Other items noted on Drawings.

1.06 CONTRACTOR USE OF SITE AND PREMISES

A. Construction Operations: Limited to areas noted on Drawings.

B. Arrange use of site to allow:
   1. Owner occupancy.
   2. Work by Others.
   3. Work by Owner.

C. Provide access to and from site as required by law and by Owner:
   1. Emergency Building Exits During Construction: Keep all exits required by code open during construction period; provide temporary exit signs if exit routes are temporarily altered.
   2. Do not obstruct roadways, sidewalks, or other public ways without permit.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 2000

PRICE AND PAYMENT PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Construction cost log.

B. Procedures for preparation and submittal of applications for progress payments.

C. Documentation of modifications in Contract Sum and Contract Time.

D. Modification procedures.

E. Correlation of Contractor submittals based on Contract modifications.

F. Procedures for preparation and submittal of application for final payment.

1.02 RELATED REQUIREMENTS

A. Section 00 5000 - Contracting Forms and Supplements: Forms to be used.

1.03 PRICE PROCEDURES - GENERAL

A. Contract Cost Log: Establish and maintain a construction cost log, including the status of all Contract Modifications (Change Orders); including those which have been accepted, declined, pending, etc.), the status of requests for information, supplemental instructions, other modification documents, and the status of allowances, including Owner's contingency allowance.

1.04 SCHEDULE OF VALUES

A. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit draft to Architect for approval.

B. Forms filled out by hand will not be accepted.

C. Submit Schedule of Values electronically within 15 days after date of Owner-Contractor Agreement.

D. Format: Utilize the Table of Contents of this Project Manual. Identify each line item with number and title of the specification Section. Identify site mobilization.

E. Revise schedule to list approved Change Orders, with each Application For Payment.

1.05 APPLICATIONS FOR PROGRESS PAYMENTS

A. Payment Period: Submit at intervals stipulated in the Agreement.

B. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit sample to Architect for approval.
   1. Forms filled out by hand will not be accepted.

C. For each item, provide a column for listing each of the following:
   1. Item Number.
   2. Description of work.
   3. Scheduled Values.
   4. Previous Applications.
   5. Work in Place and Stored Materials under this Application.
   6. Executed Change Orders.
   7. Total Completed and Stored to Date of Application.
   8. Percentage of Completion.
   9. Balance to Finish.
   10. Retainage.

D. Execute certification by signature of authorized officer.

E. Use data from approved Schedule of Values. Provide dollar value in each column for each line item for portion of work performed and for stored products.

F. List each authorized Change Order as a separate line item, listing Change Order number and dollar amount as for an original item of work.

G. Submit electronic copies of each Application for Payment.

H. Include the following with the application:
   1. Transmittal letter as specified for submittals in Section 01 3000.
   2. Construction progress schedule, revised and current as specified in Section 01 3000.
   3. Current construction photographs specified in Section 01 3000.
   4. Conditional release of liens from each Subcontractor and vendor for the current month's payment application, and unconditional release of liens from each Subcontractor and vendor for the previous month's payment application.
   5. Project record documents as specified in Section 01 7800, for review by Owner which will be returned to the Contractor.
   6. Affidavits attesting to off-site stored products.

I. When Architect requires substantiating information, submit data justifying dollar amounts in question. Provide one copy of data with cover letter for each copy of submittal. Show application number and date, and line item by number and description.

1.06 MODIFICATION PROCEDURES

A. Contractor is responsible for informing and coordinating others, in Contractor's employ and affected subcontractors, of modifications to the Contract Documents.

B. Project Modification Forms: Forms for use primarily by Contractor are included in Section 00 6000.

C. Supplemental Instructions: For minor modifications not involving an adjustment to the Contract Sum or Contract Time; Architect will issue instructions directly to Contractor.
   1. Architect's issuance of supplemental instructions may constitute a modification of the Contract Documents involving an adjustment to the Contract Sum or Contract Time. If Architect's supplemental instructions require such a modification of the Contract Documents, notify Owner immediately and prepare a request for change order or other modification according to applicable modification procedures specified in this Section. Owner's approval is required before any action is taken.

D. Construction Change Directive: For other required modifications, Architect will issue a document signed by Architect and Owner instructing Contractor to proceed with the modification, for subsequent inclusion in a Change Order.
   1. The document will describe the required changes and will designate method of determining any change in Contract Sum or Contract Time.
   2. Promptly execute the change.

E. Proposal Request: For modifications for which advance pricing is desired, Architect will issue a document which includes a detailed description of a proposed modification with supplementary or revised drawings and specifications, a modification in Contract Time for executing the modification with a stipulation of any overtime work required and the period of time during which the requested price will be considered valid. Contractor shall prepare and submit a fixed price quotation within 10 days.

F. Contractor may propose a change by submitting a request for change order or modification to Architect, describing the proposed change and its full effect on the Work, with a statement describing the reason for the change, and the effect on the Contract Sum and Contract Time with full documentation and a statement describing the effect on Work by separate or other contractors.
   1. Document any requested substitutions in accordance with Section 01 2500 - Substitution Procedures.

G. Computation of Change in Contract Amount: As specified in the Agreement and Conditions of the Contract.
   1. For change requested by Architect for work falling under a fixed price contract, the amount will be based on Contractor's price quotation.

2. For change requested by Contractor, the amount will be based on the Contractor's request for a Change Order as approved by Owner and Architect.
3. For pre-determined unit prices and quantities, the amount will be based on the fixed unit prices.
4. For change ordered by Architect without a quotation from Contractor, the amount will be determined by Architect based on the Contractor's substantiation of costs as specified for Time and Material work.

H. Substantiation of Costs: Provide full information required for evaluation.
1. Provide the following data:
   a. Quantities of products, labor, and equipment.
   b. Taxes, insurance, and bonds.
   c. Overhead and profit.
   d. Justification for any change in Contract Time in accordance with the Agreement.
   e. Credit for deletions from Contract, similarly documented.
2. Support each claim for additional costs with additional information:
   a. Origin and date of claim.
   b. Dates and times work was performed, and by whom.
   c. Time records and wage rates paid.
   d. Invoices and receipts for products, equipment, and subcontracts, similarly documented.
3. For Time and Material work, submit itemized account and supporting data after completion of change, within time limits indicated in the Conditions of the Contract.

I. Execution of Change Orders: Architect will issue Change Orders for signatures of parties as provided in the Conditions of the Contract.

J. After execution of Change Order, promptly revise Schedule of Values and Application for Payment forms to record each authorized Change Order as a separate line item and adjust the Contract Sum.

K. Promptly revise progress schedules to reflect any change in Contract Time, revise sub-schedules to adjust times for other items of work affected by the change, and resubmit.

L. Promptly enter changes in Project Record Documents.

1.07 APPLICATION FOR FINAL PAYMENT

A. Prepare Application for Final Payment as specified for progress payments, identifying total adjusted Contract Sum, previous payments, and sum remaining due.

B. Application for Final Payment will not be considered until the following have been accomplished:
1. All closeout procedures specified in Section 01 7000.
2. Receipt of final Certificate of Occupancy from jurisdictional authority.
3. Acceptance of Work by Owner and Architect.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 2300

ALTERNATES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Procedures for pricing Alternates.

B. Documentation of changes to Contract Sum and Contract Time.

1.02 GENERAL ALTERNATE REQUIREMENTS

A. The description of each Alternate is recognized to be incomplete and abbreviated, but requires that each change must be complete for the scope or work affected. Refer to applicable specification Sections and applicable Drawings for the specific requirements of work.
   1. Where Drawings and specifications are inconsistent, and the inconsistency was not corrected by Addendum, calculate bid to include the greater quantity and superior quality of work.

1.03 DESCRIPTION OF ALTERNATE REQUIREMENTS

A. Alternates are defined as alternative products, materials, equipment, systems, methods, units of work, or major elements of construction which may, at Owner's option, be selected for the work in place of corresponding requirements of the Contract Documents. Selection may occur prior to the Contract date, or may be deferred for possible selection at a subsequent date.

B. Include as part of each Alternate, miscellaneous devices, appurtenances, differences in utility or power requirements, and similar items incidental to or required for complete and functioning installation, whether or not specifically mentioned as part of the alternate description.

C. Immediately following award of the Contract, prepare and distribute to each entity involved, notification of the status of each Alternate. Indicate whether alternates have been accepted, rejected, or deferred for consideration at a later date. Indicate a complete description of negotiated modifications to described scope of Alternates, if any.

1.04 ACCEPTANCE OF ALTERNATES

A. Alternates will be reviewed and accepted or rejected at Owner's option. Accepted Alternates will be identified in the Owner-Contractor Agreement.

B. Coordinate related work and modify surrounding work to integrate the Work of each Alternate.

1.05 SCHEDULE OF ALTERNATES

A. See Drawings for list of Alternates and other information regarding each Alternate.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 2500

SUBSTITUTION PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Procedural requirements for proposed substitutions.

1.02 RELATED REQUIREMENTS

A. Section 01 6000 - Product Requirements: Fundamental product requirements, product options, delivery, storage, and handling, and substitution limitations.

1.03 DEFINITIONS

A. Substitutions: Changes from Contract Documents requirements proposed by Contractor to materials, products, assemblies, and equipment.
   1. Substitutions for Cause: Proposed due to changed Project circumstances beyond Contractor's control.
      a. Unavailability.
      b. Regulatory changes.
      c. Other limitations specified in Section 01 6000.
   2. Substitutions for Convenience: Proposed due to possibility of offering substantial advantage to the Project.
      a. Substitution requests offering advantages solely to the Contractor will not be considered.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

A. A Substitution Request for products, assemblies, materials, and equipment constitutes a representation that the submitter:
   1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product, equipment, assembly, or system.
   2. Agrees to provide the same warranty for the substitution as for the specified product.
   3. Agrees to provide same or equivalent maintenance service and source of replacement parts, as applicable.
   4. Agrees to coordinate installation and make changes to other work that may be required for the work to be complete, with no additional cost to Owner.
   5. Waives claims for additional costs or time extension that may subsequently become apparent.

B. A Substitution Request for specified installer constitutes a representation that the submitter:
   1. Has acted in good faith to obtain services of specified installer, but was unable to come to commercial, or other terms.

C. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents. Burden of proof is on proposer.
   1. Note explicitly any non-compliant characteristics.
   2. Submit shop drawings, product data, and certified test results attesting to the proposed product equivalence.
   3. Architect will notify Contractor in writing of decision to accept or reject request.

D. Substitution Request Content: Include information necessary for tracking the status of each Substitution Request, and information necessary to provide an actionable response.
   1. Form included in the Project Manual are adequate for this purpose, and must be used; see Section 00 6000 - Project Forms.

E. Limit each request to a single proposed substitution item.
   1. Submit an electronic document, combining the request form with supporting data into single document.

3.02 SUBSTITUTION PROCEDURES DURING CONSTRUCTION

A. Architect may consider requests for substitution only within 60 days after date established in Notice to Proceed, unless otherwise determined by Architect to be acceptable under extenuating circumstances.
   1. Substitutions will also be considered when a Product, through no fault of Contractor, becomes unavailable or unsuitable due to regulatory change.

B. Submit request for Substitution for Cause within 14 days of discovery of need for substitution, but not later than 14 days prior to time required for review and approval by Architect, in order to stay on approved project schedule.

C. Submit request for Substitution for Convenience immediately upon discovery of its potential advantage to the project, but not later than 14 days prior to time required for review and approval by Architect, in order to stay on approved project schedule.
   1. In addition to meeting general documentation requirements, document how the requested substitution benefits the Owner through cost savings, time savings, greater energy conservation, or in other specific ways.
   2. Document means of coordinating of substitution item with other portions of the work, including work by affected subcontractors.
   3. Bear the costs engendered by proposed substitution of:
      a. Other construction by Owner.
      b. Other unanticipated project considerations.

D. Substitutions will not be considered under one or more of the following circumstances:
   1. When they are indicated or implied on shop drawing or product data submittals, without having received prior approval.
   2. Without a separate written request.
   3. When acceptance will require revisions to Contract Documents.

3.03 RESOLUTION

A. Architect may request additional information and documentation prior to rendering a decision. Provide this data in an expeditious manner.

B. Architect will notify Contractor in writing of decision to accept or reject request.
   1. Architect's decision following review of proposed substitution will be noted on the submitted form.

3.04 ACCEPTANCE

A. Accepted substitutions modify the Contract, and thereby change the Work of the Project. They will be documented and incorporated into Work of the project by Change Order, or similar instrument provided for in the Conditions of the Contract.

3.05 CLOSEOUT ACTIVITIES

A. See Section 01 7800 - Closeout Submittals, for closeout submittals.

B. Include completed and approved Substitution Request Forms as part of the Project record.

END OF SECTION

SECTION 01 3000

ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General administrative requirements.

B. Electronic document submittal service.

C. Administrative Meetings:
   1. Preconstruction meeting.
   2. Progress meetings.
   3. Sustainability progress meetings.

D. Construction progress schedule.

E. Progress and documentation photographs.

F. Use of Architect's digital Drawing files.

G. Submittals for review, information, and project closeout.

H. Number of copies of submittals.

I. Requests for Information (RFI) procedures.

J. Submittal procedures.

1.02 GENERAL ADMINISTRATIVE REQUIREMENTS

A. Comply with requirements of Section 01 7000 - Execution and Closeout Requirements for coordination of execution of administrative tasks with timing of construction activities.

B. Make the following types of submittals to Architect:
   1. Requests for Information (RFI).
   2. Requests for substitution.
   3. Shop drawings, product data, and samples.
   4. Test and inspection reports.
   5. Design data.
   6. Manufacturer's instructions and field reports.
   7. Applications for payment and change order requests.
   8. Progress schedules.
   9. Coordination drawings.
   10. Correction Punch List and Final Correction Punch List for Substantial Completion.
   11. Closeout submittals.
   12. Other specified submittals.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Meeting Minutes: Submit meeting minutes for each type of meeting as specified in this Section.

C. Construction Progress Schedule: Submit construction progress schedule according to the requirements specified in this Section.

D. Submittal Schedule: Submit submittal schedule according to the requirements specified in this Section.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 ELECTRONIC DOCUMENT SUBMITTAL SERVICE

A. All documents transmitted for purposes of administration of the contract are to be in electronic (PDF) format, as appropriate to the document, and transmitted via an Internet-based submittal service that receives, logs and stores documents, provides electronic stamping and signatures, and notifies addressees via email.
   1. Besides submittals for review, information, and closeout, this procedure applies to Requests for Information (RFIs), progress documentation, contract modification documents (e.g. supplementary instructions, change proposals, change orders), applications for payment, field reports and meeting minutes, Contractor's correction punchlist, and any other document any participant wishes to make part of the project record.
   2. Contractor and Architect are required to use this service.
   3. It is Contractor's responsibility to submit documents in allowable format.
   4. Subcontractors, suppliers, and Architect's consultants will be permitted to use the service at no extra charge.
   5. Users of the service need an email address, internet access, and PDF review software that includes ability to mark up and apply electronic stamps (such as Adobe Acrobat, www.adobe.com, or Bluebeam PDF Revu, www.bluebeam.com), unless such software capability is provided by the service provider.
   6. Paper document transmittals will not be reviewed; emailed electronic documents will not be reviewed.
   7. All other specified submittal and document transmission procedures apply, except that electronic document requirements do not apply to samples or color selection charts.

B. Submittal Service: The selected service is:
   1. Architect's existing Internet-based service.
   2. Substitutions: Permitted, subject to approval of Architect.

C. Training: One, one-hour, web-based training session will be arranged for all participants, with representatives of Architect and Contractor participating; further training is the responsibility of the user of the service.
   1. Representatives of Owner will be scheduled and included in this training.

D. Project Closeout: Architect will determine when to terminate the service for the project and is responsible for obtaining archive copies of files for Owner.

3.02 PRECONSTRUCTION MEETING

A. Architect will schedule a meeting after Notice to Proceed.

B. Attendance Required:
   1. Owner.
   2. Architect.
   3. Contractor.
   4. Other invited participants.

C. Minimum Agenda:
   1. Execution of Owner-Contractor Agreement.
   2. Submission of executed bonds and insurance certificates.
   3. Distribution of Contract Documents.
   4. Submission of list of subcontractors, list of products, schedule of values, and progress schedule.
   5. Submission of initial Submittal schedule.
   6. Submission of list of known or anticipated substitution requests.
   7. Designation of personnel representing the parties to Contract, including Contractor, Owner, and Architect.
   8. Procedures and processing of field decisions, RFI's, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
   9. Scheduling.

D. Record minutes and distribute electronically within two days after meeting to participants, with copies to Architect, Owner, participants, and those affected by decisions made.

3.03 PROGRESS MEETINGS

A. Schedule and administer meetings throughout progress of the work at weekly intervals, unless otherwise agreed upon and approved by Owner.

B. Make arrangements for meetings, prepare agenda with copies for participants, preside at meetings.

C. Attendance Required:
1. Contractor.
2. Owner.
3. Architect.
4. Contractor's superintendent.
5. Major subcontractors.

D. Minimum Agenda:
1. Review minutes of previous meetings.
2. Review of work progress.
3. Field observations, problems, and decisions.
4. Identification of problems that impede, or will impede, planned progress.
5. Review of submittals schedule and status of submittals.
6. Review of RFIs log and status of responses.
7. Review of known or anticipated substitution requests.
8. Modification (Change Order) status.
9. Review of off-site fabrication and delivery schedules.
10. Maintenance of progress schedule.
11. Corrective measures to regain projected schedules.
12. Planned progress during succeeding work period.
13. Coordination of projected progress.
14. Maintenance of quality and work standards.
15. Effect of proposed changes on progress schedule and coordination.
16. Other business relating to work.

E. Record minutes and distribute electronically within two days after meeting to participants, with copies to Architect, Owner, participants, and those affected by decisions made.

3.04 SUSTAINABILITY PROGRESS MEETINGS

A. Schedule and administer sustainability meetings throughout progress of the Work; maximum three meetings at intervals appropriate to stage of construction.

B. Make arrangements for meetings; agenda will be prepared by Owner's LEED/sustainability consultant will preside at meetings.

C. Attendance Required: Owner's LEED/sustainability consultant, project superintendent, major subcontractors and suppliers, Owner, Architect, and Architect's consultants as appropriate to agenda topics for each meeting.

D. Minimum Agenda:
1. Review minutes of previous meetings.
2. Review of LEED credit summary/scorecard, LEED submittals, and Work progress.
3. Review status of construction waste management, construction IAQ management, commissioning, and related LEED point issues.
4. Field observations, problems, and decisions.
5. Other business relating to sustainable design Work.

E. Owner's LEED/sustainability consultant will record minutes and distribute electronically within two days after meeting to participants, with copies to Architect, Owner, participants, and those affected by decisions made.

3.05 PROJECT CLOSEOUT MEETING

A. Specified in Section 01 7000 - Execution and Closeout Requirements.

3.06 CONSTRUCTION PROGRESS SCHEDULE

A. Within 10 days after date of the Agreement, submit preliminary schedule defining planned operations for the first 60 days of work, with a general outline for remainder of work.

B. If preliminary schedule requires revision after review, submit revised schedule within 10 days.

C. Within 20 days after review of preliminary schedule, submit draft of proposed complete schedule for review.
   1. Include written certification that major Subcontractors have reviewed and accepted proposed schedule.

D. Within 10 days after joint review, submit complete schedule.

E. Submit updated schedule with each Application for Payment.

3.07 PROGRESS PHOTOGRAPHS AND DOCUMENTATION

A. Indoor Air Quality Control Documentation: Take minimum 6 photographs at three different occasions (minimum 18 total) during construction of the different SMACNA requirements, and provide a brief description of the SMACNA approach employed, documenting implementation of the IAQ management measures, such as protection of ducts, cleaning of air handling units, installation of filters, and on-site stored or installed absorptive materials.

B. Digital Photographs: 24 bit color, minimum resolution of 1024 by 768, in JPG format; provide files unaltered by photo editing software.
   1. Delivery Medium: Via email.
   2. File Naming: Include project identification, date and time of view, and view identification.
   3. PDF File: Assemble all photos into printable pages in PDF format, with 2 to 3 photos per page, each photo labeled with file name; one PDF file per submittal.

3.08 DIGITAL DRAWING FILES

A. Architect's Digital Files: Upon request by Contractor, a digital copy of Project Building Information Model (BIM) or CADD Drawing files will be provided as a courtesy for Contractor's limited use. Such information is not considered to be a part of the Contract Documents.
   1. Use of this information is at Contractor's sole risk.
   2. Report to Architect discrepancies, if any, between published Contract Documents and information provided according to General Conditions and other administrative requirements of the Contract.
   3. Prior to receiving digital files, execute data licensing agreement; Architect's standard form.
   4. Architect is not responsible for updating or maintaining currency of digital drawing files after initially provided to Contractor.
   5. Submittals prepared using any of these files as the primary submittal content without the inclusion of substantial additional content generated by Contractor according to specified requirements for applicable submittals will not be accepted or reviewed by Architect.

3.09 REQUESTS FOR INFORMATION (RFI)

A. Definition: A request seeking one of the following:
   1. An interpretation, amplification, or clarification of some requirement of Contract Documents arising from inability to determine from them the exact material, process, or system to be installed; or when the elements of construction are required to occupy the same space (interference); or when an item of work is described differently at more than one place in Contract Documents.
   2. A resolution to an issue which has arisen due to field conditions and affects design intent.

B. Whenever possible, request clarifications at the next appropriate project progress meeting, with response entered into meeting minutes, rendering unnecessary the issuance of a formal RFI.

C. Preparation: Prepare an RFI immediately upon discovery of a need for interpretation of Contract Documents. Failure to submit a RFI in a timely manner is not a legitimate cause for claiming additional costs or delays in execution of the work.
   1. Prepare a separate RFI for each specific item.
      a. Review, coordinate, and comment on requests originating with subcontractors and/or materials suppliers.
      b. Do not forward requests which solely require internal coordination between subcontractors.
   2. Prepare using an electronic version of the form included in Section 00 6000 - Project Forms.
   3. Combine RFI and its attachments into a single electronic file. PDF format is required.

D. Reason for the RFI: Prior to initiation of an RFI, carefully study all Contract Documents to confirm that information sufficient for their interpretation is definitely not included.
   1. Include in each request Contractor's signature attesting to good faith effort to determine from Contract Documents information requiring interpretation.
   2. Unacceptable Uses for RFIs: Do not use RFIs to request the following:
      a. Approval of submittals (use procedures specified elsewhere in this Section).
      b. Approval of substitutions (see Section - 01 6000 - Product Requirements).
      c. Changes that entail change in Contract Time and Contract Sum (comply with provisions of the Conditions of the Contract).
      d. Different methods of performing work than those indicated in the Contract Drawings and Specifications (comply with provisions of the Conditions of the Contract).
   3. Improper RFIs: Requests not prepared in compliance with requirements of this section, and/or missing key information required to render an actionable response. They will be returned without a response, with an explanatory notation.
   4. Frivolous RFIs: Requests regarding information that is clearly indicated on, or reasonably inferable from, Contract Documents, with no additional input required to clarify the question. They will be returned without a response, with an explanatory notation.
      a. The Owner reserves the right to assess the Contractor for the costs (on time-and-materials basis) incurred by the Architect, and any of its consultants, due to processing of such RFIs.

E. Content: Include identifiers necessary for tracking the status of each RFI, and information necessary to provide an actionable response.
   1. Official Project name and number, and any additional required identifiers established in Contract Documents.
   2. Owner's, Architect's, and Contractor's names.
   3. Discrete and consecutive RFI number, and descriptive subject/title.
   4. Issue date, and requested reply date; "ASAP", "As Soon as Possible", or "Immediately" not acceptable as reply date.
   5. Reference to particular Contract Document(s) requiring additional information/interpretation. Identify pertinent drawing and detail number and/or specification section number, title, and paragraph(s).
   6. Annotations: Field dimensions and/or description of conditions which have engendered the request.
   7. Contractor's Suggested Resolution: A written and/or a graphic solution, to scale, is required in cases where clarification of coordination issues is involved, for example; routing, clearances, and/or specific locations of work shown diagrammatically in Contract Documents. If applicable, state the likely impact of the suggested resolution on Contract Time or the Contract Sum.

F. Attachments: Include sketches, coordination drawings, descriptions, photos, submittals, and other information necessary to substantiate the reason for the request.

G. RFI Log: Prepare and maintain a tabular log of RFIs for the duration of the project.
   1. Indicate current status of every RFI. Update log promptly and on a regular basis.
   2. Note dates of when each request is made, and when a response is received.
   3. Highlight items requiring priority or expedited response.
   4. Highlight items for which a timely response has not been received to date.

H. Review Time: Architect will respond and return RFIs to Contractor within seven calendar days of receipt. For the purpose of establishing the start of the mandated response period, RFIs received after 12:00 noon will be considered as having been received on the following regular working day.
   1. Response period may be shortened or lengthened for specific items, subject to mutual agreement, and recorded in a timely manner in progress meeting minutes.

I. Responses: Content of answered RFIs will not constitute in any manner a directive or authorization to perform extra work or delay the project. If in Contractor's belief it is likely to lead to a change to Contract Sum or Contract Time, promptly issue a notice to this effect, and follow up with an appropriate Change Order request to Owner.
   1. Response may include a request for additional information, in which case the original RFI will be deemed as having been answered, and an amended one is to be issued forthwith. Identify the amended RFI with an R suffix to the original number.
   2. Do not extend applicability of a response to specific item to encompass other similar conditions, unless specifically so noted in the response.
   3. Upon receipt of a response, promptly review and distribute it to all affected parties, and update the RFI Log.
   4. Notify Architect within seven calendar days if an additional or corrected response is required by submitting an amended version of the original RFI, identified as specified above.

3.10 SUBMITTAL SCHEDULE

A. Submit to Architect for review a schedule for submittals in tabular format.
   1. Provide initial schedule at first progress meeting, and provide updated and current schedule at each progress meeting.
      a. Secure Architect's approval of submittal schedule before making any other product-related submittals.
   2. Coordinate with Contractor's construction schedule and schedule of values.
   3. Format schedule to allow tracking of status of submittals throughout duration of construction.
   4. Include in schedule anticipated dates for each submittal to Architect, required dates of return of reviewed submittal to Contractor, and any required lead times associated with applicable submittals.
      a. Schedule submittals to expedite the Project, and coordinate submission of related items.
      b. Arrange information to include specification number and title, submittal category (for review or for information), description of item of work covered, and role and name of subcontractor.
   5. Account for time required for preparation, review, manufacturing, fabrication and delivery when establishing submittal delivery and review deadline dates.
      a. For assemblies, equipment, systems comprised of multiple components and/or requiring detailed coordination with other work, allow for additional time to make corrections or revisions to initial submittals, and time for their review.
      b. If Contractor fails to submit a submittal schedule, Contractor will not be entitled to any increase in Contract Sum or extension of Contract Time based on the time required for review of submittals.

B. Coordinate submittals into logical groupings to facilitate interrelation of the several items:
   1. Submit complete package of specified submittals for each product or system, generally associated with an individual specification Section. Partial submittals will not be reviewed, and no delay claim will be considered as the result of a partial submittal being returned for proper resubmittal.
   2. Submit all concrete shop drawings, product data, schedules, and other specified submittal information in a single package as specified in Division 03.
   3. Submit all masonry shop drawings, product data, schedules, and other specified submittal information in a single package as specified in Division 04.
   4. Submit all structural steel framing shop drawings, product data, schedules, and other specified submittal information in a single package as specified in Division 05.
   5. Submit all door, frame, and hardware product data, schedules, and other specified submittal information in a single package as specified in Division 08.

3.11 SUBMITTALS FOR REVIEW

A. When the following are specified in individual Sections, submit them for review:
   1. Product data.
   2. Shop drawings.
   3. Samples for selection.
   4. Samples for verification.

B. Submit to Architect for review for the limited purpose of checking for compliance with information given and the design concept expressed in Contract Documents.

C. Samples will be reviewed for aesthetic, color, or finish selection as applicable.

D. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article below and for record documents purposes described in Section 01 7800 - Closeout Submittals.

3.12 SUBMITTALS FOR INFORMATION

A. When the following are specified in individual Sections, submit them for information:
   1. Design data.
   2. Sustainability design submittals and reports.
   3. Certificates.
   4. Test reports.
   5. Inspection reports.
   6. Manufacturer's instructions.
   7. Manufacturer's field reports.
   8. Other types specified.

B. Submit for Architect's knowledge as contract administrator or for Owner.

3.13 SUBMITTALS FOR PROJECT CLOSEOUT

A. Submit Correction Punch List for Substantial Completion.

B. Submit Final Correction Punch List for Substantial Completion.

C. When the following are specified in individual Sections, submit at project closeout in compliance with requirements of Section 01 7800 - Closeout Submittals:
   1. Project record documents.
   2. Operation and maintenance data.
   3. Warranties.
   4. Bonds.
   5. Maintenance materials.
   6. Other types specified.

D. Submit for Owner's benefit during and after project completion.

3.14 NUMBER OF COPIES OF SUBMITTALS

A. Electronic Documents - Submittals for Review and Information: Submit one electronic copy in PDF format; an electronically-marked up file will be returned. Create PDFs at native size and right-side up; illegible files will be rejected.

B. Submittals for Review: Submit electronically as specified.

C. Submittals for Information: Submit electronically as specified.

D. Samples: Submit the number specified in individual specification Sections; one of which will be retained by Architect.
   1. After review, produce duplicates.
   2. Retained samples will not be returned to Contractor unless specifically so stated.

3.15 SUBMITTAL PROCEDURES - GENERAL

A. General Requirements:
   1. Submit separate packages of submittals for review and submittals for information, when included in the same specification Section.
   2. Transmit using approved form.
      a. Use Contractor's form, subject to prior approval by Architect.
   3. Sequentially identify each item. For revised submittals use original number and a sequential combination numerical and alphabetical suffix.
   4. Identify: Project; Contractor; subcontractor or supplier; pertinent drawing and detail number; and specification section number and article/paragraph, as appropriate on each copy.

5. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of products required, field dimensions, adjacent construction work, and coordination of information is in accordance with the requirements of the work and Contract Documents.
    a. Submittals not bearing Contractor's review stamp, indicating both review and approval, will not be reviewed and be returned for required review.
    b. Submittals from sources other than Contractor will not be acknowledged, reviewed, or returned.
6. Deliver each submittal on date noted in submittal schedule, unless an earlier date has been agreed to by all affected parties, and is of the benefit to the project.
7. Schedule submittals to expedite the Project, and coordinate submission of related items.
    a. For each submittal for review, allow 15 days excluding delivery time to and from the Contractor.
    b. Review time will be extended day-for-day if legal holiday(s) are within the projected review time period.
    c. For sequential reviews involving Architect's consultants, Owner, or another affected party, allow an additional 7 days.
    d. For sequential reviews involving approval from authorities having jurisdiction (AHJ), in addition to Architect's approval, allow an additional 30 days.
8. Identify variations from Contract Documents and product or system limitations that may be detrimental to successful performance of the completed work.
9. Provide space for Contractor and Architect review stamps.
10. When revised for resubmission, identify all changes made since previous submission. Include brief description or narrative of what and how review comments were addressed.
11. Distribute reviewed submittals. Instruct parties to promptly report inability to comply with requirements.
12. Incomplete submittals will not be reviewed, unless they are partial submittals for distinct portion(s) of the work, and have received prior approval for their use.
13. Submittals not reviewed by Contractor will be rejected, and will not be reviewed by Architect. Claims for delay as the result of submittals not reviewed by Contractor will not be allowed.
14. Submittals not requested will be recognized, and will be returned "Not Reviewed".

B. Product Data Procedures:
1. Submit only information required by individual specification sections.
2. Collect required information into a single submittal.
3. Submit concurrently with related shop drawing submittal.
4. Do not submit (Material) Safety Data Sheets for materials or products.
5. Manufacturer's Catalog Submittals: If manufacturer's published catalog information is used as part of a submittal, include only those pages from catalog that are specifically applicable to the proposed products for this Project.
    a. Clearly identify in the submittal those specific products and components for which review and action is requested.
    b. Submittals received that do not clearly identify specific applicable products, or that include more pages than those specifically applicable to the subject submittal, will be returned as "not reviewed" and the time for submittal review will not commence until a properly scoped submittal is received by Architect.

C. Shop Drawing Procedures:
1. Prepare accurate, drawn-to-scale, original shop drawing documentation by interpreting Contract Documents and coordinating related work.
2. Do not reproduce Contract Documents to create shop drawings, unless otherwise permitted.
3. Generic, non-project-specific information submitted as shop drawings do not meet the requirements for shop drawings.

D. Samples Procedures:
1. Transmit related items together as single package to Architect's office, unless otherwise specified.
2. Identify each item to allow review for applicability in relation to shop drawings showing installation locations.
3. Include with transmittal high-resolution image files of samples to facilitate electronic review and approval. Provide separate submittal page for each item image.

3.16 SUBMITTAL REVIEW

A. Submittals for Review: Architect will review each submittal, and approve, or take other appropriate action. See below for actions to be taken.

B. Submittals for Information: Architect will acknowledge receipt and review. See below for actions to be taken.

C. Architect's actions will be reflected by marking each returned submittal using virtual stamp on electronic submittals.
   1. Notations may be made directly on submitted items and/or listed on appended Submittal Review cover sheet.

D. Architect's Actions:
   1. Architect will review each submittal, mark it with appropriate "action," and return it to Contractor within specified time allowance; except when it must be held for coordination, and Contractor is so advised.
   2. Where submittals include materials, products, systems, or manufacturers not specified, approved by Addendum prior to execution of the Contract, or approved in writing in conjunction with the proposed products list submittal specified in Section 01 6000 - Product Requirements, Architect reserves the right to exceed the specified time allowance to allow sufficient time to determine the acceptability of such items, and no claim for delay by Contractor will be allowed.
   3. Where submittals include a material, product, system, or manufacturer substitution which has not been previously accepted or approved in writing, Architect reserves the right to reject such submittal and require a compliant submittal, or may direct that other action be taken by Contractor to achieve compliance with Contract Documents, and no claim for delay by Contractor will be allowed.
   4. Architect's review is for general conformance only and does not relieve Contractor from full compliance with the Contract Documents.

END OF SECTION

SECTION 01 3114

FACILITY SERVICES COORDINATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Coordination of facility services construction.

B. Services of a coordinator for facility services construction.

C. Coordination documents.

1.02 MECHANICAL AND ELECTRICAL COORDINATOR

A. Provide staff dedicated to this Project who are technically qualified and administratively experienced in field coordination of the type of work required to be coordinated, for the duration of the Work.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Coordination Drawings:
   1. Submit coordination drawings and schedules prior to submitting shop drawings, product data, and samples.
   2. Submit coordination drawings in a timely manner to facilitate proper coordination with the construction schedule, and to avoid adverse impacts on progress of construction.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 COORDINATION REQUIRED

A. See Drawings, Division 23 specifications, and Division 26 specifications for mechanical/electrical coordination schedules which define responsibilities for providing, setting, and final connecting of applicable devices and equipment items.

B. Coordinate the work listed below:
   1. Fire Suppression: Division 21.
   2. Plumbing: Division 22.
   3. Heating, Ventilating, and Air Conditioning: Division 23.
   4. Electrical: Division 26.
   5. Communications: Division 27.
   6. Electronic Safety and Security: Division 28.
   7. All facility construction work affected by work listed above.

C. Coordinate progress schedules, including dates for submittals and for delivery of products.

D. Conduct meetings among subcontractors and others concerned, to establish and maintain coordination and schedules, and to resolve coordination matters in dispute.

E. Participate in progress meetings. Report on progress of work to be adjusted under coordination requirements, and any required changes in schedules. Transmit minutes of meetings and reports to concerned parties.

3.02 COORDINATION OF INSTALLATIONS

A. Comply with manufacturer’s installation instruction and recommendations to the extent that those instructions and recommendations are more explicit or stringent than requirements contained in the Contract Documents.

B. Coordinate installation of materials and equipment above and below ceilings with suspension systems, light fixtures, and other building components. Where mounting heights are not detailed or dimensioned, install services and overhead equipment to provide the maximum headroom possible.

C. Coordinate ceiling and joist cavity space carefully with all affected trades. In the event of conflict, install mechanical and electrical systems within the cavity space allocation in the following order of priority:
   1. Plumbing waste and vent piping, roof drain mains and leaders.
   2. Supply, return and exhaust ductwork.
   3. Steam and condensate piping and traps.
   4. Fire sprinkler mains and leaders.
   5. Electrical conduit.
   6. Domestic hot and cold water, and lab gas piping.
   7. Heating and cooling water supply and return piping.
   8. Fire sprinkler branch piping and sprinkler run outs.
   9. Pneumatic control piping and tubing.

D. Coordinate installation of equipment and piping support, sleeves, and other structural components that penetrate walls, floors, ceilings, or roofs.

3.03 COORDINATION DOCUMENTS

A. Prepare coordination drawings to organize installation of products for efficient use of available space, for proper sequence of installation, and to identify potential conflicts.

B. Prepare a master schedule identifying responsibilities for activities that directly relate to this work, including submittals and temporary utilities; organize by specification Section.

C. Identify electrical power characteristics and control wiring required for each item of equipment.

D. Maintain documents for the duration of the work, recording changes due to site instructions, modifications or adjustments.

E. Coordination Drawings for Acoustical and Gypsum Board Ceilings, Plumbing, Fire Protection, HVAC and Electrical:
   1. Submit to Architect as information submittal as specified in Section 01 3000 - Administrative Requirements.
   2. HVAC: Prepare reproducible coordination layout and installation drawings at minimum 1/4 inch per foot scale for resolution of interferences and conflicts with other trades.
   3. Plumbing, Fire Protection, Electrical, and Ceilings: Superimpose these shop drawings on the HVAC coordination drawings and verify layout and elevations to eliminate conflicts; highlight apparent conflicts. Fabrication of ductwork, fire protection piping, or other prefabricated systems is at risk until coordination drawings have been completed and reviewed by Contractor and Architect.
      a. Gravity systems have routing priority above the ceilings.
   4. Access Panels: Clearly show locations of access panels for maintenance in “hard” ceilings for access to HVAC boxes, fire damper motors, plumbing valves, fire protection drains, valves, light fixture remote ballasts, ceiling hung equipment, and similar items requiring access; coordinate with reflected ceiling plans. Indicate locations of access panels in walls and location of plumbing cleanouts.
   5. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of above-ceiling coordinated items; require attendance by all affected installers.
      a. Convene under general provisions of Section 01 7000 - Execution and Closeout Requirements.
      b. Discuss installation of coordinated items above ceilings.
      c. Ceilings may not be lowered to resolve apparent conflicts without written approval of Owner and Architect.

3.04 COORDINATION OF SUBMITTALS

A. Review shop drawings, product data, and samples for compliance with Contract Documents and for coordination with related work. Transmit copies of reviewed documents to Architect.

B. Check field dimensions and clearances and relationship to available space and anchors.

C. Check compatibility with equipment and work of other Sections, electrical characteristics, and operational control requirements.

D. Check motor voltages and control characteristics.

E. Coordinate controls, interlocks, wiring of switches, and relays.

F. Coordinate wiring and control diagrams.

G. When changes in the work are made, review their effect on other work.

H. Verify information and coordinate maintenance of record documents.

3.05 COORDINATION OF SUBSTITUTIONS AND MODIFICATIONS

A. Review proposals and requests for substitution prior to submission to Architect.

B. Verify compliance with Contract Documents and for compatibility with work of other Sections.

3.06 INSPECTION OF WORK

A. Inspect work for compliance with Contract Documents.

B. Maintain a list of observed deficiencies and defects; promptly submit to Architect.

3.07 DOCUMENTATION

A. Observe and maintain a record of tests. Record:
   1. Specification Section number and product name.
   2. Name of Contractor, subcontractor, and installer if applicable.
   3. Name of testing agency and name of inspector.
   4. Name of manufacturer's representative present.
   5. Date, time, and duration of tests.
   6. Type of test, and results.
   7. Retesting required.

B. Assemble background documentation and retain in the event that dispute resolution becomes necessary.

3.08 EQUIPMENT START-UP

A. Verify utilities, connections, and controls are complete and equipment is in operable condition as required by Section 01 7000.

B. Observe start-up and adjustments, test run, record time and date of start-up, and results.

C. Observe equipment demonstrations made to Owner; record times and additional information required for operation and maintenance manuals.

3.09 INSPECTION AND ACCEPTANCE OF EQUIPMENT

A. Prior to inspection, verify that equipment is tested, operational, clean, and ready for operation.

END OF SECTION

SECTION 01 3329.02

LEED V4 DESIGN REPORTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General requirements for sustainable design reporting.

1.02 REPORTING REQUIREMENTS

A. Free-standing furniture and furnishings are included in the Contract.

B. A Sustainable Design Consultant has been employed by Owner to review sustainable design documentation.

C. Contractor must familiarize himself with the relevant reporting requirements and provide the necessary information and instruction to all subcontractors and installers.

1.03 DEFINITIONS

A. Definitions in this Article are in addition to sustainable design definitions directly related to products, as listed in Section - 01 6000 - Product Requirements.

B. Indoor Air Quality (IAQ) Management Plan: Plan developed by the Contractor to provide a healthy indoor environment for workers and building occupants during construction. Plan must meet or exceed the recommendations of SMACNA (OCC) "IAQ Guidelines for Occupied Buildings Under Construction".

C. Material Cost: The dollar value of materials being provided to the site, after Contractor mark-ups, including transportation costs, taxes, fees, and shop labor, but excluding field equipment and field labor costs.

1.04 PRODUCT REPORTING SCOPE

A. General: Product reporting scope for the purpose of achieving the selected sustainability certification level is limited to those items directly affecting ability to achieve targeted credits.
   1. Environmental Product Declarations (EPD): Documentation complying with definition and quality requirements in Section 01 6000 - Product Requirements.
      a. Provide for at least 20 different permanently installed products sourced from at least five different manufacturers that meet the sustainable design certification program criteria.

B. LEED Product Reporting Scope (for EQ Credit only): May include any of the products in the following product categories, whether specified or not:
   1. Interior paints and coatings.
   2. Interior adhesives and sealants, including flooring adhesives.
   3. Flooring.
   4. Composite wood.
   5. Products making up wall and ceiling assemblies.
   6. Thermal and acoustical insulation.
   7. Free-standing furniture.

1.05 REFERENCE STANDARDS

A. BIFMA e3 - Furniture Sustainability Standard; Business and Institutional Furniture Manufacturers Association.

B. ILFI (DEC) - International Living Future Institute ‘Declare’ Program.

C. SMACNA (OCC) - IAQ Guidelines for Occupied Buildings Under Construction.

D. USGBC LEED v4-BD+C - LEED v4 for Building Design and Construction.

E. USGBC LEED v4-ID+C - LEED v4 for Interior Design and Construction.

1.06 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for additional submittal procedures requirements.

B. Sustainable Design Documentation: The scope of required documentation is specified in this section and in applicable individual specification sections.

C. LEED v4 Prerequisites and Credits - Documentation is required for the following items:
   1. New Product Documentation:
      a. Materials and Resources: Use the Building Product Disclosure and Optimization (BPDO) Calculator spreadsheet software available from USGBC to track and document materials and products purchases and use. Use for documentation of USGBC LEED v4-BD+C and USGBC LEED v4-ID+C MR Credits.
      b. Building Product Disclosure and Optimization - Environmental Product Declarations.
         1) Submit information for the required number and sources of Environmental Product Declarations complying with LEED reporting requirements.
            (a) Submit for at least twenty permanently installed products, sourced from at least five different manufacturers.
         2) Submit third-party certifications for permanently installed products which demonstrate environmental impact reduction below industry average.
            (a) Submit for 50 percent, by cost, of the total value of permanently installed products in the project.
      c. Building Product Disclosure and Optimization - Sourcing of Raw Materials.
         1) Raw Materials' Suppliers self-declared reports on sourcing and extracting, or, preferably, third-party verified corporate sustainability reports (CSR).
      d. Building Product Disclosure and Optimization - Material Ingredients.
         1) Material Ingredient Reporting: Use, as is appropriate:
            (a) Manufacturers' inventories of ingredients.
            (b) ILFI (DEC) 'Declare' product labels.
            (c) BIFMA e3 Furniture Sustainability Standard assessment or scorecard.
      e. Indoor Environmental Quality - Low-emitting Materials: Use the Low-Emitting Materials Calculator spreadsheet software (available from USGBC) to track and document materials and products purchases and use. Use for documentation of USGBC LEED v4-BD+C and USGBC LEED v4-ID+C EQ Credits.
   2. Waste Disposal Management: Periodic reports quantifying diversion of construction waste away from landfills and incineration facilities.
      a. Include information on percentage of diverted material and number of material streams.
   3. Furniture Cost Statement: Submit the total cost of all furniture, including purchase price, taxes, and delivery to site, but not labor, tools, or equipment for installation.
      a. Submit prior to or along with initial application for payment.
      b. Update and re-submit whenever the total cost changes due to contract modifications.
   4. Flooring: Submit general emissions evaluation information for all flooring materials.
   5. Composite wood: Submit composite wood evaluation information for all materials not covered by another product category.
   6. Ceilings, walls, thermal, and acoustic insulation: Submit general emissions evaluation for all products.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PROCEDURES

A. Submit sustainable design documentation required of Contractor, using procedures defined under Submittals for Information in Section 01 3000.

B. Submit sustainable design documentation to Sustainable Design Consultant, not to Architect, unless otherwise indicated.

C. Where an item of sustainable design documentation is specified, fill out and submit electronically the appropriate form(s), and/or use appropriate software.
   1. Fill out one line for each different brand name product and each different manufacturer of a lot of commodity products.
   2. Where required attachments are specified, attach the documentation.

3. Mark each blank with the appropriate information; use "ATT" for items attached; if any item is not relevant use the code "NR"; if any item is not available use the code "NA".

D. Each form must be signed by the entity capable of certifying the information.
   1. Certification signatures must be made by an officer of the company.
   2. For products, certification must be made by the manufacturer not the supplier.
   3. For custom fabricated products, certification by the fabricator is acceptable.

E. Submit the completed forms in accordance with the requirements of Section 01 3000, as information submittals.
   1. Give each form a unique submittal number.
   2. Do not combine sustainable design documentation with product data or shop drawing submittals.

F. Submit forms applicable to work for which application for payment is being made, either prior to or concurrent with application for payment; payment will not be made until relevant forms have been submitted.

G. For work covered by multiple applications for payment, the initial submittal of a form is sufficient for subsequent applications unless the nature of the product has changed.

END OF SECTION

SECTION 01 3566.05

LEED V4 CREDIT SUMMARY

PART 1 GENERAL

1.01 PROJECT GOALS

A. This project has been designed to achieve the LEED Gold (minimum 60 points) rating as defined in USGBC LEED v4-ID+C for Commercial Interiors.
   1. This project is pursuing MR: Building Product Disclosure and Optimization (BPDO) category credit(s) for Environmental Product Declarations, Sourcing of Raw Materials, and Materials Ingredients.
      a. To achieve Environmental Product Declarations category points, project has targeted successful completion of requirements of Option 1, Environmental Product Declaration path.
      b. To achieve Sourcing of Raw Materials category points, project has targeted successful completion of requirements of Option 1, Raw Material Source and Extraction Reporting path.
      c. To achieve Material Ingredients category points, project has targeted successful completion of requirements of Option 1, Material Ingredient Reporting path.
   2. This project is also pursuing EQ: Low-Emitting Materials credit(s) using the Product Category Calculations Method and Budget Calculation Method.

1.02 RELATED REQUIREMENTS

A. Section 01 3329.02 - LEED v4 Design Reporting for Contractor's reporting responsibilities.

B. Section 01 3566.12 - LEED v4 Certification Project Procedures for Contractor's procedural responsibilities.

1.03 DEFINITIONS

A. Sustainability Rating System: United States Green Building Council's LEED v4 for Commercial Interiors.

B. Yes: Achievement of this credit is essential for certification of this project.

C. "?": Achievement of this credit would be desirable but is not mandatory.

D. No: Achievement of this credit is not expected or not possible for this project.

E. This section does not include specific work criteria and is included for Contractor's information only.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - CREDIT SUMMARY

3.01 CREDIT SUMMARY

A. See following pages.

END OF SECTION

LEED v4 for ID+C: Commercial Interiors

Project Checklist

Project Name: Boulder County HUB

Date: 3/25/2021

Y	?	N		Credit Name	Possible Points
0	**0**	**2**		**Integrative Process**	**2**
		2	Credit	Integrative Process	2
3	**0**	**15**		**Location and Transportation**	**18**
			Credit	LEED for Neighborhood Development Location	18
2		**6**	Credit	Surrounding Density and Diverse Uses	8
		7	Credit	Access to Quality Transit	7
1			Credit	Bicycle Facilities	1
		2	Credit	Reduced Parking Footprint	2
8	**0**	**4**		**Water Efficiency**	**12**
Y			Prereq	Indoor Water Use Reduction	Required
8		**4**	Credit	Indoor Water Use Reduction	12
26	**7**	**5**		**Energy and Atmosphere**	**38**
Y			Prereq	Fundamental Commissioning and Verification	Required
Y			Prereq	Minimum Energy Performance	Required
Y			Prereq	Fundamental Refrigerant Management	Required
5			Credit	Enhanced Commissioning	5
18	**5**	**2**	Credit	Optimize Energy Performance	25
1	**1**		Credit	Advanced Energy Metering	2
		3	Credit	Renewable Energy Production	3
	1		Credit	Enhanced Refrigerant Management	1
2			Credit	Green Power and Carbon Offsets	2
6	**6**	**1**		**Materials and Resources**	**13**
Y			Prereq	Storage and Collection of Recyclables	Required
Y			Prereq	Construction and Demolition Waste Management Planning	Required
1			Credit	Long-Term Commitment	1
1	**3**		Credit	Interiors Life-Cycle Impact Reduction	4
1	**1**		Credit	Building Product Disclosure and Optimization - Environmental Product Declarations	2
	1	**1**	Credit	Building Product Disclosure and Optimization - Sourcing of Raw Materials	2
1	**1**		Credit	Building Product Disclosure and Optimization - Material Ingredients	2
2			Credit	Construction and Demolition Waste Management	2
11	**2**	**4**		**Indoor Environmental Quality**	**17**
Y			Prereq	Minimum Indoor Air Quality Performance	Required
Y			Prereq	Environmental Tobacco Smoke Control	Required
2			Credit	Enhanced Indoor Air Quality Strategies	2
2	**1**		Credit	Low-Emitting Materials	3
1			Credit	Construction Indoor Air Quality Management Plan	1
2			Credit	Indoor Air Quality Assessment	2
1			Credit	Thermal Comfort	1
2			Credit	Interior Lighting	2
	1	**2**	Credit	Daylight	3
1			Credit	Quality Views	1
		2	Credit	Acoustic Performance	2
5	**1**	**0**		**Innovation**	**6**
4	**1**		Credit	Innovation	5
1			Credit	LEED Accredited Professional	1
2	**1**	**1**		**Regional Priority**	**4**
		1	Credit	Regional Priority: Specific Credit	1

1			Credit	Regional Priority: Specific Credit	1
1			Credit	Regional Priority: Specific Credit	1
	1		Credit	Regional Priority: Specific Credit	1

61	17	32	**TOTALS**	Possible Points: **110**

Certified: 40 to 49 points, **Silver:** 50 to 59 points, **Gold:** 60 to 79 points, **Platinum:** 80+

SECTION 01 3566.12

LEED V4 CERTIFICATION PROJECT PROCEDURES

PART 1 GENERAL

1.01 PROJECT APPROACH

A. This project intends to achieve recognition for sustainable design using LEED v4 Certification program.

B. Project Goals for Sustainability Certification are described in Section 01 3566.05 - LEED v4 Credit Summary.

C. Contractor is not responsible for the application for Sustainability certification, nor for determination of methods of achieving Sustainability credits unless specifically so indicated.

D. Many of the Sustainability credits can be achieved only through intelligent design of the project and are beyond the control of the Contractor. However, certain credits relate to the products and procedures used for construction. Therefore, full cooperation of the Contractor and subcontractors is essential to achieving final certification goal, and they must familiarize themselves with the relevant requirements, and provide the necessary information and instructions to product suppliers and installers.

E. Since Contractor and subcontractors may not be familiar with detailed LEED Sustainability procedures, this section includes a list of other specifications sections that contain related requirements for products and procedures necessary for achievement of targeted Sustainability certification level.
   1. Achievement of many prerequisites and credits is dependent on proper performance by Contractor and subcontractors, using specific required project management and work execution means and methods.
   2. Achievement of other credits involves quantifying percentages of installed products by weight and cost; these require careful recordkeeping and reporting by the Contractor.
   3. See www.usgbc.org for more information.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 PROCEDURES

A. General: Conduct project management and construction operations in a manner consistent with, and in support of successful achievement of Owner's targeted certification level.
   1. Collect and report the quantities, costs, weights, volumes and/or sourcing information for applicable materials and products specified.
   2. Collect VOC and other emissions information for:
      a. Interior paints and coatings applied on site. Calculated by volume.
      b. Interior adhesives and sealants applied on site (including flooring adhesive). Calculated by volume.
      c. Flooring. 90 percent.
      d. Composite Wood. 90 percent not covered by other product categories.
      e. Ceilings, walls, thermal, and acoustic insulation. 90 percent. Healthcare, Schools projects include additional insulation requirements.
      f. Furniture (include in calculations if part of scope of work). Calculated by cost.

B. Construction Waste Management and Disposal: Implement approved waste management plan during the entire duration of the Contract.

C. Commissioning Authority Activities: Cooperate with Commissioning Authority to coordinate construction and closeout activities scheduling.

D. Sustainable Design Reporting: Comply with requirements of Section 01 3329.02.

3.02 SMOKING POLICY

A. General: Smoking policy on the project site is implemented for the following reasons:
   1. Protection and promotion of health of all persons on the project site.
   2. Prevention of fire.
   3. Prevention of exposure of building occupants, indoor surfaces, and ventilation air distribution systems to environmental tobacco smoke, resulting in build-up on hard surfaces, and absorption of smoke by textiles and fabrics.
   4. Promotion of successful results of Indoor Air Quality

B. Smoking is not permitted anywhere on project site.

3.03 CONSTRUCTION WASTE MANAGEMENT

A. Comply with applicable requirements of Section 01 7419 - Construction Waste Management and Disposal.

3.04 TEMPORARY ENVIRONMENTAL CONTROLS

A. Comply with applicable requirements of Section 01 5719 - Temporary Environmental Controls.

END OF SECTION

SECTION 01 4000

QUALITY REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Submittals.

B. Quality assurance.

C. References and standards.

D. Testing and inspection agencies and services.

E. Contractor's construction-related professional design services.

F. Contractor's design-related professional design services (delegated design work).

G. Control of installation.

H. Mock-ups.

I. Tolerances.

J. Manufacturers' field services.

K. Defect Assessment.

L. Basis of design specifications.

1.02 DEFINITIONS

A. Contractor's Professional Design Services: Design of some aspect or portion of the project by party other than the design professional of record. Provide these services as part of the Contract for Construction.
   1. Design Services Types Required:
      a. Construction-Related: Services Contractor needs to provide in order to carry out the Contractor's sole responsibilities for construction means, methods, techniques, sequences, and procedures.
      b. Design-Related: Design services explicitly required to be performed by another design professional due to highly-technical and/or specialized nature of a portion of the project. Services primarily involve engineering analysis, calculations, and design, and are not intended to alter the aesthetic aspects of the design.

B. Design Data: Design-related, signed and sealed drawings, calculations, specifications, certifications, shop drawings and other submittals provided by Contractor, and prepared directly by, or under direct supervision of, design professional appropriately licensed in Colorado.

1.03 CONTRACTOR'S CONSTRUCTION-RELATED PROFESSIONAL DESIGN SERVICES

A. Coordination: Contractor's professional design services are subject to requirements of project's Conditions for Construction Contract.

B. Provide such engineering design services as may be necessary to plan and safely conduct certain construction operations, pertaining to, but not limited to the following:
   1. Temporary sheeting, shoring, or supports.
   2. Temporary scaffolding.
   3. Temporary bracing.
   4. Temporary falsework for support of spanning or arched structures.
   5. Temporary stairs or steps required for construction access only.
   6. Temporary hoist(s) and rigging.
   7. Investigation of soil conditions to support construction equipment.

1.04 CONTRACTOR'S DESIGN-RELATED PROFESSIONAL DESIGN SERVICES (DELEGATED DESIGN WORK)

A. Coordination: Contractor's professional design services are subject to requirements of project's Conditions of the Contract for Construction.

B. Performance and Design Requirements: Where professional design services or certifications by a licensed design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with requirements specified in individual specification Sections.
   1. Base design of products and systems on performance and design criteria indicated or specified in individual specification Sections.
   2. Submit a Request for Information to Architect if the criteria indicated or specified are not sufficient to perform required design services.

C. Scope of Contractor's Professional Design Services is specified in the following Sections, which include but may not be limited to:
   1. Section 05 5200 - Metal Railings.
   2. Section 07 6200 - Sheet Metal Flashing and Trim.
   3. Section 07 8400 - Firestopping.
   4. Section 08 4313 - Aluminum-Framed Storefronts.
   5. Section 08 8000 - Glazing.
   6. Section 10 8210 - Equipment Screens.

D. Design of building systems, or components of systems, to be provided by Contractor; refer to applicable Division 21 and 28 Sections:
   1. Fire sprinkler systems.
   2. Electronic safety and security systems.

E. Contractor's Responsibilities:
   1. Coordinate design and space requirements with other affected work and Architect.
   2. Review applicable submittals and coordinate selections with Architect.
   3. Receive and unload products and systems at the site; inspect for completeness and for damage.
   4. Handle, store, install, and finish products and systems.
   5. Repair or replace damaged, defective, or missing items.
   6. Arrange for manufacturer's warranties, inspections, and service.
   7. Comply with applicable provisions of Division 01 - General Requirements, specifically including administrative requirements, coordination, quality, regulatory, and product requirements.
   8. Coordinate delegated design work with Sections 07 8400 - Firestopping, 08 3100 - Access Doors and Panels, applicable Division 09 painting Sections, and applicable Division 23 HVAC instrumentation and control Sections. Provide work scope specified in these Sections that is applicable to delegated design work.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Design Data: Submit for Architect's knowledge for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents, or for Owner's information.
   1. Include calculations that have been used to demonstrate compliance to performance and regulatory criteria provided, and to determine design solutions.
   2. Include required product data and shop drawings.
   3. Include a statement or certification attesting that design data complies with criteria indicated, such as building codes, loads, functional, and similar engineering requirements.
   4. Include signature and seal of design professional responsible for allocated design services on calculations and drawings.
   5. Provide additional copies of design data for Architect's design consultants, including but not limited to structural engineer, mechanical engineer, plumbing engineer, and electrical engineer; transmit to each design consultant's address concurrently, if requested by Architect.

C. Certificates: When specified in individual specification sections, submit certification by the manufacturer and Contractor or installation/application subcontractor to Architect, in quantities specified for Product Data.
   1. Indicate material or product complies with or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
   2. Certificates may be recent or previous test results on material or product, but must be acceptable to Architect.

D. Subcontractor, Trade Contractor and Installer Qualifications: When specified in individual specification Sections, submit qualifications data substantiating specified qualifications; three copies, one of which will be reviewed and returned to Contractor indicating action taken.

E. Manufacturer's Instructions: When specified in individual specification Sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, for the Owner's information. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

F. Manufacturer's Field Reports: When specified in individual specification Sections, submit reports for Architect's benefit as contract administrator or for Owner.
   1. Submit report in duplicate within 30 days of observation to Architect for information.
   2. Submit for information for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents.

G. Warranty Documentation: When specified in individual specification Sections, submit specified manufacturer warranty indicating all required inclusions and restricted exclusions, and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

A. Designer Qualifications: Where professional engineering design services and design data submittals are specifically required of Contractor by Contract Documents, provide services of a Professional Engineer experienced in design of this type of work and licensed in Colorado.

1.07 REFERENCES AND STANDARDS

A. For products and workmanship specified by reference to a document or documents not included in the Project Manual, also referred to as reference standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

B. Comply with reference standard of date of issue current on date of Contract Documents, except where a specific date is established or required by applicable code.

C. Obtain copies of standards where required by product specification Sections.
   1. Maintain copy at project site during submittals, planning, and progress of the specific work, until Substantial Completion.

D. Should specified reference standards conflict with Contract Documents, request clarification from Architect before proceeding.

E. Neither the contractual relationships, duties, or responsibilities of the parties in Contract nor those of Architect shall be altered from the Contract Documents by mention or inference otherwise in any reference standard document.

1.08 TESTING AND INSPECTION AGENCIES AND SERVICES

A. Special Testing and Inspection: It is recognized that specified special testing and inspection program is intended to assist Contractor, Owner, Architect, and jurisdictional authorities in nominal determination of probable compliance with specified requirements for certain elements of the Work. This program is not intended to limit Contractor's standard quality control program.

1.09 TESTING AND INSPECTION AGENCIES AND SERVICES

A. Owner will employ and pay for services of an independent testing agency to perform specified testing and inspection.

1.10 BASIS OF DESIGN SPECIFICATIONS

A. Individual specification Sections may include a Basis of Design Manufacturer or Product, which forms the basis of the specifications, Drawing details, and other requirements of the Contract Documents. The specified Basis of Design Manufacturer or Product is not intended to exclude other manufacturers, products, or systems which comply with the requirements of the Contract Documents, subject to the provisions and requirements specified in individual specification Sections.

B. Comply with the administrative requirements for substitutions specified in Section 01 6000 - Product Requirements for proposed products or systems other than the specified Basis of Design Manufacturer or Product.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 CONTROL OF INSTALLATION

A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce work of specified quality.

B. Comply with manufacturers' instructions, including each step in sequence.

C. Comply with specified standards as minimum quality for the work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

D. Have work performed by persons qualified to produce required and specified quality.

E. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.

F. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.

3.02 MOCK-UPS

A. Before installing portions of the Work where mock-ups are required, construct mock-ups in location and size indicated for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work. The purpose of mock-up is to demonstrate the proposed range of aesthetic effects and workmanship and, if applicable, compliance with moisture management materials, claddings, and fenestrations.

B. Accepted mock-ups establish the standard of quality the Architect will use to judge the Work.

C. Notify Architect fifteen (15) working days in advance of dates and times when mock-ups will be completed and ready for review and evaluation.

D. Provide supervisory personnel who will oversee mock-up construction. Provide workers that will be employed during the construction at Project.

E. Tests will be performed under provisions identified in this Section and identified in the respective product specification Sections.

F. Assemble and erect specified items with specified backing materials, attachment and anchorage devices, weather barriers, flashings, sealants, applied coatings, surface treatments, and finishes.

G. Obtain Architect's approval of mock-ups before starting work, fabrication, or construction.
   1. Architect will issue written comments within seven (7) working days of initial review and each subsequent follow up review of each mock-up.
   2. Make corrections as necessary until Architect's approval is issued.

H. Architect will use accepted mock-ups as a comparison standard for the remaining Work.

I. Where mock-up has been accepted by Architect and is specified in product specification Sections to be removed, protect mock-up throughout construction, remove mock-up and clear area when directed to do so by Architect.

3.03 TOLERANCES

A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.

B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Architect before proceeding.

C. Adjust products to appropriate dimensions; position before securing products in place.

3.04 TESTING AND INSPECTION

A. See individual specification Sections and structural Drawings for testing and inspection required.

B. Testing Agency Duties:
   1. Test samples of mixes submitted by Contractor.
   2. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
   3. Perform specified sampling and testing of products in accordance with specified standards.
   4. Ascertain compliance of materials and mixes with requirements of Contract Documents.
   5. Promptly notify Architect and Contractor of observed irregularities or non-compliance of Work or products.
   6. Perform additional tests and inspections required by Architect.
   7. Submit reports of all tests/inspections specified.

C. Limits on Testing/Inspection Agency Authority:
   1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
   2. Agency may not approve or accept any portion of the Work.
   3. Agency may not assume any duties of Contractor.
   4. Agency has no authority to stop the Work.

D. Contractor Responsibilities:
   1. Deliver to agency at designated location, adequate samples of materials proposed to be used that require testing, along with proposed mix designs.
   2. Cooperate with laboratory personnel, and provide access to the Work and to manufacturers' facilities.
   3. Provide incidental labor and facilities:
      a. To provide access to Work to be tested/inspected.
      b. To obtain and handle samples at the site or at source of Products to be tested/inspected.
      c. To facilitate tests/inspections.
      d. To provide storage and curing of test samples.
   4. Re-testing: Performed by same agency if required because of non-conformance to specified requirements, on instructions from Architect.
      a. Paid for by Contractor if required because of non-conformance with specified requirements.

3.05 MANUFACTURERS' FIELD SERVICES

A. When specified in individual specification Sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust and balance of equipment, and inspection of surfaces to receive waterproofing systems as applicable, and to initiate instructions when necessary.
   1. Manufacturer's field representative will be required to submit daily reports as specified in this Section, when daily observations and inspections are specified in individual Sections.

B. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

3.06 DEFECT ASSESSMENT

A. Replace Work or portions of the Work not complying with specified requirements.

B. If, in the opinion of Architect, it is not practical to remove and replace the Work, Architect will direct an appropriate remedy or adjust payment, with Owner's consent.

END OF SECTION

SECTION 01 4100

REGULATORY REQUIREMENTS

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. Obtain and pay for required permits, fees, licenses, and inspections as stipulated in the Agreement.

B. Arrange for required regulatory inspections and approvals.

C. Verify applicable codes and regulations.

D. Comply with applicable codes and regulations as stipulated in the Agreement.
   1. Contractor is not required to ascertain that the Contract Documents are in accordance with applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities.
   2. Contractor is required to promptly report to Architect any nonconformity discovered by or made known to Contractor as a request for information as specified, or in such form as Architect may otherwise require.

E. Listing of applicable Codes and regulations in this Section is not to be considered complete and all-inclusive; listing refers to primary applicable Codes and regulations only. See Drawings for additional information.

1.02 SUMMARY OF APPLICABLE CODES AND REFERENCE STANDARDS

A. Federal Regulations (Including but not limited to); currently adopted editions of the following, unless noted otherwise:
   1. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines.
   2. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design.
   3. 29 CFR 1910 - Occupational Safety and Health Standards.

B. City of Lafayette, State of Colorado Regulations, and other regulations (including but not limited to); currently adopted editions of the following, unless noted otherwise:
   1. Zoning Code: Local jurisdiction.
   2. Fire Protection District: Local jurisdiction.
   3. ICC A117.1 - Accessible and Usable Buildings and Facilities.
   4. ICC (IFC) - International Fire Code.
   5. ICC (IBC) - International Building Code.
   6. ICC (IPC) - International Plumbing Code.
   7. ICC (IMC) - International Mechanical Code.
   8. ICC (IFGC) - International Fuel Gas Code.
   9. NFPA 70 - National Electrical Code.
   10. ICC (IECC) - International Energy Conservation Code.
   11. Erosion and Sedimentation Control Regulations: Local jurisdiction, unless otherwise specified.

1.03 RELATED REQUIREMENTS

A. Section 01 4000 - Quality Requirements: Additional regulatory requirements.

1.04 QUALITY ASSURANCE

A. Become familiar with applicable requirements of codes and regulations.

B. Verify that substituted materials and equipment used in the Work meet or exceed requirements of applicable codes and regulations.

C. Contractor's Designer Qualifications: Refer to Section - 01 4000 - Quality Requirements.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 4216

DEFINITIONS AND EXPLANATIONS

PART 1 GENERAL

1.01 SUMMARY

A. This Section supplements the definitions contained in the General Conditions and other Contract Documents.

B. Other definitions are included in individual specification Sections.

C. Limitations: Definitions and explanations are not necessarily complete or exclusive, but are generally applicable to the Work to the extent such definitions or explanations are not stated more explicitly in other provisions of the Contract Documents.

1.02 SPECIFICATION EXPLANATIONS

A. General: Explanations are provided to assist in understanding format, language, implied requirements and conventions of specification content. None of these explanations will be interpreted to modify the substance of content requirements.

B. Division 01 General Requirements: Expand on the broad provisions of the Conditions of the Contract, and govern the execution of the work of all Sections of the specifications. Division 01 General Requirements specify administrative and procedural requirements relating to execution of the Work, and temporary facilities for use during the construction period.

C. Sections and Divisions: The basic unit of specification text is the "Section," each of which is named and numbered. These are organized into related families called "Divisions," which generally conform to the most current edition of "MasterFormat" as published by CSI. Any Section title is not intended to limit meaning or content of Section, nor to be fully descriptive of requirements specified therein, nor to be an integral part of the text.

D. Imperative Language: Used generally in the Specifications. Except as otherwise specified, requirements expressed imperatively are to be performed by Contractor. For clarity of reading at certain locations, contrasting subjective language is used to describe the responsibilities which must be fulfilled either indirectly by Contractor, or when so noted by others.

1.03 SPECIFICATION CONTENT CONVENTIONS

A. Overlapping Requirements: Where compliance with two or more industry standards or sets of requirements is specified, and overlapping of those requirements also establishes different or conflicting minimums or levels of quality, the more stringent requirement will be enforced (which is generally the more costly level).

B. Refer apparently equal but different requirements and uncertainties as to which level of quality is required to Architect for interpretation or decision before proceeding.

C. Specification Minimum: In every instance, the specified requirement is the minimum to be performed or fulfilled. In complying with minimum requirements, the indicated numeric values are either minimums or maximums as noted or as appropriate for the context of the requirement. Refer instances of uncertainty to Architect for decision.

D. Abbreviations: The language of the Specifications and elsewhere in the Contract Documents is of the abbreviated type in certain instances, and implies words and meanings which will be appropriately interpreted. Actual work abbreviations of a self-explanatory nature have been included in the text.

E. Trade associations and general standards are frequently abbreviated. Singular words will be interpreted as plural and plural words will be interpreted as singular wherever applicable and wherever the full context of the requirements so indicate.

F. Specialists: In certain instances the Specification text may require that specific work be assigned to certain specialists or expert entities for the performance of those units of the Work. These are specified as requirements on which the Contractor has no choice or option.

1.04 DEFINITIONS

A. Approve/Approved: Where used in conjunction with Architect's or Architect's consultant response to submittals, requests, applications, inquiries, reports, and claims by Contractor, the meaning of the term "approve" or "approved" will be held to the limitations of Architect's responsibilities and duties as specified in Section 01 3000 - Administrative Requirements and stipulated in the General Conditions of the Contract. In no case will approval by Architect be interpreted as an assurance to Contractor that the requirements of the Contract Documents have been fulfilled.

B. By Others: Work performed by entities outside the Contract; interchangeable with "NIC" or "Not in Contract."

C. Contract Documents: Those documents defined in the Owner-Contractor Agreement (Contract) as applicable to the construction of the Project by Contractor.
   1. Refer to General Conditions of the Contract for Construction for broader definition of this term.

D. Contractor's Option: Where materials, products, systems or methods are specified to be at Contractor's option, the choice of which material, method, product, or system will be used is solely Contractor's. There will be no change in Contract Sum or Time because of such choice.

E. Directed, Requested, etc.: Where not otherwise explained, terms such as "directed," "requested," "authorized," "selected," "approved," "required," "accepted," and "permitted" mean "directed by Architect", "requested by Architect", etc. However, no such implied meaning will be interpreted to extend Architect's responsibility into Contractor's area of construction supervision.

F. Drawings: Capitalized term referring to the drawings prepared by Architect and its design consultants, and by any Owner consultants as applicable; bound and published as a sub-set of the Contract Documents as defined in Owner-Contractor Agreement (Contract). Non-capitalized term "drawings" used in the Contract Documents generally refers to other drawings not part of the Contract Documents, unless the context explicitly indicates otherwise.
   1. Refer to General Conditions of the Contract for Construction for broader definition of this term.

G. Equipment: Defined as products with operational parts, regardless of whether motorized or manually operated, and particularly including connections (wiring, piping, etc.).

H. Final Acceptance: The administrative action taken by Owner authorizing final payment and settlement of the Contract.
   1. Refer to General Conditions of the Contract for Construction for broader definition of this term.

I. Furnish: To supply, deliver, unload, and inspect for damage (by Contractor).

J. General Requirements: Provisions or requirements of Division 01 specification Sections. General Requirements apply to the entire Work of the Contract and, where so indicated, to other elements of work which are included in the Project. See specification explanations in this Section.

K. Indicated: Cross reference to details, notes or schedules on the Drawings, other paragraphs or schedules in the Specifications, and similar means of recording requirements in the Contract Documents. Where terms such as "shown," "noted," "scheduled," and "specified" are used in lieu of "indicated," it is for the purpose of helping the reader accomplish the cross reference, and no limitation is intended except as specifically noted.

L. Install: To unpack, assemble, erect, apply, place, finish, cure, protect, clean, start up, and make ready for use (by Contractor).

M. Installer: The entity (person or firm) engaged by Contractor or his Subcontractor or Sub-subcontractor for the performance of a particular unit of work at the project site, including installations, erection, application and similar required operations.

N. Material(s): Defined as products which must be substantially cut, shaped, worked, mixed, finished, refined or otherwise fabricated, processed, installed or applied to form units of work.

O. Not in Contract (NIC): Work performed by entities outside the Contract; interchangeable with "By Others."

P. Product(s): Material, machinery, components, equipment, fixtures, and systems forming the work result. Not materials or equipment used for preparation, fabrication, conveying, or erection and not incorporated into the work result. Products may be new, never before used, or re-used materials or equipment.

Q. Project Manual: The book-sized volume that includes the procurement requirements (if any), the contracting requirements, and the Specifications.

R. Provide: To furnish and install.

S. Supply: Same as Furnish.

T. Testing Agency/Laboratory: An independent entity engaged to perform specific inspections or tests of the Work, either at the project site or elsewhere; and to report and (if required) interpret the results of those inspections or tests.

U. Work (the Work): Capitalized term referring to the entire scope of work of the Project as defined in the Contract Documents. Non-capitalized term "work" used in the Contract Documents generally refers to work by specific trades or other entities as components or phases of the Work, unless the context explicitly indicates otherwise.
   1. Refer to General Conditions of the Contract for Construction for broader definition of this term.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 5000

TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Temporary telecommunications services.

B. Temporary sanitary facilities.

C. Temporary Controls: Barriers, enclosures, and fencing.

D. Vehicular access and parking.

E. Waste removal facilities and services.

F. Project identification sign.

G. Field offices.

1.02 TEMPORARY UTILITIES

A. Owner will provide the following:
   1. Electrical power and metering, consisting of connection to existing facilities.
   2. Water supply, consisting of connection to existing facilities.

B. Provide and pay for all electrical power, lighting, water, heating and cooling, and ventilation required for construction purposes.

C. Use trigger-operated nozzles for water hoses, to avoid waste of water.

1.03 TELECOMMUNICATIONS SERVICES

A. Provide, maintain, and pay for telecommunications services to field office at time of project mobilization.

B. Telecommunications services shall include:
   1. Personal computer or lap-top computer dedicated to project telecommunications, with necessary software and printer.
   2. Telephone Lines: Minimum of one phone line, reserved for project use only.
   3. Internet Connections: Minimum of one; 2.4G or faster.
   4. Email: Account/address reserved for project use only.

1.04 TEMPORARY SANITARY FACILITIES

A. Provide and maintain required temporary facilities and enclosures. Provide at time of project mobilization.

B. New permanent facilities may not be used during construction operations.

C. Maintain daily in clean and sanitary condition.

D. At end of construction, return facilities to same or better condition as originally found.

1.05 BARRIERS

A. Provide barriers to prevent unauthorized entry to construction areas, to prevent access to areas that could be hazardous to workers or the public and to protect existing facilities and adjacent properties from damage from construction operations and demolition.

B. Provide barricades and covered walkways required by governing authorities for public rights-of-way.

C. Provide protection for plants designated to remain. Replace damaged plants.

D. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

1.06 FENCING

A. Construction: Commercial grade chain link fence.

B. Provide minimum 6 foot high fence around construction site; equip with vehicular and pedestrian gates with locks.

1.07 EXTERIOR ENCLOSURES

A. Provide temporary insulated weather tight closure of exterior openings to accommodate acceptable working conditions and protection for Products, to allow for temporary heating and maintenance of required ambient temperatures identified in individual specification sections, and to prevent entry of unauthorized persons. Provide access doors with self-closing hardware and locks.

1.08 VEHICULAR ACCESS AND PARKING

A. Comply with regulations relating to use of streets and sidewalks, access to emergency facilities, and access for emergency vehicles.

B. Coordinate access and haul routes with governing authorities and Owner.

C. Provide and maintain access to fire hydrants, free of obstructions.

D. Provide means of removing mud from vehicle wheels before entering streets.

E. Existing parking areas located at Project site may be used for construction parking.

1.09 WASTE REMOVAL

A. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition.

B. Provide containers with lids. Remove trash from site periodically.

C. If materials to be recycled or re-used on the project must be stored on-site, provide suitable non-combustible containers; locate containers holding flammable material outside the structure unless otherwise approved by the authorities having jurisdiction.

D. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.

1.10 PROJECT IDENTIFICATION

A. Provide project identification sign of design, construction, and location approved by Owner.

B. No other signs are allowed without Owner permission except those required by law.

1.11 FIELD OFFICES

A. Provide space within existing building for Project meetings, with table and chairs to accommodate 10 persons.

1.12 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

A. Remove temporary utilities, equipment, facilities, materials, prior to Date of Substantial Completion inspection.

B. Clean and repair damage caused by installation or use of temporary work.

C. Restore existing facilities used during construction to original condition.

D. Restore new permanent facilities used during construction to specified condition.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 5719

TEMPORARY ENVIRONMENTAL CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Construction procedures to promote adequate indoor air quality after construction.

B. Building flush-out after construction and before occupancy.

C. Testing indoor air quality after completion of construction.

1.02 PROJECT GOALS

A. See Section 01 3566.05 - LEED v4 Credit Summary, for overall project goals relating to environment and energy.

B. Dust and Airborne Particulates: Prevent deposit of dust and other particulates in HVAC ducts and equipment.
   1. Cleaning of ductwork is not contemplated under this Contract.
   2. Bear the cost of cleaning required due to failure to protect ducts and equipment from construction dust.
   3. Establish condition of existing ducts and equipment prior to start of alterations.

C. Airborne Contaminants: Procedures and products have been specified to minimize indoor air pollutants.
   1. Furnish products meeting the specifications.
   2. Avoid construction practices that could result in contamination of installed products leading to indoor air pollution.

1.03 REFERENCE STANDARDS

A. ASHRAE Std 52.2 - Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size.

B. SMACNA (OCC) - IAQ Guidelines for Occupied Buildings Under Construction.

1.04 DEFINITIONS

A. Adsorptive Materials: Gypsum board, acoustical ceiling tile and panels, carpet and carpet tile, fabrics, fibrous insulation, and other similar products.

B. Contaminants: Gases, vapors, regulated pollutants, airborne mold and mildew, and the like, as specified.

C. Particulates: Dust, dirt, and other airborne solid matter.

D. Wet Work: Concrete, plaster, coatings, and other products that emit water vapor or volatile organic compounds during installation, drying, or curing.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Sustainability Documentation: Submit all submittals required in this Section.
   1. For LEED v4 certification system projects, submit in accordance with procedures specified in Section 01 3329.02 - LEED v4 Design Reporting.

C. Indoor Air Quality Management Plan: Describe in detail measures to be taken to promote adequate indoor air quality upon completion; use SMACNA (OCC) as a guide.
   1. Submit not less than 60 days before enclosure of building.
   2. Identify potential sources of odor and dust.
   3. Identify construction activities likely to produce odor or dust.
   4. Identify areas of project potentially affected, especially occupied areas.
   5. Evaluate potential problems by severity and describe methods of control.
   6. Describe construction ventilation to be provided, including type and duration of ventilation, use of permanent HVAC systems, types of filters and schedule for replacement of filters.

7. Describe cleaning and dust control procedures.
8. Describe coordination with commissioning procedures.

D. Interior Finishes Installation Schedule: Identify each interior finish that either generates odors, moisture, or vapors or is susceptible to adsorption of odors and vapors, and indicate air handling zone, sequence of application, and curing times.

E. Duct and Terminal Unit Inspection Report.

F. Product Data: Provide manufacturer's performance data for MERV 8 filtration media used during the construction period.

G. Building Flush-out Reports: Identify:
1. Recorded dates of flush-out procedure.
2. Outdoor air delivery rates.
3. Indoor temparature and relative humidity readings at a consistent time each day of the flush-out procedure.
4. Building occupancy conditions.

H. Documentation Photograph Requirements: Specified in Section 01 3000 - Administrative Requirements.

1.06 QUALITY ASSURANCE

A. Testing and Inspection Agency Qualifications: Independent testing agency having minimum of 5 years experience in performing the types of testing specified.

PART 2 PRODUCTS

2.01 MATERIALS

A. Low VOC Materials: See Section 01 6116.

B. Low VOC Materials: See other Sections for specific requirements for materials with low VOC content.

C. Temporary Air Filters - Used During Construction: MERV of 8, minimum, when tested in accordance with ASHRAE Std 52.2.

PART 3 EXECUTION

3.01 CONSTRUCTION PROCEDURES

A. Prevent the absorption of moisture and humidity by adsorptive materials by:
1. Sequencing the delivery of such materials so that they are not present in the building until wet work is completed and dry.
2. Delivery and storage of such materials in fully sealed moisture-impermeable packaging.
3. Provide sufficient ventilation for drying within reasonable time frame.

B. Do not permit smoking or consumption of food and drink within the building at any time. Further, do not permit smoking within 25 feet of entrances, operable windows, intake louvers, and similar building openings.

C. Begin construction ventilation when building is substantially enclosed.

D. If extremely dusty or dirty work must be conducted inside the building, shut down HVAC systems for the duration; remove dust and dirt completely before restarting systems.

E. When working in a portion of an occupied building, prevent movement of air from construction area to occupied area.

F. HVAC equipment and supply air ductwork may be used for ventilation during construction:
1. Operate HVAC system on 100 percent outside air, with 1.5 air changes per hour, minimum.
2. Ensure that air filters are correctly installed prior to starting use; replace filters when they lose efficiency.
3. Do not use return air ductwork for ventilation.

G. Do not store construction materials or waste in mechanical or electrical rooms.

H. Prior to use of return air ductwork without intake filters clean up and remove dust and debris generated by construction activities.
   1. Inspect duct intakes, return air grilles, and terminal units for dust.
   2. Clean plenum spaces, including top sides of lay-in ceilings, outsides of ducts, tops of pipes and conduit.
   3. Clean tops of doors and frames.
   4. Clean mechanical and electrical rooms, including tops of pipes, ducts, and conduit, equipment, and supports.
   5. Clean return plenums of air handling units.
   6. Remove intake filters last, after cleaning is complete.

I. Do not perform dusty or dirty work after starting use of return air ducts without intake filters.

J. Use other relevant recommendations of SMACNA (OCC) for avoiding unnecessary contamination due to construction procedures, including the following:
   1. HVAC Protection:
      a. Use temporary heaters whenever feasible.
      b. Seal all duct and equipment openings with plastic during transportation, delivery, installation, and the remainder of the construction period.
      c. If permanently installed air handlers are used during construction, filtration media with a Minimum Efficiency Reporting Value (MERV) 8, as determined by ASHRAE Std 52.2, shall be used over each return air grille. Replace all filtration media immediately prior to occupancy.
      d. Conduct periodic inspections during construction. If ducts become contaminated due to inadequate protection, clean ducts professionally.
      e. Promptly repair all leaks in ducts and air handlers.
      f. Do not use mechanical rooms to store construction waste materials. Keep mechanical rooms clean at all times.
   2. Source Control:
      a. For Contractor information, all paints, carpet, adhesives, and sealants are specified as low-VOC and non-toxic. Use of materials that fail to meet specified VOC levels are prohibited for use in the interior of the building.
      b. Recover, isolate and ventilate containers housing toxic materials.
      c. Avoid exhaust fumes from idling vehicles and gasoline fueled tools.
      d. Use electric or natural gas alternative for gasoline and diesel equipment where possible and practical.
      e. Cycle equipment off when not being used or needed.
      f. Pollution sources may be exhausted to the outside with portable fan system. Care should be taken to ensure exhaust does not re-circulate back into the building.
      g. Containers of wet products should be kept closed as much as possible. Waste materials, which can release odor or dust, should be covered or sealed.
      h. Smoking will not be permitted in indoor Project locations.
   3. Pathway Interruption:
      a. During construction, isolate areas of work to prevent contamination of clean or finished spaces. Utilize dust curtains or temporary enclosures to prevent dust from migrating to other areas when applicable.
      b. Ventilate using 100 percent outside air to exhaust contaminated air directly to the outside during installation of VOC emitting materials.
      c. Use pressure differentials or barriers between work and clean areas to prevent contaminated air from entering clean areas.
      d. Relocate pollutant sources (paints, sealers, adhesives, caulking, cleaners, etc.) as far away as possible from supply ducts, areas occupied by workers and absorbing materials when feasible. Absorbing materials include drywall, insulation, carpet, ceiling tile, etc. Supply and exhaust systems may have to be shut down or isolated during such activities.
   4. Housekeeping:
      a. Protect building materials from weather and store in a clean area prior to unpacking for installation.
      b. Clean all coils, air filters, and fans before performing testing and balancing procedures.
      c. Institute cleaning activities designed to control contaminants in building spaces before occupancy.

d. Suppress dust with wetting agents or sweeping compounds. Use an efficient and effective dust collecting method such as a damp cloth, wet mop, vacuum with particulate filters or wet scrubber.
e. Remove accumulations of water inside the building. Protect porous materials such as insulation and ceiling tile from exposure to moisture. Materials with evidence of moisture damage, including stains, are not acceptable, including both stored and installed materials; immediately remove from site and properly dispose.

5. Final Cleaning:
   a. Clean interior and exterior surfaces exposed to view; remove temporary labels, stains, and foreign substances; polish transparent and glossy surfaces.
   b. Clean equipment and fixtures to sanitary condition.
   c. Vacuum carpeted and soft surfaces with high efficiency particulate arrestor (HEPA) vacuum.
   d. Comply with cleaning requirements specified in Section 01 7000 - Execution and Closeout Requirements.
6. Scheduling:
   a. Complete applications of wet and odorous materials such as VOC in paints, sealants, and coatings before installing absorbing materials such as ceiling tiles, carpets, insulation, gypsum products, and fabric-covered furnishings.
   b. Avoid exposure of all interior materials to moisture.
   c. Protect stored on-site or installed absorptive materials from moisture damage.
   d. If Owner authorizes the use of permanent heating, cooling, and ventilating systems during construction period, install filter media having a MERV 8 according to ASHRAE Std 52.2 at each return-air inlet for the air-handling system used during construction.
   e. Replace all filtration media with filter media having a MERV 13 according to ASHRAE Std 52.2 immediately prior to occupancy.

3.02 BUILDING FLUSH-OUT

A. Perform building flush-out before occupancy.

B. Do not start flush-out until:
   1. All construction is complete, including all finishes.
   2. All furniture and furnishings are installed in-place.
   3. HVAC systems have been tested, adjusted, and balanced for proper operation.
   4. Cleaning of inside of HVAC ductwork, specified elsewhere, has been completed.
   5. Inspection of inside of return air ducts and terminal units confirms that cleaning is not necessary.
   6. New HVAC filtration media have been installed.

C. Building Flush-Out: Operate all ventilation systems at normal flow rates with 100 percent outside air until a total air volume of 14,000 cubic feet per square foot of floor area has been supplied.
   1. Flush-out must be documented for a total of 48 hours, non-consecutive.
   2. Obtain Owner's concurrence that construction is complete enough before beginning flush-out.
   3. Maintain interior temperature of at least 60 degrees F and interior relative humidity no higher than 60 percent.
   4. If additional construction involving materials that produce particulates or any of the specified contaminants is conducted during flush-out, start flush-out over.
   5. If interior spaces must be occupied prior to completion of the flush-out, supply a minimum of 25 percent of the total air volume prior to occupancy, and:
      a. Begin ventilation at least three hours prior to daily occupancy.
      b. Continue ventilation during all occupied periods.
      c. Provide minimum outside air volume of 0.30 cfm per square foot or design minimum outside air rate, whichever is greater.

D. Install new HVAC filtration media after completion of flush-out and before occupancy or further testing.

END OF SECTION

SECTION 01 6000

PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General product requirements.

B. Sustainable design-related product requirements.

C. Re-use of existing products.

D. Transportation, handling, storage and protection.

E. Product option requirements.

F. Substitution limitations.

G. Maintenance materials, including extra materials, spare parts, tools, and software.

1.02 RELATED REQUIREMENTS

A. Section 01 2500 - Substitution Procedures: Substitutions made after award of Contract and during construction phase.

B. Section 01 3329.02 - LEED v4 Design Reporting: Reporting requirements.

C. Section 01 3566.12 - LEED v4 Certification Project Procedures: Requirements for LEED v4 procedures.

1.03 REFERENCE STANDARDS

A. EN 15804 - Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products.

B. ISO 14025 - Environmental labels and declarations -- Type III environmental declarations -- Principles and procedures.

C. ISO 14040 - Environmental management -- Life cycle assessment -- Principles and framework.

D. ISO 14044 - Environmental management -- Life cycle assessment -- Requirements and guidelines.

E. ISO 21930 - Sustainability in buildings and civil engineering works -- Core rules for environmental product declarations of construction products and services.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Proposed Products List: Submit list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.
   1. Submit within 15 days after date of Agreement.
   2. For products specified only by reference standards, list applicable reference standards.

C. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.

D. Shop Drawing Submittals: Prepared specifically for this Project; indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

E. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
   1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.

1.05 SUSTAINABLE DESIGN SUBMITTALS

A. Sustainable Design Submittals: Items necessary to document use of sustainable construction materials, products, and practices.
   1. Submit evidence of compliance with specified requirements.
   2. See Section 01 3566.12 for Contractor's procedures necessary for achievement of targeted LEED v4 sustainability certification level.
   3. See Section 01 3329.02 for Contractor's reporting necessary for achievement of targeted LEED v4 certification level.
   4. Identify evidence submittals with the words "Sustainable Design Submittal."

1.06 QUALITY ASSURANCE

A. Composite Wood and Agrifiber: Products made of wood particles and/or plant material pressed and bonded with adhesive or resin such as particleboard, medium density fiberboard (MDF), plywood, wheatboard, strawboard, panel substrates, and door cores.

B. Environmental Product Declaration (EPD): Publicly available, critically reviewed life cycle analysis having at least a cradle-to-gate scope.
   1. Good: Product-specific; compliant with ISO 14044.
   2. Better: Industry-wide, generic; compliant with ISO 21930, or with ISO 14044, ISO 14040, ISO 14025, and EN 15804; Type III third-party certification with external verification, in which the manufacturer is recognized as the program operator.
   3. Best: Commercial-product-specific; compliant with ISO 21930, or with ISO 14044, ISO 14040, ISO 14025, and EN 15804; Type III third-party certification with external verification, in which the manufacturer is recognized as the program operator.
   4. Where demonstration of impact reduction below industry average is required, submit both industry-wide and commercial-product-specific declarations; or submit at least 5 declarations for products of the same type by other manufacturers in the same industry.

C. Manufacturer's Inventory of Product Content: Publicly available inventory of every ingredient identified by name and Chemical Abstract Service Registration Number (CAS RN).
   1. For ingredients considered a trade secret or intellectual property, the name and CAS RN may be omitted, provided the ingredient's role, amount, and GreenScreen Benchmark are given.

D. Regional Materials: Materials that are extracted, harvested, recovered, and manufactured within a radius of 100 miles from the Project site.

E. Reused Products: Materials and equipment previously used in this or other construction, salvaged and refurbished as specified.
   1. Wood fabricated from timber abandoned in transit after harvesting is considered reused, not recycled.
   2. Acceptable Evidence: Information about the origin or source, from Contractor or supplier.

F. Source Location: Location of harvest, extraction, recovery, or manufacture; where information about source location is required to be submitted, give the postal address:
   1. In every case, indicate the location of final assembly.
   2. For harvested products, indicate location of harvest.
   3. For extracted (i.e. mined) products, indicate location of extraction.
   4. For recovered products, indicate location of recovery.
   5. For products involving multiple manufacturing steps, provide a description of the process at each step, with location.
   6. Acceptable Evidence:
      a. Manufacturer's certification.
      b. Life cycle analysis (LCA) performed by third-party.

G. Sustainably Harvested Wood: Solid wood, wood chips, and wood fiber certified or labeled by an organization accredited by one of the following:
   1. American Forest Foundation, The American Tree Farm System; refer to http://www.treefarmsystem.org.
   2. The Forest Stewardship Council, The Principles for Natural Forest Management; for Canada visit http://www.fsccanada.org, for the USA visit http://www.fscus.org.

3. Sustainable Forestry Board, under The Sustainable Forestry Initiative® of the American Forest & Paper Association; refer to http://www.afandpa.org.
4. Acceptable Evidence: Copies of invoices bearing the certifying organization's certification numbers.

PART 2 PRODUCTS

2.01 EXISTING PRODUCTS

A. Do not use materials and equipment removed from existing premises unless specifically required or permitted by Contract Documents.

B. Unforeseen historic items encountered remain the property of the Owner; notify Owner promptly upon discovery; protect, remove, handle, and store as directed by Owner.

C. Existing materials and equipment indicated to be removed, but not to be re-used, relocated, reinstalled, delivered to the Owner, or otherwise indicated as to remain the property of the Owner, become the property of the Contractor; remove from site.

2.02 NEW PRODUCTS

A. Provide new products unless specifically required or permitted by Contract Documents.

B. See Section 01 4000 - Quality Requirements, for additional source quality control requirements.

C. Use of products having any of the following characteristics is not permitted:
1. Made using or containing CFC's or HCFC's.
2. Containing lead, asbestos, or other known hazardous substances.

D. Where other criteria are met, Contractor shall give preference to products that:
1. Are extracted, harvested, and/or manufactured closer to the location of the project.
2. Have longer documented life span under normal use.
3. Result in less construction waste. See Section 01 7419
4. Are made of recycled materials.
5. If made of wood, are made of sustainably harvested wood, wood chips, or wood fiber.
6. Have a published Environmental Product Declaration (EPD).

2.03 PRODUCT OPTIONS

A. Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.

B. Products Specified by Naming One or More Manufacturers: Use a product of one of the manufacturers named and meeting specifications, no options or substitutions allowed.

C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.

D. Products Specified by Naming a Basis of Design Manufacturer or Product with a Provision for Substitutions: Submit a request for substitution for any other manufacturer listed under Other Acceptable Manufacturers, or for a manufacturer not named.
1. Refer to Section 01 4000 for basis of design specifications requirements.

2.04 MAINTENANCE MATERIALS

A. Furnish extra materials, spare parts, tools, and software of types and in quantities specified in individual specification sections.

B. Deliver and place in location as directed; obtain receipt prior to final payment.

PART 3 EXECUTION

3.01 SUBSTITUTION LIMITATIONS

A. See Section 01 2500 - Substitution Procedures for general substitution procedures.

B. Architect may consider requests for substitutions when one or more of the following conditions exist, as determined by Architect. If one or more of the following conditions are determined not to exist, Architect may not consider request further, and may take no action except to record the request and its non-compliance. Consideration may be given if substitution request:
   1. Offers Owner substantial advantage in cost, time, energy conservation, or other consideration, after deducting additional responsibilities Owner must assume as the result.
   2. Does not require extensive modification of Contract Documents.
   3. Is consistent with intent of Contract Documents, and will produce intended work results.
   4. Is fully documented and properly submitted.
   5. Resolves specified Product being unable to receive required approval by Authority Having Jurisdiction (AHJ), and substitution has received such approval prior to submission.
   6. Resolves incompatibility of specified Product with other related Products, and substitution is compatible with related Products.
   7. Resolves non-coordination of specified Product with other related Products, and substitution is coordinated with related Products.
   8. Provides specified warranty when specified Product cannot be provided with specified warranty.
   9. Is proposed for a Product that, through no fault of Contractor, becomes unavailable or unsuitable due to regulatory change.
   10. Will be considered if a Product cannot be provided within the Contract Time; Architect will not consider substitution if Product cannot be provided as the result of Contractor's failure to schedule and coordinate the Work as required by Contract Documents.
   11. Has been coordinated with and among all affected Subcontractors and other portions of the Work, and is acceptable to all affected Subcontractors.

3.02 TRANSPORTATION AND HANDLING

A. Package products for shipment in manner to prevent damage; for equipment, package to avoid loss of factory calibration.

B. If special precautions are required, attach instructions prominently and legibly on outside of packaging.

C. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.

D. Transport and handle products in accordance with manufacturer's instructions.

E. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.

F. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.

G. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage, and to minimize handling.

H. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

3.03 STORAGE AND PROTECTION

A. Provide protection of stored materials and products against theft, casualty, or deterioration.

B. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication.
   1. Structural Loading Limitations: Handle and store products and materials so as not to exceed static and dynamic load-bearing capacities of project floor and roof areas.

C. Store and protect products in accordance with manufacturers' instructions.

D. Store with seals and labels intact and legible.

E. Arrange storage of materials and products to allow for visual inspection for the purpose of determination of quantities, amounts, and unit counts.

F. Store sensitive products in weathertight, climate-controlled enclosures in an environment favorable to product.

G. For exterior storage of fabricated products, place on sloped supports above ground.

H. Provide bonded off-site storage and protection when site does not permit on-site storage or protection.

I. Protect products from damage or deterioration due to construction operations, weather, precipitation, humidity, temperature, sunlight and ultraviolet light, dirt, dust, and other contaminants.

J. Comply with manufacturer's warranty conditions, if any.

K. Do not store products directly on the ground.

L. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.

M. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.

N. Prevent contact with material that may cause corrosion, discoloration, or staining.

O. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.

P. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

END OF SECTION

SECTION 01 6116

VOC CONTENT AND EMISSIONS RESTRICTIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Requirements for indoor emissions restricted products.

B. Requirements for VOC content and emissions restricted products.

C. Installer certifications regarding any non-compliant products.

1.02 DEFINITIONS

A. Indoor-Emissions-Restricted Products: All products in the following product categories, whether specified or not:
1. Interior paints and coatings applied on site.
2. Interior adhesives and sealants applied on site, including flooring adhesives.
3. Flooring.
4. Composite wood.
5. Products making up wall and ceiling assemblies.
6. Thermal and acoustical insulation.
7. Free-standing furniture.
8. Other products when specifically stated in the specifications.

B. VOC-Content-Restricted Products: All products in the following product categories, whether specified or not:
1. Interior paints and coatings applied on site.
2. Interior adhesives and sealants applied on site, including flooring adhesives.
3. Other products when specifically stated in the specifications.

C. Interior of Building: Anywhere inside the exterior weather barrier.

D. Adhesives: All gunnable, trowelable, liquid-applied, and aerosol adhesives, whether specified or not; including flooring adhesives, resilient base adhesives, and pipe jointing adhesives.

E. Sealants: All gunnable, trowelable, and liquid-applied joint sealants and sealant primers, whether specified or not; including firestopping sealants and duct joint sealers.

F. Inherently Non-Emitting Materials: Products composed wholly of minerals or metals, unless they include organic-based surface coatings, binders, or sealants; and specifically the following:
1. Concrete.
2. Clay brick.
3. Metals that are plated, anodized, or powder-coated.
4. Glass.
5. Ceramics.
6. Solid wood flooring that is unfinished and untreated.

1.03 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency.

B. ASTM D3960 - Standard Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings.

C. BIFMA e3 - Furniture Sustainability Standard; Business and Institutional Furniture Manufacturers Association.

D. BIFMA M7.1 - Standard Test Method for Determining VOC Emissions from Office Furniture Systems, Components, and Seating.

E. CAL (CDPH SM) - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions From Indoor Sources Using Environmental Chambers.

F. CARB (ATCM) - Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products; California Air Resources Board.

G. CARB (SCM) - Suggested Control Measure for Architectural Coatings; California Air Resources Board.

H. CHPS (HPPD) - High Performance Products Database.

I. CRI (GLP) - Green Label Plus Testing Program - Certified Products.

J. GreenSeal GS-36 - Adhesives for Commercial Use.

K. SCAQMD 1113 - Architectural Coatings.

L. SCAQMD 1168 - Adhesive and Sealant Applications.

M. SCS (CPD) - SCS Certified Products.

N. UL (GGG) - GREENGUARD Gold Certified Products.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: For each VOC-restricted product used in the project, submit evidence of compliance with specified requirements.

1.05 SUSTAINABLE DESIGN SUBMITTALS

A. Sustainable Design Reporting: Submit evidence of compliance with specified requirements.
   1. Refer to Section 01 3329.02 - LEED v4 Design Reporting.
   2. Identify evidence submittals with the words "Sustainable Design Submittal."

B. Installer Certifications Regarding Prohibited Content: Require each installer of any type of product (not just the products for which VOC restrictions are specified) to certify that either:
   1. No adhesives, joint sealants, paints, coatings, or composite wood or agrifiber products have been used in the installation of installer's products.
   2. Such products used comply with these requirements.

1.06 QUALITY ASSURANCE

A. Indoor Emissions Standard and Test Method: CAL (CDPH SM), using Standard Private Office exposure scenario and the allowable concentrations specified in the method, and range of total VOC's after 14 days.
   1. Wet-Applied Products: State amount applied in mass per surface area.
   2. Paints and Coatings: Test tinted products, not just tinting bases.
   3. Evidence of Compliance: Acceptable types of evidence are the following;
      a. Current UL (GGG) certification.
      b. Current SCS (CPD) Floorscore certification.
      c. Current SCS (CPD) Indoor Advantage Gold certification.
      d. Current listing in CHPS (HPPD) as a low-emitting product.
      e. Current CRI (GLP) certification.
      f. Test report showing compliance and stating exposure scenario used.
   4. Product data submittal showing VOC content is NOT acceptable evidence.
   5. Manufacturer's certification without test report by independent agency is NOT acceptable evidence.

B. VOC Content Test Method: 40 CFR 59, Subpart D (EPA Method 24), or ASTM D3960, unless otherwise indicated.
   1. Evidence of Compliance: Acceptable types of evidence are:
      a. Report of laboratory testing performed in accordance with requirements.
      b. Published product data showing compliance with requirements.
      c. Certification by manufacturer that product complies with requirements.

C. Composite Wood Emissions Standard: CARB (ATCM) for ultra-low emitting formaldehyde (ULEF) resins.
   1. Evidence of Compliance: Acceptable types of evidence are:
      a. Current SCS "No Added Formaldehyde (NAF)" certification; www.scscertified.com.
      b. Report of laboratory testing performed in accordance with requirements.
      c. Published product data showing compliance with requirements.

D. Furnishings Emissions Standard and Test Method: BIFMA e3 Sections 7.6.1 and 7.6.2, tested in accordance with BIFMA M7.1.
   1. Evidence of Compliance:
      a. Test report showing compliance and stating exposure scenario used.

PART 2 PRODUCTS

2.01 MATERIALS

A. All Products: Comply with the most stringent of federal, State, and local requirements, or these specifications.

B. All products of each category that are installed in the project must comply; Owner's project goals do not allow for partial compliance.

C. Indoor-Emissions-Restricted Products: Comply with Indoor Emissions Standard and Test Method, except for:
   1. Composite Wood, Wood Fiber, and Wood Chip Products: Comply with Composite Wood Emissions Standard or contain no added formaldehyde resins.
   2. Furnishings: Comply with Furnishings Emissions Standard and Test Method.
   3. Inherently Non-Emitting Materials.

D. VOC-Content-Restricted Products: VOC content not greater than required by the following:
   1. Adhesives, Including Flooring Adhesives: SCAQMD 1168 Rule; July 1, 2005.
   2. Aerosol Adhesives: GreenSeal GS-36.
   3. Joint Sealants: SCAQMD 1168 Rule; July 1, 2005.
   4. Paints and Coatings: Each color; most stringent of the following:
      a. 40 CFR 59, Subpart D.
      b. SCAQMD 1113 Rule.
      c. CARB (SCM).

PART 3 EXECUTION

3.01 FIELD QUALITY CONTROL

A. Owner: Reserves the right to reject non-compliant products, whether installed or not, and require their removal and replacement with compliant products, at no additional cost to Owner.

B. Contractor: Bear additional costs to restore indoor air quality due to installation of non-compliant products.

END OF SECTION

SECTION 01 7000

EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Examination, preparation, and general installation procedures.

B. Pre-installation meetings.

C. Cutting and patching.

D. Surveying for laying out the work.

E. Cleaning and protection.

F. Starting of systems and equipment.

G. Demonstration and instruction of Owner personnel.

H. Project closeout meeting.

I. Closeout procedures, including Contractor's Correction Punch List, except payment procedures.

1.02 DEFINITIONS

A. Verify, Field Verify, or Drawing Abbreviation: Use on Drawings or in specifications is intended to alert Contractor that indicated measurement or description of work may not be fully determined without comparing verified dimension in larger context or other dependent measurements due to specific product, actual versus nominal dimensions, or measurements of existing conditions.
   1. Notify Architect of discrepancies between dimensions shown and field layout or measurements.

1.03 REFERENCE STANDARDS

A. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Cutting and Patching: Submit written request in advance of cutting or alteration that affects:
   1. Structural integrity of any element of Project.
   2. Integrity of weather exposed or moisture resistant element.
   3. Efficiency, maintenance, or safety of any operational element.
   4. Visual qualities of sight exposed elements.
   5. Work of Owner or separate Contractor.
   6. Include in Request:
      a. Identification of Project.
      b. Location and description of affected work.
      c. Necessity for cutting or alteration.
      d. Description of proposed work and products to be used.
      e. Alternatives to cutting and patching.
      f. Effect on work of Owner or separate Contractor, if applicable.
      g. Written permission of affected separate Contractor, if applicable.
      h. Date and time work will be executed.

C. Project Record Documents: Accurately record actual locations of capped and active utilities.

1.05 QUALIFICATIONS

A. For demolition work, employ a firm specializing in the type of work required.
   1. Minimum of five years of documented experience.

1.06 PROJECT CONDITIONS

A. Smoking of any kind is not permitted on Project site at any time.

B. Use of explosives is not permitted without written permission from Owner.

C. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.

D. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion.

E. Perform dewatering activities, as required, for the duration of the project.

F. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.

G. Dust Control: Execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere and over adjacent property.
   1. Provide dust-proof enclosures to prevent entry of dust generated outdoors.

H. Erosion and Sediment Control: Plan and execute work by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas. Prevent erosion and sedimentation.
   1. Minimize amount of bare soil exposed at one time.
   2. Provide temporary measures such as berms, dikes, and drains, to prevent water flow.
   3. Construct fill and waste areas by selective placement to avoid erosive surface silts or clays.
   4. Periodically inspect earthwork to detect evidence of erosion and sedimentation; promptly apply corrective measures.

I. Noise Control: Provide methods, means, and facilities to minimize noise produced by construction operations.

J. Rodent Control: Provide methods, means, and facilities to prevent rodents from accessing or invading premises.

K. Pollution Control: Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations. Comply with federal, state, and local regulations.

1.07 ADMINISTRATIVE COORDINATION - GENERAL

A. See Section 01 3114 - Facility Services Coordination, for detailed coordination requirements.

B. Coordinate scheduling, submittals, and work of the various Sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.

C. Notify affected utility companies and comply with their requirements.

D. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various Sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.

E. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on Drawings. Follow routing indicated for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

F. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.

G. Coordinate completion and clean-up of work of separate Sections.

H. After Owner occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

PART 2 PRODUCTS

2.01 PATCHING MATERIALS

A. New Materials: As specified in product Sections; match existing products and work for patching and extending work.

B. Type and Quality of Existing Products: Determine by inspecting and testing products where necessary, referring to existing work as a standard.

C. Product Substitutions: For any proposed change in materials, submit request for substitution described in Section 01 2500 - Substitution Procedures.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.

B. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.

C. Examine and verify specific conditions described in individual specification Sections.

D. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or misfabrication.

E. Verify that utility services are available, of the correct characteristics, and in the correct locations.

F. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.

3.02 PREPARATION

A. Clean substrate surfaces prior to applying next material or substance.

B. Seal cracks or openings of substrate prior to applying next material or substance.

C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

3.03 PRE-INSTALLATION MEETINGS

A. When required in individual specification Sections, convene a pre-installation meeting at the site prior to commencing work of the Section.

B. Require attendance of parties directly affecting, or affected by, work of the specific Section.

C. Notify Architect minimum 7 calendar days in advance of proposed meeting date.

D. Prepare agenda and preside at meeting:
   1. Review conditions of examination, preparation and installation procedures.
   2. Review coordination with related work.

E. Record minutes and distribute copies within two days after meeting to participants, with electronic copies to Architect, Owner, participants, and those affected by decisions made.

3.04 LAYING OUT THE WORK

A. Promptly notify Architect of any dimension discrepancies discovered.

3.05 GENERAL INSTALLATION REQUIREMENTS

A. In addition to compliance with regulatory requirements, conduct construction operations in compliance with NFPA 241, including applicable recommendations in Appendix A.

B. Install products as specified in individual Sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.

C. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.

D. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.

E. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.

F. Make neat transitions between different surfaces, maintaining texture and appearance.

3.06 CUTTING AND PATCHING

A. Whenever possible, execute the work by methods that avoid cutting or patching.

B. Perform whatever cutting and patching is necessary to:
   1. Complete the work.
   2. Fit products together to integrate with other work.
   3. Provide openings for penetration of mechanical, electrical, and other services.
   4. Match work that has been cut to adjacent work.
   5. Repair areas adjacent to cuts to required condition.
   6. Repair new work damaged by subsequent work.
   7. Remove samples of installed work for testing when requested.
   8. Remove and replace defective and non-complying work.

C. Execute work by methods that avoid damage to other work and that will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.

D. Employ original installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.

E. Cut rigid materials, resulting in clean and neat edges, using masonry saw or core drill. Cutting rigid materials using chisels, impact or pneumatic tools is not allowed without prior approval.

F. Restore work with new products in accordance with requirements of Contract Documents.

G. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

H. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Section 07 8400, to full thickness of the penetrated element.

I. Patching:
   1. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
   2. Match color, texture, and appearance.
   3. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.

3.07 PROGRESS CLEANING

A. General Project Requirement: Cleaning materials, products, and applications must be GreenSeal-compliant; materials, products, and applications that are not GreenSeal-compliant are not permitted.

B. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.

C. Remove debris and rubbish from wall cavities, pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.

D. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.

E. Collect and remove waste materials, debris, and trash/rubbish from site weekly and dispose off-site; do not burn or bury.

3.08 PROTECTION OF INSTALLED WORK

A. Protect installed work from damage by construction operations.

B. Provide special protection where specified in individual specification Sections.

C. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.

D. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.

E. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.

F. Protect work from spilled liquids. If work is exposed to spilled liquids, immediately remove protective coverings, dry out work, and replace protective coverings.

G. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.
   1. Keep waterproofed and roofed surfaces clean and free of debris that could cause damage to surfaces and membranes, particularly sharp objects including fasteners, wire cut-offs, and similar items.

H. Prohibit traffic from landscaped areas.

I. Remove protective coverings when no longer needed; reuse or recycle coverings if possible.

J. Failure to protect installed and existing work may result in withholding of payments to Contractor as determined by Architect. Damage resulting from failure to protect installed and existing work must be fully repaired or replaced as applicable to the satisfaction of Architect at no additional cost to Owner.

3.09 SYSTEM STARTUP

A. Coordinate with requirements of Section 01 9113 - General Commissioning Requirements.

B. Coordinate schedule for start-up of various equipment and systems.

C. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions that may cause damage.

D. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.

E. Verify that wiring and support components for equipment are complete and tested.

F. Execute start-up under supervision of applicable Contractor personnel and manufacturer's representative in accordance with manufacturers' instructions.

G. When specified in individual specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.

H. Submit a written report that equipment or system has been properly installed and is functioning correctly.

3.10 DEMONSTRATION AND INSTRUCTION

A. Demonstrate operation and maintenance of products to Owner's personnel two weeks prior to date of Substantial Completion.

B. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at scheduled time, at equipment location.

C. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.

D. Provide a qualified person who is knowledgeable about the Project to perform demonstration and instruction of Owner's personnel.

E. Utilize operation and maintenance manuals as basis for instruction. Review contents of manual with Owner's personnel in detail to explain all aspects of operation and maintenance.

F. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instruction.

G. The amount of time required for instruction on each item of equipment and system is that specified in individual Sections.

3.11 ADJUSTING

A. Adjust operating products and equipment to ensure smooth and unhindered operation.

B. Testing, Adjusting, and Balancing HVAC Systems: See Division 23 and Section 01 4000 - Quality Requirements.

3.12 FINAL CLEANING

A. General Project Requirement: Cleaning materials, products, and applications must be GreenSeal-compliant; materials, products, and applications that are not GreenSeal-compliant are not permitted.

B. Execute final cleaning after Substantial Completion but before making final application for payment.

C. Use cleaning materials that are nonhazardous.

D. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, and vacuum carpeted and soft surfaces.

E. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.

F. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.

G. Clean filters of operating equipment.

H. Clean debris from roofs, overflow drains, area drains, and drainage systems.

I. Clean site; sweep paved areas, rake clean landscaped surfaces.

J. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

3.13 PROJECT CLOSEOUT MEETING

A. Schedule and administer a Project closeout meeting minimum two months before scheduled Date of Substantial Completion, at location mutually agreed upon by Owner, Contractor, and Architect.

B. Attendance Required: Owner, Contractor, job superintendent, and Architect.

C. Minimum Agenda:
   1. Review specified closeout process, tasks required of respective participants, task scheduling, and deadline dates for each critical path task in the closeout process.
   2. Review closeout submittals required and submittal procedures for each.
   3. Review maintenance materials requirements and Owner's requirements for delivery and storage.
   4. Review final inspection requirements of AHJ and coordination of same.
   5. Review status of record documentation, and discuss process for completing and distributing record documentation to Owner and Architect.

D. Record minutes and distribute electronically within two days after meeting to participants and those affected by decisions made.

3.14 CLOSEOUT PROCEDURES

A. Make submittals that are required by governing or other authorities.
   1. Provide copies to Architect and Owner.

B. Notify Architect in writing when work is considered ready for Architect's Substantial Completion inspection.
   1. Prerequisite for Substantial Completion: In addition to definition of Substantial Completion in the General Conditions or Agreement, Substantial Completion is not considered achieved until Certificate of Occupancy is issued by primary jurisdictional authority, allowing Owner to fully occupy or utilize building and associated facilities for intended use in all respects.

C. Submit written certification containing Contractor's Correction Punch List, that Contract Documents have been reviewed, work has been inspected, and that work is complete in accordance with Contract Documents and ready for Architect's Substantial Completion inspection.

D. Conduct Substantial Completion inspection and create Final Correction Punch List containing Architect's and Contractor's comprehensive list of items identified to be completed or corrected and submit to Architect.

E. Correct items of work listed in Final Correction Punch List and comply with requirements for access to Owner-occupied areas.

F. Accompany Owner and Architect on Contractor's preliminary final inspection.

G. Notify Architect when work is considered finally complete and ready for Architect's Substantial Completion final inspection.

H. Complete items of work determined by Architect listed in executed Certificate of Substantial Completion.

END OF SECTION

SECTION 01 7419

CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 GENERAL

1.01 WASTE MANAGEMENT REQUIREMENTS

A. Owner requires that this project generate the least amount of trash and waste possible.

B. Employ processes that ensure the generation of as little waste as possible due to error, poor planning, breakage, mishandling, contamination, or other factors.

C. Minimize trash/waste disposal in landfills; reuse, salvage, or recycle as much waste as economically feasible.

D. LEED Certification for this project is dependent on diversion of minimum 75 percent, by weight, of potential landfill trash/waste by recycling and/or salvage.

E. Submit monthly (with payment application) Waste Disposal Reports in the form of individual haul tickets or tipping fee receipts; all landfill disposal, recycling, salvage, and reuse must be reported regardless of to whom the cost or savings accrues; use the same units of measure on all reports.

F. Develop and follow a Waste Management Plan designed to implement these requirements.

G. The following sources may be useful in developing the Waste Management Plan:

H. Methods of trash/waste disposal that are not acceptable are:
   1. Burning on the project site.
   2. Burying on the project site.
   3. Dumping or burying on other property, public or private.
   4. Other illegal dumping or burying.
   5. Incineration, either on- or off-site.

I. Regulatory Requirements: Contractor is responsible for knowing and complying with regulatory requirements, including but not limited to Federal, state and local requirements, pertaining to legal disposal of all construction and demolition waste materials.

1.02 DEFINITIONS

A. Clean: Untreated and unpainted; not contaminated with oils, solvents, caulk, or the like.

B. Construction and Demolition Waste: Solid wastes typically including building materials, packaging, trash, debris, and rubble resulting from construction, remodeling, repair and demolition operations.
   1. This definition also includes trash and waste generated by construction workers and Contractor's personnel while engaged in the work and on lunch and other breaks, including but not limited to items such as lunch bags, food wrappers, drinking cups, and similar trash and waste.

C. Hazardous: Exhibiting the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity or reactivity.

D. Nonhazardous: Exhibiting none of the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity, or reactivity.

E. Nontoxic: Neither immediately poisonous to humans nor poisonous after a long period of exposure.

F. Recyclable: The ability of a product or material to be recovered at the end of its life cycle and remanufactured into a new product for reuse by others.

G. Recycle: To remove a waste material from the project site to another site for remanufacture into a new product for reuse by others.

H. Recycling: The process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for the purpose of using the altered form. Recycling does not include burning, incinerating, or thermally destroying waste.

I. Return: To give back reusable items or unused products to vendors for credit.

J. Reuse: To reuse a construction waste material in some manner on the project site.

K. Salvage: To remove a waste material from the project site to another site for resale or reuse by others.

L. Sediment: Soil and other debris that has been eroded and transported by storm or well production run-off water.

M. Source Separation: The act of keeping different types of waste materials separate beginning from the first time they become waste.

N. Toxic: Poisonous to humans either immediately or after a long period of exposure.

O. Trash: Any product or material unable to be reused, returned, recycled, or salvaged.

P. Waste: Extra material or material that has reached the end of its useful life in its intended use. Waste includes salvageable, returnable, recyclable, and reusable material.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Sustainable Design Submittals: Submit Waste Management Plan and Waste Disposal Reports in accordance with procedures specified in Section 01 3566.12 - LEED v4 Certification Project Procedures.

C. Submit Waste Management Plan within 10 calendar days after receipt of Notice of Award of Bid, or prior to any trash or waste removal, whichever occurs sooner; submit projection of all trash and waste that will require disposal and alternatives to landfilling.

D. Waste Management Plan: Include the following information:
   1. Analysis of the trash and waste projected to be generated during the entire project construction cycle, including types and quantities.
   2. Landfill Alternatives: List all waste materials that will be diverted from landfills by reuse, salvage, or recycling.
      a. List each material proposed to be salvaged, reused, or recycled.
      b. List the local market for each material.
      c. State the estimated net cost, versus landfill disposal.
   3. Meetings: Describe regular meetings to be held to address waste prevention, reduction, recycling, salvage, reuse, and disposal.
   4. Materials Handling Procedures: Describe the means by which materials to be diverted from landfills will be protected from contamination and prepared for acceptance by designated facilities; include separation procedures for recyclables, storage, and packaging.
   5. Transportation: Identify the destination and means of transportation of materials to be recycled; i.e. whether materials will be site-separated and self-hauled to designated centers, or whether mixed materials will be collected by a waste hauler.

E. Waste Disposal Reports: Submit at specified intervals, with details of quantities of trash and waste, means of disposal or reuse, and costs; show both totals to date and since last report.
   1. Submit updated Report and supporting weigh tickets with each Application for Progress Payment; failure to submit Report will delay payment.
   2. Submit Report on a form acceptable to Owner.
   3. Landfill Disposal: Include the following information:
      a. Identification of material.
      b. Amount, in tons or cubic yards, of trash/waste material from the project disposed of in landfills.
      c. State the identity of landfills, total amount of tipping fees paid to landfill, and total disposal cost.
      d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.
   4. Recycled and Salvaged Materials: Include the following information for each:
      a. Identification of material, including those retrieved by installer for use on other projects.
      b. Amount, in tons or cubic yards, date removed from the project site, and receiving party.
      c. Transportation cost, amount paid or received for the material, and the net total cost or savings of salvage or recycling each material.

d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.
e. Certification by receiving party that materials will not be disposed of in landfills or by incineration.

5. Material Reused on Project: Include the following information for each:
   a. Identification of material and how it was used in the project.
   b. Amount, in tons or cubic yards.
   c. Include weight tickets as evidence of quantity.
6. Other Disposal Methods: Include information similar to that described above, as appropriate to disposal method.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 WASTE MANAGEMENT PROCEDURES

A. See Section 01 3000 for additional requirements for project meetings, reports, submittal procedures, and project documentation.

B. See Section 01 5000 for additional requirements related to trash/waste collection and removal facilities and services.

C. See Section 01 6000 for waste prevention requirements related to delivery, storage, and handling.

D. See Section 01 7000 for trash/waste prevention procedures related to demolition, cutting and patching, installation, protection, and cleaning.

3.02 WASTE MANAGEMENT PLAN IMPLEMENTATION

A. Manager: Designate an on-site person or persons responsible for instructing workers and overseeing and documenting results of the Waste Management Plan.

B. Communication: Distribute copies of the Waste Management Plan to job site foreman, each subcontractor, Owner, and Architect.

C. Instruction: Provide on-site instruction of appropriate separation, handling, and recycling, salvage, reuse, and return methods to be used by all parties at the appropriate stages of the project.

D. Meetings: Discuss trash/waste management goals and issues at project meetings.
   1. Preconstruction meeting.
   2. Regular job-site meetings.

E. Facilities: Provide specific facilities for separation and storage of materials for recycling, salvage, reuse, return, and trash disposal, for use by all contractors and installers.
   1. As a minimum, provide:
      a. Separate area for storage of materials to be reused on-site, such as wood cut-offs for blocking.
      b. Separate dumpsters for each category of recyclable, if required by recycling company.
      c. Recycling bins at worker lunch area.
   2. Provide containers as required.
   3. Provide temporary enclosures around piles of separated materials to be recycled or salvaged.
   4. Provide materials for barriers and enclosures that are nonhazardous, recyclable, or reusable to the maximum extent possible; reuse project construction waste materials if possible.
   5. Locate enclosures out of the way of construction traffic.
   6. Provide adequate space for pick-up and delivery and convenience to subcontractors.
   7. If an enclosed area is not provided, clearly lay out and label a specific area on-site.
   8. Keep recycling and trash/waste bin areas neat and clean and clearly marked in order to avoid contamination of materials.

F. Hazardous Wastes: Separate, store, and dispose of hazardous wastes according to applicable regulations.

G. Recycling: Separate, store, protect, and handle at the site identified recyclable waste products in order to prevent contamination of materials and to maximize recyclability of identified materials. Arrange for timely pickups from the site or deliveries to recycling facility in order to prevent contamination of recyclable materials.

H. Reuse of Materials On-Site: Set aside, sort, and protect separated products in preparation for reuse.

I. Salvage: Set aside, sort, and protect products to be salvaged for reuse off-site.

END OF SECTION

SECTION 01 7800

CLOSEOUT SUBMITTALS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Project record documents.

B. Operation and maintenance data.

C. Materials transparency manual.

D. Warranties and bonds.

1.02 RELATED REQUIREMENTS

A. Section 01 3000 - Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.

B. Individual Product Sections: Specific requirements for operation and maintenance data.

C. Individual Product Sections: Warranties required for specific products or Work.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Project Record Documents: Submit documents to Architect with claim for final Application for Payment.

C. Operation and Maintenance Data:
1. Submit two copies of preliminary draft or proposed formats and outlines of contents before start of Work. Architect will review draft and return one copy with comments.
2. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit completed documents within ten days after acceptance.
3. Submit one copy of completed documents 15 days prior to final inspection. This copy will be reviewed and returned after final inspection, with Architect comments. Revise content of all document sets as required prior to final submission.
4. Submit two sets of revised final documents in final form within 10 days after final inspection.

D. Materials Transparency Manual:
1. Compile and submit a digital and a printed version of information disclosing materials content for interior finishes, furnishings (including workstations), built-in furniture. Meet IWBI (BS) requirements for format and content.

E. Warranties and Bonds:
1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within 10 days after acceptance.
2. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment.
3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PROJECT RECORD DOCUMENTS

A. Maintain on site one set of the following record documents; record actual revisions to the Work:
1. Drawings.
2. Specifications.
3. Addenda.
4. Change Orders and other modifications to the Contract.

5. Reviewed shop drawings, product data, and samples.
6. Manufacturer's instruction for assembly, installation, and adjusting.

B. Ensure entries are complete and accurate, enabling future reference by Owner.

C. Store record documents separate from documents used for construction.

D. Record information concurrent with construction progress.

E. Specifications: Legibly mark and record at each product Section description of actual products installed, including the following:
1. Manufacturer's name and product model and number.
2. Product substitutions or alternates utilized.
3. Changes made by Addenda and modifications.

F. Record Drawings: Legibly mark each item to record actual construction including:
1. Measured depths of foundations in relation to finish main floor datum.
2. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
3. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
4. Field changes of dimension and detail.
5. Details not on original Contract Drawings.

3.02 OPERATION AND MAINTENANCE DATA

A. Source Data: For each product or system, list names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.

B. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.

C. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.

D. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

3.03 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES

A. For Each Product, Applied Material, and Finish:
1. Product data, with catalog number, size, composition, and color and texture designations.
2. Information for re-ordering custom manufactured products, if any.

B. Instructions for Care and Maintenance: Manufacturer's recommendations for cleaning agents and methods, precautions against detrimental cleaning agents and methods, and recommended schedule for cleaning and maintenance.

C. Moisture Protection and Weather-exposed Products: Include product data listing applicable reference standards, chemical composition, and details of installation. Provide recommendations for inspections, maintenance, and repair.

D. Additional information as specified in individual product specification Sections.

E. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

3.04 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS

A. For Each Item of Equipment and Each System:
1. Description of unit or system, and component parts.
2. Identify function, normal operating characteristics, and limiting conditions.
3. Include performance curves, with engineering data and tests.
4. Complete nomenclature and model number of replaceable parts.

B. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

C. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.

D. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.

E. Provide servicing and lubrication schedule, and list of lubricants required.

F. Include manufacturer's printed operation and maintenance instructions.

G. Include sequence of operation by controls manufacturer.

H. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

I. Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.

J. Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.

K. Include test and balancing reports.

L. Additional Requirements: As specified in individual product specification Sections.

3.05 ASSEMBLY OF OPERATION AND MAINTENANCE MANUALS

A. Assemble operation and maintenance data into electronic files for Owner's personnel use, with data arranged in the same sequence as, and identified by, the specification Sections.
   1. Where systems involve more than one specification Section, provide separate electronic bookmarked tab for each system.

B. Electronic Cover Page: Identify each file with first page titled OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.

C. Table of Contents: Arrange content by systems under Section numbers and sequence of Table of Contents of this Project Manual.

D. Project Directory: Provide title of Project; names, addresses, and telephone numbers of Architect, Consultants, and Contractor with name of responsible parties; schedule of products and systems, indexed to content of the volume.

E. Electronic Bookmarking: Provide electronically bookmarked divider pages in each file for each separate product and system; identify the contents on the divider page; immediately following the divider page include a description of product and major component parts of equipment.

F. Arrangement of Contents: Organize each volume in parts as follows:
   1. Project Directory.
   2. Table of Contents, of all volumes, and of this volume.
   3. Operation and Maintenance Data: Arranged by system, then by product category.
      a. Source data.
      b. Product data, shop drawings, and other submittals.
      c. Operation and maintenance data.
      d. Field quality control data.
      e. Electronic scans warranties and bonds.
   4. Design Data: To allow for addition of design data furnished by Architect or others, provide a bookmarked divider page labeled "Design Data" and allow for insertion of additional electronic data, if applicable.

3.06 WARRANTIES AND BONDS

A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until Date of Substantial completion is determined.
   1. Warranties must clearly state that warranty commences on Date of Substantial Completion, and the actual Date of Substantial Completion according to the Contract must be clearly stated on the warranty form.

B. Verify that documents are in proper form, contain full information, and are notarized.

C. Co-execute submittals when required.

D. Retain warranties and bonds until time specified for submittal.

E. Include photocopies of each in operation and maintenance manuals, indexed separately on Table of Contents.

F. Table of Contents: Neatly typed, in the sequence of the Table of Contents of the Project Manual, with each item identified with the number and title of the specification Section in which specified, and the name of product or work item.

END OF SECTION

SECTION 01 9113

GENERAL COMMISSIONING REQUIREMENTS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Commissioning. Commissioning is a systematic process of ensuring that all building systems perform interactively according to the design intent and the owner's operational needs. This is achieved by beginning in the design phase and documenting design intent and continuing through construction, acceptance and the warranty period with actual verification of performance. The commissioning process shall encompass and coordinate the traditionally separate functions of system documentation, equipment startup, control system calibration, testing and balancing, performance testing and training. Commissioning during the construction phase is intended to achieve the following specific objectives according to the Contract Documents:

1. Verify that applicable equipment and systems are installed according to the manufacturer's recommendations and to industry accepted minimum standards and that they receive adequate operational checkout by installing contractors.
2. Verify and document proper performance of equipment and systems.
3. Verify that O&M documentation left on site is complete.
4. Verify that the Owner's operating personnel are adequately trained.

B. The commissioning process does not take away from or reduce the responsibility of the system designers or installing contractors to provide a finished and fully functioning product.

C. Abbreviations. The following are common abbreviations used in the Specifications and in the Commissioning Plan. Definitions are found in Section 1.6.

A/E -	Architect and design engineers	FT -	Functional performance test
CA -	Commissioning authority	GC -	General contractor (prime)
CC -	Controls contractor	MC -	Mechanical contractor
Cx -	Commissioning	PC -	Prefunctional checklist
Cx Plan-	Commissioning Plan document	PM -	Project manager (of the Owner)
EC -	Electrical contractor	Subs -	Subcontractors to General
		TAB -	Test and balance contractor

1.2 COORDINATION

A. Commissioning Team. The members of the commissioning team consist of the Commissioning authority (CA), the designated Owner's Representative and Project Manager (PM), the General Contractor (GC or Contractor), the architect and design engineers (particularly the mechanical engineer), the Mechanical Contractor (MC), the Electrical Contractor (EC), the TAB representative, the Controls Contractor (CC), any other installing subcontractors or suppliers of equipment. If known, the Owner's building or plant operator/engineer is also a member of the commissioning team.

B. Management. The CA is hired by the Owner directly. The CA directs and coordinates the commissioning activities and the reports to the PM. All members work together to fulfill their contracted responsibilities and meet the objectives of the Contract Documents. The CA's responsibilities are the same regardless of who hired the CA. Refer to Part 1.5 for additional management details.

C. Scheduling. The CA will work with the PM and GC according to established protocols to schedule the commissioning activities. The CA will provide sufficient notice to the GC for

scheduling commissioning activities. The GC will integrate all commissioning activities into the master schedule. All parties will address scheduling problems and make necessary notifications in a timely manner in order to expedite the commissioning process.

1. The CA will provide the initial schedule of primary commissioning events at the commissioning scoping meeting. The *Commissioning Plan—Construction Phase* provides a format for this schedule. As construction progresses more detailed schedules are developed by the CA. The Commissioning Plan also provides a format for detailed schedules.

1.3 COMMISSIONING PROCESS

A. Commissioning Plan. The commissioning plan provides guidance in the execution of the commissioning process. Just after the initial commissioning scoping meeting the CA will update the plan which is then considered the "final" plan, though it will continue to evolve and expand as the project progresses. The *Specifications* will take precedence over the *Commissioning Plan*.

B. Commissioning Process. The following narrative provides a brief overview of the typical commissioning tasks during construction and the general order in which they occur.

1. Commissioning during construction begins with a scoping meeting conducted by the CA where the commissioning process is reviewed with the commissioning team members.
2. Additional meetings will be required throughout construction, scheduled by the CA with necessary parties attending, to plan, scope, coordinate, schedule future activities and resolve problems.
3. Equipment documentation is submitted to the CA during normal submittals, including detailed start-up procedures.
4. The CA works with the Subs in developing startup plans and startup documentation formats, including providing the Subs with prefunctional checklists to be completed, during the startup process.
5. In general, the checkout and performance verification proceeds from simple to complex; from component level to equipment to systems and intersystem levels with prefunctional checklists being completed before functional testing.
6. The MC shall coordinate with the CA to execute and document the prefunctional checklists and perform startup and initial checkout. The CA documents that the checklists and startup were completed according to the approved plans. This includes the CA witnessing start-up of selected equipment. Coordinate all testing with the CA.
7. The CA develops specific equipment and system functional performance test procedures. The Subs review the procedures.
8. The procedures are executed by the Subs, under the direction of, and documented by the CA.
9. Items of non-compliance in material, installation or setup are corrected at the Sub’s expense and the system retested. If follow-up testing still results in failures, any subsequent tests will be at the Sub’s expense.
10. The CA reviews the O&M documentation for completeness.
11. Commissioning is completed before Substantial Completion.
12. The CA reviews, pre-approves and coordinates the training provided by the Subs and verifies that is was completed.
13. Deferred testing is conducted, as specified or required.
14. Review of building operations within 10 months after substantial completion and produce plan for resolution of any outstanding commissioning related issues.

1.4 RELATED WORK

A. Specific commissioning requirements are given in the following sections of these specifications. All of the following sections apply to the Work of this section.

1. 01 1001 "General Requirements" for Cx meetings, coordination, submittals, and project closeout.

2. 23 0500 “Common Work Results for Mechanical" Alerts the Mechanical Contractor and all subcontractors to Cx responsibilities in 23 0800.
3. 23 0593 "Testing, Adjusting, and Balancing for HVAC" Alerts the TAB Contractor to their Cx responsibilities.
4. 23 0800 "Commissioning of HVAC" for the Cx responsibilities of the mechanical, controls and TAB contractors and the prefunctional testing and startup responsibilities of each.
5. 23 0900 "Instrumentation and Control for HVAC" Alerts the Controls Contractor to their Cx responsibilities.
6. 23 0993 “Sequences of Operation for Mechanical Systems” details the Sequences to be commissioned.
7. 26 0500 "Common Work Results for Electrical" Alerts the Electrical Contractor and all subcontractors to Cx responsibilities in 26 0800.
8. 26 0800 "Commissioning of Electrical Systems" for the Cx responsibilities of the Electrical Contractor and subcontractors and the prefunctional testing and startup responsibilities of each.

1.5 RESPONSIBILITIES

A. The responsibilities of various parties in the commissioning process are provided in this section. The responsibilities of the mechanical contractor, TAB and controls contractor are in Division 23 and those of the electrical contractor in Division 26. It is noted that the services for the Project Manager, Architect, HVAC Mechanical and Electrical Designers/Engineers, and Commissioning Authority are not provided for in this contract. That is, the Contractor is not responsible for providing their services. Their responsibilities are listed here to clarify the commissioning process.

B. All Parties
   1. Attend commissioning scoping meeting and additional meetings, as necessary (approximately every two weeks during mechanical and electrical system installation and testing).

C. Architect (or A/E)
   1. Construction and Acceptance Phase
      a. The owner manages the CA contract.
      b. Attend the commissioning scoping meeting and selected commissioning team meetings.
      c. Perform normal submittal review, construction observation, as-built drawing preparation, O&M manual preparation, etc., as contracted.
      d. Provide any design narrative documentation requested by the CA.
      e. Coordinate resolution of system deficiencies identified during commissioning, according to the contract documents.
      f. Prepare and submit final as-built design intent documentation for inclusion in the O&M manuals. Review and approve the O&M manuals.
   2. Warranty Period
      a. Coordinate resolution of design non-conformance and design deficiencies identified during warranty-period commissioning.

D. Mechanical and Electrical Designers/Engineers (of the A/E)
   1. Construction and Acceptance Phase
      a. Perform normal submittal review, construction observation, as-built drawing preparation, etc., as contracted. One site observation should be completed just prior to system startup.
      b. Provide any design narrative and sequences documentation requested by the CA. The designers shall assist (along with the contractors) in clarifying the operation and control of commissioned equipment in areas where the specifications, control drawings or equipment documentation is not sufficient for writing detailed testing procedures.

c. Attend commissioning scoping meetings and other selected commissioning team meetings.
d. Participate in the resolution of system deficiencies identified during commissioning, according to the contract documents.
e. Prepare and submit the final as-built design intent and operating parameters documentation for inclusion in the O&M manuals. Review and approve the O&M manuals.
f. From the Contractor's red-line drawings, edit and update one-line diagrams developed as part of the design narrative documentation and those provided by the vendor as shop drawings for the chilled and hot water, condenser water, domestic water, steam and condensate systems; supply, return and exhaust air systems and emergency power system.
g. Review the prefunctional checklists for major pieces of equipment for sufficiency prior to their use.
h. Review the functional test procedure forms for major pieces of equipment for sufficiency prior to their use.
i. Witness testing of selected pieces of equipment and systems.

2. Warranty Period
a. Participate in the resolution of non-compliance, non-conformance and design deficiencies identified during commissioning during warranty-period commissioning.

E. Commissioning Authority (CA): The CA is not responsible for design concept, design criteria, compliance with codes, design or general construction scheduling, cost estimating, or construction management. The CA may assist with problem-solving non-conformance or deficiencies, but ultimately that responsibility resides with the general contractor and the A/E. The primary role of the CA is to develop and coordinate the execution of a testing plan, observe and document performance—that systems are functioning in accordance with the documented design intent and in accordance with the Contract Documents. The Contractors will provide all tools or the use of tools to start, check-out and functionally test equipment and systems, except for specified testing with portable data-loggers, which shall be supplied and installed by the CA.
1. Construction and Acceptance Phase
a. Coordinates and directs the commissioning activities in a logical, sequential and efficient manner using consistent protocols and forms, centralized documentation, clear and regular communications and consultations with all necessary parties, frequently updated timelines and schedules and technical expertise.
b. Coordinate the commissioning work and, with the GC, ensure that commissioning activities are being scheduled into the master schedule.
c. Draft a Commissioning Plan—Construction Phase.
d. Plan and conduct a commissioning scoping meeting and other commissioning meetings.
e. Request and review additional information required to perform commissioning tasks, including O&M materials, contractor start-up and checkout procedures.
f. Before startup, gather and review the current control sequences and interlocks and work with contractors and design engineers until sufficient clarity has been obtained, in writing, to be able to write detailed testing procedures.
g. Review and approve normal Contractor submittals applicable to systems being commissioned for compliance with commissioning needs, concurrent with the A/E reviews.
h. Write and distribute prefunctional tests and checklists.
i. Develop an enhanced start-up and initial systems checkout plan with Subs.
j. Perform site visits, as necessary, to observe component and system installations. Attends selected planning and job-site meetings to obtain information on construction progress. Review construction meeting minutes for

revisions/substitutions relating to the commissioning process. Assist in resolving any discrepancies.

k. Witness all or part of the HVAC piping test and flushing procedure, sufficient to be confident that proper procedures were followed. Document this testing and include the documentation in O&M manuals. Notify owner's project manager of any deficiencies in results or procedures.
l. Witness all or part of any ductwork testing and cleaning procedures, sufficient to be confident that proper procedures were followed. Document this testing and include the documentation in O&M manuals. Notify owner's project manager of any deficiencies in results or procedures.
m. Approve prefunctional tests and checklist completion by reviewing prefunctional checklist reports and by selected site observation and spot checking.
n. Approve systems startup by reviewing start-up reports and by selected site observation.
o. Review TAB execution plan and make recommendations for contractor and Cx Agent coordination.
p. Oversee sufficient functional testing of the control system and approve it to be used for TAB, before TAB is executed.
q. Approve air and water systems balancing by spot testing, by reviewing completed reports and by selected site observation.
r. With necessary assistance and review from installing contractors, write the functional performance test procedures for equipment and systems. This may include energy management control system trending, stand-alone datalogger monitoring or manual functional testing. Submit to PM for review, and for approval if required.
s. Analyze any functional performance trend logs and monitoring data to verify performance.
t. Coordinate, witness, and approve manual functional performance tests performed by installing contractors. Coordinate retesting as necessary until satisfactory performance is achieved.
u. Maintain a master deficiency and resolution log and a separate testing record. Provide the PM with written progress reports and test results with recommended actions.
v. Witness performance testing of smoke control systems by others and all other owner contracted tests or tests by manufacturer's personnel over which the CA may not have direct control. Document these tests and include this documentation in Commissioning Record in O&M manuals.
w. Review equipment warranties to ensure that the Owner's responsibilities are clearly defined.
x. Oversee and approve the training of the Owner's operating personnel.
y. Compile and maintain a commissioning record and building systems book(s).
z. Review and approve the preparation of the O&M manuals.
aa. Provide a final commissioning report (as described in this section).
bb. Develop a Cx Systems Manual.
cc. Prepare a standard trend logging package of primary parameters that will provide the operations staff clear indications of system function in order to identify proper system operation and trouble shoot problems. The CA shall also provide any needed information on interpreting the trends.

2. Warranty Period
   a. Coordinate and supervise required seasonal or deferred testing and deficiency corrections.
   b. Return to the site at 10 months into the 12 month warranty period and review with facility staff the current building operation and the condition of outstanding issues related to the original and seasonal commissioning. Also interview facility staff and identify problems or concerns they have operating the building as originally

intended. Make suggestions for improvements and for recording these changes in the O&M manuals. Identify areas that may come under warranty or under the original construction contract. Assist facility staff in developing reports, documents and requests for services to remedy outstanding problems.

c. Optional: Assist in the development of a preventative maintenance plan, a detailed operating plan or an energy and resource management plan or as-built documentation.

F. Project Manager—Owner's Representative (PM)

1. Construction and Acceptance Phase
   a. Facilitate the coordination of the commissioning work by the CA, and, with the GC and CA, ensure that commissioning activities are being scheduled into the master schedule.
   b. Review and approve the final Commissioning Plan—Construction Phase.
   c. Attend a commissioning scoping meeting and other commissioning team meetings.
   d. Perform the normal review of Contractor submittals.
   e. Furnish a copy of all construction documents, addenda, change orders and approved submittals and shop drawings related to commissioned equipment to the CA.
   f. Review and approve the functional performance test procedures submitted by the CA, prior to testing.
   g. When necessary, observe and witness prefunctional checklists, startup and functional testing of selected equipment.
   h. Review commissioning progress and deficiency reports.
   i. Coordinate the resolution of non-compliance and design deficiencies identified in all phases of commissioning.
   j. Sign-off (final approval) on individual commissioning tests as completed and passing. Recommend completion of the commissioning process to the Project Manager.
   k. Assist the GC in coordinating the training of owner personnel.

2. Warranty Period
   a. Assist the CA as necessary in the seasonal or deferred testing and deficiency corrections required by the specifications.

G. Owner's Project Manager (PM)

1. Construction and Acceptance Phase
   a. Manage the contract of the A/E and of the GC.
   b. Arrange for facility operating and maintenance personnel to attend various field commissioning activities and field training sessions according to the *Commissioning Plan—Construction Phase.*
   c. Provide final approval for the completion of the commissioning work.

2. Warranty Period
   a. Ensure that any seasonal or deferred testing and any deficiency issues are addressed.

H. General Contractor (GC)

1. Construction and Acceptance Phase
   a. Facilitate the coordination of the commissioning work by the CA, and ensure that commissioning activities are being scheduled into the master schedule.
   b. Include any cost of commissioning in the total contract price.
   c. Furnish a copy of all construction documents, addenda, change orders and approved submittals and shop drawings related to commissioned equipment to the CA.
   d. In each purchase order or subcontract written, include requirements for submittal data, O&M data, commissioning tasks and training.

e. Ensure that all Subs execute their commissioning responsibilities according to the Contract Documents and schedule.
f. A representative shall attend a commissioning scoping meeting and other necessary meetings scheduled by the CA to facilitate the Cx process.
g. Coordinate the training of owner personnel.
h. Prepare O&M manuals, according to the Contract Documents, including clarifying and updating the original sequences of operation to as-built conditions.

2. Warranty Period
a. Ensure that Subs execute seasonal or deferred functional performance testing, witnessed by the CA, according to the specifications.
b. Ensure that Subs correct deficiencies and make necessary adjustments to O&M manuals and as-built drawings for applicable issues identified in any seasonal testing.

I. Equipment Suppliers
1. Provide all requested submittal data, including detailed start-up procedures and specific responsibilities of the Owner to keep warranties in force.
2. Assist in equipment testing per agreements with Subs.
3. Include all special tools and instruments (only available from vendor, specific to a piece of equipment) required for testing equipment according to these Contract Documents in the base bid price to the Contractor, except for stand-alone datalogging equipment that may be used by the CA.
4. Analyze specified products and verify that the designer has specified the newest most updated equipment reasonable for this project's scope and budget.
5. Provide information requested by CA regarding equipment sequence of operation and testing procedures.
6. Review test procedures for equipment installed by factory representatives.

1.6 DEFINITIONS

J. Acceptance Phase - phase of construction after startup and initial checkout when functional performance tests, O&M documentation review and training occurs.

K. Approval - acceptance that a piece of equipment or system has been properly installed and is functioning in the tested modes according to the Contract Documents.

L. Architect / Engineer (A/E) - the prime consultant (architect) and sub-consultants who comprise the design team, generally the HVAC mechanical designer/engineer and the electrical designer/engineer.

M. Basis of Design - The basis of design is the documentation of the primary thought processes and assumptions behind design decisions that were made to meet the design intent. The basis of design describes the systems, components, conditions and methods chosen to meet the intent. Some reiterating of the design intent may be included.

N. Commissioning authority (CA) - an independent agent, not otherwise associated with the A/E team members or the Contractor, though he/she may be hired as a subcontractor to them. The CA directs and coordinates the day-to-day commissioning activities. The CA does not take an oversight role like the PM.

O. Commissioning Plan - an overall plan, developed before or after bidding, that provides the structure, schedule and coordination planning for the commissioning process.

P. Contract Documents - the documents binding on parties involved in the construction of this project (drawings, specifications, change orders, amendments, contracts, *Cx Plan*, etc.).

Q. Contractor - the general contractor or authorized representative.

R. Control system - the central building energy management control system.

S. Datalogging - monitoring flows, currents, status, pressures, etc. of equipment using stand-alone dataloggers separate from the control system.

T. Deferred Functional Tests - FTs that are performed later, after substantial completion, due to partial occupancy, equipment, seasonal requirements, design or other site conditions that disallow the test from being performed.

U. Deficiency - a condition in the installation or function of a component, piece of equipment or system that is not in compliance with the Contract Documents (that is, does not perform properly or is not complying with the design intent).

V. Design Intent - a dynamic document that provides the explanation of the ideas, concepts and criteria that are considered to be very important to the owner. It is initially the outcome of the programming and conceptual design phases.

W. Design Narrative or Design Documentation - sections of either the Design Intent or Basis of Design.

X. Factory Testing - testing of equipment on-site or at the factory by factory personnel with an Owner's representative present.

Y. Functional Performance Test (FT) - test of the dynamic function and operation of equipment and systems using manual (direct observation) or monitoring methods. Functional testing is the dynamic testing of systems (rather than just components) under full operation (e.g., the chiller pump is tested interactively with the chiller functions to see if the pump ramps up and down to maintain the differential pressure setpoint). Systems are tested under various modes, such as during low cooling or heating loads, high loads, component failures, unoccupied, varying outside air temperatures, fire alarm, power failure, etc. The systems are run through all the control system's sequences of operation and components are verified to be responding as the sequences state. Traditional air or water test and balancing (TAB) is not functional testing, in the commissioning sense of the word. TAB's primary work is setting up the system flows and pressures as specified, while functional testing is verifying that which has already been set up. The commissioning authority develops the functional test procedures in a sequential written form, coordinates, oversees and documents the actual testing, which is usually performed by the installing contractor or vendor. FTs are performed after prefunctional checklists and startup are complete.

Z. General Contractor (GC) - the prime contractor for this project. Generally refers to all the GC's subcontractors as well. Also referred to as the Contractor, in some contexts.

AA. Indirect Indicators - indicators of a response or condition, such as a reading from a control system screen reporting a damper to be 100% closed.

BB. Manual Test - using hand-held instruments, immediate control system readouts or direct observation to verify performance (contrasted to analyzing monitored data taken over time to make the "observation").

CC. Monitoring - the recording of parameters (flow, current, status, pressure, etc.) of equipment operation using dataloggers or the trending capabilities of control systems.

DD. Non-Compliance - see Deficiency.

EE. Non-Conformance - see Deficiency.

FF. Over-written Value - writing over a sensor value in the control system to see the response of a system (e.g., changing the outside air temperature value from 50F to 75F to verify economizer operation). See also "Simulated Signal."

GG. Owner-Contracted Tests - tests paid for by the Owner outside the GC's contract and for which the CA does not oversee. These tests will not be repeated during functional tests if properly documented.

HH. Phased Commissioning - commissioning that is completed in phases (by floors, for example) due to the size of the structure or other scheduling issues, in order minimize the total construction time.

II. Prefunctional Checklist (PC) - a list of items to inspect and elementary component tests to conduct to verify proper installation of equipment, provided by the CA to the Sub. Prefunctional checklists are primarily static inspections and procedures to prepare the equipment or system for initial operation (e.g., belt tension, oil levels OK, labels affixed, gages in place, sensors calibrated, etc.). However, some prefunctional checklist items entail simple testing of the function of a component, a piece of equipment or system (such as measuring the voltage imbalance on a three phase pump motor of a chiller system). The word prefunctional refers to before functional testing. Prefunctional checklists augment and are combined with the manufacturer's start-up checklist. Even without a commissioning process, contractors typically perform some, if not many, of the prefunctional checklist items a commissioning authority will recommend. However, few contractors document in writing the execution of these checklist items. Therefore, for most equipment, the contractors execute the checklists on their own. The commissioning authority only requires that the procedures be documented in writing, and does not witness much of the prefunctional checklisting, except for larger or more critical pieces of equipment.

JJ. Project Manager (PM) - the Owner's representative in the day-to-day activities of construction. In general, the project management services contractor (PM) is hired by the owner to assist in the overall management of the project including supervising and on-site managing authority over a project's construction. The General Contractor reports to the PM. The PM is the Owner's on-site representative.

KK. Sampling. - functionally testing only a fraction of the total number of identical or near identical pieces of equipment. Refer to Part 3.6, F for details.

LL. Seasonal Performance Tests - FT that are deferred until the system(s) will experience conditions closer to their design conditions.

MM. Simulated Condition - condition that is created for the purpose of testing the response of a system (e.g., applying a hair blower to a space sensor to see the response in a VAV box).

NN. Simulated Signal - disconnecting a sensor and using a signal generator to send an amperage, resistance or pressure to the transducer and DDC system to simulate a sensor value.

OO. Specifications - the construction specifications of the Contract Documents.

PP. Startup - the initial starting or activating of dynamic equipment, including executing prefunctional checklists.

QQ. Subs - the subcontractors to the GC who provide and install building components and systems.

RR. Test Procedures - the step-by-step process which must be executed to fulfill the test requirements. The test procedures are developed by the CA.

SS. Test Requirements - requirements specifying what modes and functions, etc. shall be tested. The test requirements are not the detailed test procedures. The test requirements are specified in the Contract Documents (Sections 230800; 260800, etc.).

TT. Trending - monitoring using the building control system.

UU. Vendor - supplier of equipment.

VV. Warranty Period - warranty period for entire project, including equipment components. Warranty begins at Substantial Completion and extends for at least one year, unless specifically noted otherwise in the Contract Documents and accepted submittals.

1.7 SYSTEMS TO BE COMMISSIONED

A. The following systems will be commissioned on this project as they apply to the final design.

Equipment and System	Functional Test Req'mts Spec'd In:	Equipment and System	Functional Test Req'mts Spec'd In:
HVAC System		X Indoor air quality[1]	230800
X Boilers	230800	X Equipment sound control	230800
X Chillers	230800		
X Pumps	230800	Electrical System	
X Piping systems	230800	X Daylight dimming controls	260800
X Ductwork	230800	X Lighting occupancy sensors	260800
X Variable frequency drives	230800	X Automated Shades	260800
X Air handlers	230800	X Network lighting controls	260800
X Packaged units (DX and HP)	230800	X PV Energy System	260800
X Terminal units (air)	230800		
X Unit heaters	230800	Other	
X Heat exchangers	230800	X Service water heaters	230800
X Computer room units	230800	X Service water pumps	230800
X HVAC control system	230800	X Refrigeration systems	230800
X Testing, Adjusting and Balancing work	230800	X Chemical treatment systems	230800
X Specialty fans	230800		

1. *Indoor air quality (IAQ) commissioning does not ensure that indoor air quality will be adequate or without deficiency at building turnover or during occupancy, unless the owner has specifically specified that actual air quality testing is performed. Commissioning indoor air quality entails performing tasks that minimize the potential for IAQ problems, but it does not eliminate their possibility.*

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

A. All standard testing equipment required to perform startup and initial checkout and required functional performance testing shall be provided by the Division contractor for the equipment being tested. For example, the mechanical contractor of Division 23 shall ultimately be responsible for all standard testing equipment for the HVAC system and controls system in Division 23, except for equipment specific to and used by TAB in their commissioning responsibilities. Two-way radios shall be provided by the Division Contractor.

B. Special equipment, tools and instruments (only available from vendor, specific to a piece of equipment) required for testing equipment, according to these Contract Documents shall be included in the base bid price to the Contractor and left on site, except for stand-alone datalogging equipment that may be used by the CA.

C. Datalogging equipment and software required for temporary trending of specific equipment will be provided by the Owner, unless otherwise specified.

D. All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified in the *Specifications.* If not otherwise noted, the following minimum requirements apply: Temperature sensors and digital thermometers shall

have a certified calibration within the past year to an accuracy of 0.5°F and a resolution of + or - 0.1°F. Pressure sensors shall have an accuracy of + or - 2.0% of the value range being measured (not full range of meter) and have been calibrated within the last year. All equipment shall be calibrated according to the manufacturer's recommended intervals and when dropped or damaged. Calibration tags shall be affixed or certificates readily available.

E. Refer to Part 3.6 E for details regarding equipment that may be required to simulate required test conditions.

PART 3 - EXECUTION

3.1 MEETINGS

A. Scoping Meeting. Within 90 days of commencement of construction, the CA will schedule, plan and conduct a commissioning scoping meeting with the entire commissioning team in attendance. Meeting minutes will be distributed to all parties by the CA. Information gathered from this meeting will allow the CA to revise the *Commissioning Plan* to its "final" version, which will also be distributed to all parties.

B. Miscellaneous Meetings. Other meetings will be planned and conducted by the CA as construction progresses. These meetings will cover coordination, deficiency resolution and planning issues with particular Subs. The CA will plan these meetings and will minimize unnecessary time being spent by Subs. For large projects, these meetings may be held monthly, until the final 3 months of construction when they may be held as frequently as one per week.

3.2 REPORTING

A. The CA will provide regular reports to the PM, depending on the management structure, with increasing frequency as construction and commissioning progresses. Standard forms are provided and referenced in the *Commissioning Plan.*

B. The CA will regularly communicate with all members of the commissioning team, keeping them apprised of commissioning progress and scheduling changes through memos, progress reports, etc.

C. Testing or review approvals and non-conformance and deficiency reports are made regularly with the review and testing as described in later sections.

D. A final summary report (about four to six pages, not including backup documentation) by the CA will be provided to the PM, focusing on evaluating commissioning process issues and identifying areas where the process could be improved. All acquired documentation, logs, minutes, reports, deficiency lists, communications, findings, unresolved issues, etc., will be compiled in appendices and provided with the summary report. Prefunctional checklists, functional tests and monitoring reports will not be part of the final report, but will be stored in the Commissioning Record in the O&M manuals.

3.3 SUBMITTALS

A. The CA will provide appropriate contractors with a specific request for the type of submittal documentation the CA requires to facilitate the commissioning work. These requests will be integrated into the normal submittal process and protocol of the construction team. At minimum, the submittals will include the manufacturer and model number, the manufacturer's printed installation and detailed start-up procedures, full sequences of operation, O&M data, performance data, any performance test procedures, control drawings and details of owner contracted tests. In addition, the installation and checkout materials that are actually shipped inside the equipment and the actual field checkout sheet forms to be used by the factory or field technicians shall be submitted to the Commissioning authority. All documentation requested by the CA will be included by the Subs in their O&M manual contributions.

B. The Commissioning authority will review and approve submittals related to the commissioned equipment for conformance to the Contract Documents as it relates to the commissioning process, to the functional performance of the equipment and adequacy for developing test procedures. This review is intended primarily to aid in the development of functional testing procedures and only secondarily to verify compliance with equipment specifications. The Commissioning authority will notify the PM or A/E as requested, of items missing or areas that are not in conformance with Contract Documents and which require resubmission.

C. The CA may request additional design narrative from the A/E and Controls Contractor, depending on the completeness of the design intent documentation and sequences provided with the Specifications.

D. These submittals to the CA do not constitute compliance for O&M manual documentation. The O&M manuals are the responsibility of the Contractor, though the CA will review and approve them.

3.4 START-UP, PREFUNCTIONAL CHECKLISTS AND INITIAL CHECKOUT

A. The following procedures apply to all equipment to be commissioned, according to Section 1.7, Systems to be Commissioned. Some systems that are not comprised of actual dynamic machinery, e.g., electrical system power quality, may have very simplified PCs and startup.

B. General. Prefunctional checklists are important to ensure that the equipment and systems are hooked up and operational. It ensures that functional performance testing (in-depth system checkout) may proceed without unnecessary delays. Each piece of equipment receives full prefunctional checkout. No sampling strategies are used. The prefunctional testing for a given system must be successfully completed prior to formal functional performance testing of equipment or subsystems of the given system.

C. Start-up and Initial Checkout Plan. The CA shall assist the commissioning team members responsible for startup of any equipment in developing detailed start-up plans for all equipment. The primary role of the CA in this process is to ensure that there is written documentation that each of the manufacturer-recommended procedures have been completed. Parties responsible for prefunctional checklists and startup are identified in the commissioning scoping meeting and in the checklist forms. Parties responsible for executing functional performance tests are identified in the testing requirements in Sections 230800 and 260800.
   1. The CA adapts, if necessary, the representative prefunctional checklists and procedures from Section 230800 or 260800. These checklists indicate required procedures to be executed as part of startup and initial checkout of the systems and the party responsible for their execution.
   2. These checklists and tests are provided by the CA to the Contractor. The Contractor determines which trade is responsible for executing and documenting each of the line item tasks and notes that trade on the form. Each form will have more than one trade responsible for its execution.
   3. The subcontractor responsible for the purchase of the equipment develops the full start-up plan by combining (or adding to) the CA's checklists with the manufacturer's detailed start-up and checkout procedures from the O&M manual and the normally used field checkout sheets. The plan will include checklists and procedures with specific boxes or lines for recording and documenting the checking and inspections of each procedure and a summary statement with a signature block at the end of the plan. The full start-up plan could consist of something as simple as:
      a. The CA's prefunctional checklists.
      b. The manufacturer's standard written start-up procedures copied from the installation manuals with check boxes by each procedure and a signature block added by hand at the end.
      c. The manufacturer's normally used field checkout sheets.
   4. The subcontractor submits the full startup plan to the CA for review and approval.

5. The CA reviews and approves the procedures and the format for documenting them, noting any procedures that need to be added.
6. The full start-up procedures and the approval form may be provided to the PM for review and approval, depending on management protocol.

D. Sensor and Actuator Calibration.
1. All field-installed temperature, relative humidity, CO, CO_2 and pressure sensors and gages, and all actuators (dampers and valves) on all equipment shall be calibrated using the methods described below. Alternate methods may be used, if approved by the Owner before-hand. All test instruments shall have had a certified calibration within the last 12 months. Sensors installed *in* the unit at the factory with calibration certification provided need not be field calibrated.
2. All procedures used shall be fully documented on the prefunctional checklists or other suitable forms, clearly referencing the procedures followed and written documentation of initial, intermediate and final results.

E. Sensor Calibration Methods
1. All Sensors. Verify that all sensor locations are appropriate and away from causes of erratic operation. Verify that sensors with shielded cable are grounded only at one end. For sensor pairs that are used to determine a temperature or pressure difference, make sure they are reading within 0.2°F of each other for temperature and within a tolerance equal to 2% of the reading, of each other, for pressure. Tolerances for critical applications may be tighter.
2. Sensors Without Transmitters--Standard Application. Make a reading with a calibrated test instrument within 6 inches of the site sensor. Verify that the sensor reading (via the permanent thermostat, gage or building automation system (BAS)) is within the tolerances in the table below of the instrument-measured value. If not, install offset in BAS, calibrate or replace sensor.
3. Sensors With Transmitters--Standard Application. Disconnect sensor. Connect a signal generator in place of sensor. Connect ammeter in series between transmitter and BAS control panel. Using manufacturer's resistance-temperature data, simulate minimum desired temperature. Adjust transmitter potentiometer zero until 4 mA is read by the ammeter. Repeat for the maximum temperature matching 20 mA to the potentiometer span or maximum and verify at the BAS. Record all values and recalibrate controller as necessary to conform with specified control ramps, reset schedules, proportional relationship, reset relationship and P/I reaction. Reconnect sensor. Make a reading with a calibrated test instrument within 6 inches of the site sensor. Verify that the sensor reading (via the permanent thermostat, gage or building automation system (BAS)) is within the tolerances in the table below of the instrument-measured value. If not, replace sensor and repeat. For pressure sensors, perform a similar process with a suitable signal generator.
4. Critical Applications. For critical applications (process, manufacturing, etc.) more rigorous calibration techniques may be required for selected sensors. Describe any such methods used on an attached sheet.

5. Tolerances, Standard Applications

Sensor	Required Tolerance (+/-)	Sensor	Required Tolerance (+/-)
Cooling coil, chilled and condenser water temps	1.0F	Flow rates, water and air	+10% / -5% of design
OA wet bulb or dew point	2.0F	Outside air, space, duct air temps	1.5F
Hot water coil and boiler water temp	2.0F	Oxygen or CO_2 monitor	0.1 % pts

Watt/hour, voltage & amperage	5% of design	CO monitor	0.01 % pts
Pressures, air, water and gas	5% of design		

F. Valve and Damper Stroke Setup and Check
   1. For all valve and damper actuator positions checked, verify the actual position against the BAS readout. Set pumps or fans to normal operating mode. Command valve or damper closed, visually verify that valve or damper is closed and adjust output zero signal as required. Command valve or damper open, verify position is full open and adjust output signal as required. Command valve or damper to a few intermediate positions. If actual valve or damper position doesn't reasonably correspond, replace actuator or add pilot positioner (for pneumatics).
   2. Closure for heating coil valves (NO): Set heating setpoint 20°F above room temperature. Observe valve open. Remove control air or power from the valve and verify that the valve stem and actuator position do not change. Restore to normal. Set heating setpoint to 20°F below room temperature. Observe the valve close. For pneumatics, by override in the EMS, increase pressure to valve by 3 psi (do not exceed actuator pressure rating) and verify valve stem and actuator position does not change. Restore to normal.
   3. Closure for cooling coil valves (NC): Set cooling setpoint 20°F above room temperature. Observe the valve close. Remove control air or power from the valve and verify that the valve stem and actuator position do not change. Restore to normal. Set cooling setpoint to 20°F below room temperature. Observe valve open. For pneumatics, by override in the EMS, increase pressure to valve by 3 psi (do not exceed actuator pressure rating) and verify valve stem and actuator position does not change. Restore to normal.

G. Execution of Prefunctional Checklists and Startup.
   1. Four weeks prior to startup, the Subs and vendors schedule startup and checkout with the PM, GC and CA. The performance of the prefunctional checklists, startup and checkout are directed and executed by the Sub or vendor. When checking off prefunctional checklists, signatures may be required of other Subs for verification of completion of their work.
   2. The CA shall observe, at minimum, the procedures for each piece of primary equipment, unless there are multiple units, (in which case a sampling strategy may be used as approved by the PM). In no case will the number of units witnessed be less than four on any one building, nor less than 20% of the total number of identical or very similar units.
   3. For lower-level components of equipment, (e.g., VAV boxes, sensors, controllers), the CA shall observe a sampling of the prefunctional and start-up procedures. The sampling procedures are identified in the commissioning plan.
   4. The Subs and vendors shall execute startup and provide the CA with a signed and dated copy of the completed start-up and prefunctional tests and checklists.
   5. Only individuals that have direct knowledge and witnessed that a line item task on the prefunctional checklist was actually performed shall initial or check that item off. It is not acceptable for witnessing supervisors to fill out these forms.

H. Deficiencies, Non-Conformance and Approval in Checklists and Startup.
   1. The Subs shall clearly list any outstanding items of the initial start-up and prefunctional procedures that were not completed successfully, at the bottom of the procedures form or on an attached sheet. The procedures form and any outstanding deficiencies are provided to the CA within two days of test completion.
   2. The CA reviews the report and submits either a non-compliance report or an approval form to the Sub or PM. The CA shall work with the Subs and vendors to correct and retest deficiencies or uncompleted items. The CA will involve the PM and others as necessary. The installing Subs or vendors shall correct all areas that are deficient or incomplete in the checklists and tests in a timely manner, and shall notify the CA as soon as outstanding items have been corrected and resubmit an updated start-up report and a Statement of Correction on the original non-compliance report. When satisfactorily

completed, the CA recommends approval of the execution of the checklists and startup of each system to the PM using a standard form.

3. Items left incomplete, which later cause deficiencies or delays during functional testing will result in backcharges to the responsible party. Refer to Part 3.7 herein for details.

3.5 PHASED COMMISSIONING

A. The project will require startup and initial checkout to be executed in phases. This phasing will be planned and scheduled in a coordination meeting of the CA, PM, mechanical, TAB, controls, and the GC. Results will be added to the master and commissioning schedule.

3.6 FUNCTIONAL PERFORMANCE TESTING

A. This sub-section applies to all commissioning functional testing for all divisions.

B. The general list of equipment to be commissioned is found in Part 1.7.

C. The parties responsible to execute each test will be listed on each function test procedure. The controls contractor and CA will need to be present for all functional testing and the mechanical and electrical contractors will need to have people on site to assist when needed. Functional testing will be scheduled with the GC and contractors will be notified in advance when they are required.

D. Objectives and Scope. The objective of functional performance testing is to demonstrate that each system is operating according to the documented design intent and Contract Documents. Functional testing facilitates bringing the systems from a state of substantial completion to full dynamic operation. Additionally, during the testing process, areas of deficient performance are identified and corrected, improving the operation and functioning of the systems.

1. In general, each system should be operated through all modes of operation (seasonal, occupied, unoccupied, warm-up, cool-down, part- and full-load) where there is a specified system response. Verifying each sequence in the sequences of operation is required. Proper responses to such modes and conditions as power failure, freeze condition, low oil pressure, no flow, equipment failure, etc. shall also be tested.

E. Development of Test Procedures. Before test procedures are written, the CA shall obtain all requested documentation and a current list of change orders affecting equipment or systems, including an updated points list, program code, control sequences and parameters. Using the testing parameters and requirements in Sections 230800 and 260800, the CA shall develop specific test procedures and forms to verify and document proper operation of each piece of equipment and system. Each Sub or vendor responsible to execute a test shall provide limited assistance to the CA in developing the procedures review (answering questions about equipment, operation, sequences, etc.). Prior to execution, the CA shall provide a copy of the test procedures to the Sub(s) who shall review the tests for feasibility, safety, equipment and warranty protection. The CA may submit the tests to the A/E for review, if requested.

1. The CA shall review owner-contracted, factory testing or required owner acceptance tests which the CA is not responsible to oversee, including documentation format, and shall determine what further testing or format changes may be required to comply with the *Specifications*. Redundancy of testing shall be minimized.
2. The purpose of any given specific test is to verify and document compliance with the stated criteria of acceptance given on the test form.
3. The test procedure forms developed by the CA shall include (but not be limited to) the following information:
    a. System and equipment or component name(s)
    b. Equipment location and ID number
    c. Unique test ID number, and reference to unique prefunctional checklist and start-up documentation ID numbers for the piece of equipment
    d. Date
    e. Project name
    f. Participating parties

g. A copy of the specification section describing the test requirements
h. A copy of the specific sequence of operations or other specified parameters being verified
i. Formulas used in any calculations
j. Required pre-test field measurements
k. Instructions for setting up the test.
l. Special cautions, alarm limits, etc.
m. Specific step-by-step procedures to execute the test, in a clear, sequential and repeatable format
n. Acceptance criteria of proper performance with a Yes / No check box to allow for clearly marking whether or not proper performance of each part of the test was achieved.
o. A section for comments
p. Signatures and date block for the CA

F. Test Methods.

1. Functional performance testing and verification may be achieved by manual testing (persons manipulate the equipment and observe performance) or by monitoring the performance and analyzing the results using the control system's trend log capabilities or by stand-alone dataloggers. The CA may substitute specified methods or require an additional method to be executed, other than what was specified, with the approval of the PM. This may require a change order and adjustment in charge to the Owner. The CA will determine which method is most appropriate for tests that do not have a method specified.
2. Simulated Conditions. Simulating conditions (not by an overwritten value) shall be allowed, though timing the testing to experience actual conditions is encouraged wherever practical.
3. Overwritten Values. Overwriting sensor values to simulate a condition, such as overwriting the outside air temperature reading in a control system to be something other than it really is, shall be allowed, but shall be used with caution and avoided when possible. Before simulating conditions or overwriting values, sensors, transducers and devices shall have been calibrated.
4. Simulated Signals. Using a signal generator which creates a simulated signal to test and calibrate transducers and DDC constants is generally recommended over using the sensor to act as the signal generator via simulated conditions or overwritten values.
5. Altering Setpoints. Rather than overwriting sensor values, and when simulating conditions is difficult, altering setpoints to test a sequence is acceptable. For example, to see the AC compressor lockout work at an outside air temperature below 55F, when the outside air temperature is above 55F, temporarily change the lockout setpoint to be 2F above the current outside air temperature.
6. Indirect Indicators. Relying on indirect indicators for responses or performance shall be allowed only after visually and directly verifying and documenting, over the range of the tested parameters, that the indirect readings through the control system represent actual conditions and responses. Much of this verification is completed during prefunctional testing.
7. Setup. Each function and test shall be performed under conditions that simulate actual conditions as close as is practically possible. The Sub executing the test shall provide all necessary materials, system modifications, etc. to produce the necessary flows, pressures, temperatures, etc. necessary to execute the test according to the specified conditions. At completion of the test, the Sub shall return all affected building equipment and systems, due to these temporary modifications, to their pre-test condition.
8. Sampling. Multiple identical pieces of non-life-safety or otherwise non-critical equipment may be functionally tested using a sampling strategy. Significant application differences and significant sequence of operation differences in otherwise identical equipment invalidates their common identity. A small size or capacity difference, alone, does not

constitute a difference. It is noted that no sampling by Subs is allowed in prefunctional checklist execution.

a. A common sampling strategy referenced in the *Specifications* as the "20% Sampling—5% Failure Rule" is defined by the following example.
b. The example below describes a 20% Sampling—5% Failure Rule.
    1) Randomly test at least 20% of each group of identical equipment. In no case test less than three units in each group. This 20%, or three, constitute the "first sample."
    2) If 5% of the units in the first sample fail the functional performance tests, test another 20% of the group (the second sample).
c. If 5% of the units in the second sample fail, test all remaining units in the whole group.
d. If at any point, frequent failures are occurring and testing is becoming more troubleshooting than verification, the CA may stop the testing and require the responsible Sub to perform and document a checkout of the remaining units, prior to continuing with functionally testing the remaining units.

G. Coordination and Scheduling. The Subs shall provide sufficient notice to the CA regarding their completion schedule for the prefunctional checklists and startup of all equipment and systems. The CA will schedule functional tests through the PM, GC and affected Subs. The CA shall direct, witness and document the functional testing of all equipment and systems. The Subs shall execute the tests.

H. In general, functional testing is conducted after prefunctional testing and startup has been satisfactorily completed. The control system is sufficiently tested and approved by the CA before it is used for TAB or to verify performance of other components or systems. The air balancing and water balancing is completed and debugged before functional testing of air-related or water-related equipment or systems. Testing proceeds from components to subsystems to systems. When the proper performance of all interacting individual systems has been achieved, the interface or coordinated responses between systems is checked.

I. Test Equipment. Refer to Part 2 for test equipment requirements.

J. Problem Solving. The CA will recommend solutions to problems found, however the burden of responsibility to solve, correct and retest problems is with the GC, Subs and A/E.

3.7 DOCUMENTATION, NON-CONFORMANCE AND APPROVAL OF TESTS

A. Documentation. The CA shall witness and document the results of all functional performance tests using the specific procedural forms developed for that purpose. Prior to testing, these forms are provided to the PM for review and approval and to the Subs for review. The CA will include the filled out forms in the O&M manuals.

B. Non-Conformance.
1. The CA will record the results of the functional test on the procedure or test form. All deficiencies or non-conformance issues shall be noted and reported to the PM on a standard non-compliance form.
2. Corrections of minor deficiencies identified may be made during the tests at the discretion of the CA. In such cases the deficiency and resolution will be documented on the procedure form.
3. Every effort will be made to expedite the testing process and minimize unnecessary delays, while not compromising the integrity of the procedures. However, the CA will not be pressured into overlooking deficient work or loosening acceptance criteria to satisfy scheduling or cost issues, unless there is an overriding reason to do so at the request of the PM.
4. As tests progress and a deficiency is identified, the CA discusses the issue with the executing contractor.

a. When there is no dispute on the deficiency and the Sub accepts responsibility to correct it:
   1) The CA documents the deficiency and the Sub's response and intentions and they go on to another test or sequence. After the day's work, the CA submits the non-compliance reports to the PM for signature, if required. A copy is provided to the Sub and CA. The Sub corrects the deficiency, signs the statement of correction at the bottom of the non-compliance form certifying that the equipment is ready to be retested and sends it back to the CA.
   2) The CA reschedules the test and the test is repeated.

b. If there is a dispute about a deficiency, regarding whether it is a deficiency or who is responsible:
   1) The deficiency shall be documented on the non-compliance form with the Sub's response and a copy given to the PM and to the Sub representative assumed to be responsible.
   2) Resolutions are made at the lowest management level possible. Other parties are brought into the discussions as needed. Final interpretive authority is with the A/E. Final acceptance authority is with the Project Manager.
   3) The CA documents the resolution process.
   4) Once the interpretation and resolution have been decided, the appropriate party corrects the deficiency, signs the statement of correction on the non-compliance form and provides it to the CA. The CA reschedules the test and the test is repeated until satisfactory performance is achieved.

5. Cost of Retesting.
   a. The cost for the *Sub* to retest a prefunctional or functional test, if they are responsible for the deficiency, shall be theirs. If they are not responsible, any cost recovery for retesting costs shall be negotiated with the GC.
   b. For a deficiency identified, not related to any prefunctional checklist or start-up fault, the following shall apply: The CA and PM will direct the retesting of the equipment once at no "charge" to the GC for their time. However, the CA's and PM's time for a second retest will be charged to the GC, who may choose to recover costs from the responsible Sub.
   c. The time for the CA and PM to direct any retesting required because a specific *prefunctional* checklist or start-up test item, reported to have been successfully completed, but determined during functional testing to be faulty, will be backcharged to the GC, who may choose to recover costs from the party responsible for executing the faulty prefunctional test.
   d. Refer to the sampling section of Section 01810, Part 3.6 for requirements for testing and retesting identical equipment.
6. The Contractor shall respond in writing to the CA and PM at least as often as commissioning meetings are being scheduled concerning the status of each apparent outstanding discrepancy identified during commissioning. Discussion shall cover explanations of any disagreements and proposals for their resolution.
7. The CA retains the original non-conformance forms until the end of the project.
8. Any required retesting by any contractor shall not be considered a justified reason for a claim of delay or for a time extension by the prime contractor.

C. Failure Due to Manufacturer Defect. If 10%, or three, whichever is greater, of identical pieces (size alone does not constitute a difference) of equipment fail to perform to the Contract Documents (mechanically or substantively) due to manufacturing defect, not allowing it to meet its submitted performance spec, all identical units may be considered unacceptable by the GC or PM. In such case, the Contractor shall provide the Owner with the following:

1. Within one week of notification from the GC or PM, the Contractor or manufacturer's representative shall examine all other identical units making a record of the findings. The findings shall be provided to the GC and PM within two weeks of the original notice.
2. Within two weeks of the original notification, the Contractor or manufacturer shall provide a signed and dated, written explanation of the problem, cause of failures, etc. and all proposed solutions which shall include full equipment submittals. The proposed solutions shall not significantly exceed the specification requirements of the original installation.
3. The GC and PM will determine whether a replacement of all identical units or a repair is acceptable.
4. Two examples of the proposed solution will be installed by the Contractor and the GC will be allowed to test the installations for up to one week, upon which the GC and PM will decide whether to accept the solution.
5. Upon acceptance, the Contractor and/or manufacturer shall replace or repair all identical items, at their expense and extend the warranty accordingly, if the original equipment warranty had begun. The replacement/repair work shall proceed with reasonable speed beginning within one week from when parts can be obtained.

D. Approval. The CA notes each satisfactorily demonstrated function on the test form. Formal approval of the functional test is made later after review by the CA and by the PM, if necessary. The CA recommends acceptance of each test to the PM using a standard form. The PM gives final approval on each test using the same form, providing a signed copy to the CA and the Contractor.

3.8 OPERATION AND MAINTENANCE MANUALS

A. Standard O&M Manuals.
1. The specific content and format requirements for the standard O&M manuals are detailed in Section 011001 – General Requirements. Special requirements for the controls contractor and TAB contractor are found Section 230800.
2. A/E Contribution. The A/E will include in the beginning of the O&M manuals a separate section describing the systems including:
   a. The design intent narrative prepared by the A/E and provided as part of the bid documents, updated to as-built status by the A/E.
   b. Simplified professionally drawn single line system diagrams on 8 ½" x 11" or 11" x 17" sheets. These shall include chillers, water system, condenser water system, heating system, supply air systems, and exhaust systems. These shall show major pieces of equipment such as pumps, chillers, boilers, control valves, expansion tanks, coils, service valves, etc.

3. CA Review and Approval. Prior to substantial completion, the CA shall review the O&M manuals, documentation and redline as-builds *for systems that were commissioned* to verify compliance with the *Specifications.* The CA will communicate deficiencies in the manuals to the PM or A/E, as requested. Upon a successful review of the corrections, the CA recommends approval and acceptance of these sections of the O&M manuals to the PM or A/E. The CA also reviews each equipment warranty and verifies that all requirements to keep the warranty valid are clearly stated. This work does not supersede the A/E's review of the O&M manuals according to the A/E's contract.

B. Commissioning Record in O&M Manuals.

4. Final Report Details. The final commissioning report shall include an executive summary, list of participants and roles, brief building description, overview of commissioning and testing scope and a general description of testing and verification methods. For each piece of commissioned equipment, the report should contain the disposition of the commissioning authority regarding the adequacy of the equipment, documentation and training meeting the contract documents in the following areas: 1) Equipment meeting the equipment specifications, 2) Equipment installation, 3) Functional performance and efficiency, 4) Equipment documentation and design intent, and 5) Operator training. All

outstanding non-compliance items shall be specifically listed. Recommendations for improvement to equipment or operations, future actions, commissioning process changes, etc. shall also be listed. Each non-compliance issue shall be referenced to the specific functional test, inspection, trend log, etc. where the deficiency is documented. The functional performance and efficiency section for each piece of equipment shall include a brief description of the verification method used (manual testing, BAS trend logs, data loggers, etc.) and include observations and conclusions from the testing.

5. Other documentation will be retained by the CA.

3.9 TRAINING OF OWNER PERSONNEL

A. The GC shall be responsible for training coordination and scheduling and ultimately for ensuring that training is completed.

B. The CA shall be responsible for overseeing and approving the content and adequacy of the training of Owner personnel for commissioned equipment.

1. The CA shall interview the facility manager and lead engineer to determine the special needs and areas where training will be most valuable. The Owner and CA shall decide how rigorous the training should be for each piece of commissioned equipment. The CA shall communicate the results to the Subs and vendors who have training responsibilities.
2. In addition to these general requirements, the specific training requirements of Owner personnel by Subs and vendors is specified in Division 23 and Division 26.
3. Each Sub and vendor responsible for training will submit a written training plan to the CA for review and approval prior to training. The plan will cover the following elements:
   a. Equipment (included in training)
   b. Intended audience
   c. Location of training
   d. Objectives
   e. Subjects covered (description, duration of discussion, special methods, etc.)
   f. Duration of training on each subject
   g. Instructor for each subject
   h. Methods (classroom lecture, video, site walk-through, actual operational demonstrations, written handouts, etc.)
   i. Instructor and qualifications
4. For the primary HVAC equipment, the Controls Contractor shall provide a short discussion of the control of the equipment during the mechanical or electrical training conducted by others.
5. The GC develops an overall training plan and coordinates and schedules, with the PM and CA, the overall training for the commissioned systems. The CA develops criteria for determining that the training was satisfactorily completed, including attending some of the training.
6. Videotaping of the training sessions will be provided by the GC and added to the O&M manuals.

3.10 DEFERRED TESTING

A. Unforeseen Deferred Tests. If any check or test cannot be completed due to the building structure, required occupancy condition or other deficiency, execution of checklists and functional testing may be delayed upon approval of the PM. These tests will be conducted in the same manner as the seasonal tests as soon as possible. Services of necessary parties will be negotiated.

B. Seasonal Testing. During the warranty period, seasonal testing (tests delayed until weather conditions are closer to the system's design) specified in Section 230800 shall be completed as part of this contract. The CA shall coordinate this activity. Tests will be executed, documented and deficiencies corrected by the appropriate Subs, with facilities staff and the CA witnessing. Any final adjustments to the O&M manuals and as-builds due to the testing will be made.

3.11 WRITTEN WORK PRODUCTS

A. The commissioning process generates a number of written work products described in various parts of the *Specifications.* The *Commissioning Plan—Construction Phase,* lists all the formal written work products, describes briefly their contents, who is responsible to create them, their due dates, who receives and approves them and the location of the specification to create them. In summary, the written products are:

1.	Product	Developed By
a.	Final commissioning plan	CA
b.	Meeting minutes	CA
c.	Commissioning schedules	CA with GC and PM
d.	Equipment documentation submittals	Subs
e.	Sequence clarifications	A/E
f.	Prefunctional checklists	Subs and CA
g.	Startup and initial checkout plan	Subs and CA
h.	Startup and initial checkout forms filled out	Subs
i.	TAB Plan	TAB
j.	Controls Commissioning Plan	CC
k.	Final TAB report	TAB
l.	Issues log (deficiencies)	CA
m.	Commissioning Progress Record	CA
n.	Deficiency reports	CA
o.	Functional test forms	CA
p.	Filled out functional tests	CA
q.	O&M manuals	Subs
r.	Commissioning record book	CA
s.	Overall training plan	GC and PM
t.	Specific training agendas	Subs
u.	Final commissioning report	CA
v.	Misc. approvals	CA
w.	LEED Documentation and uploads	CA

END OF SECTION

SECTION 02 4100

DEMOLITION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Selective demolition of existing site elements.

B. Selective demolition of building elements for alteration purposes.

1.02 DEFINITIONS

A. Demolish (Demo): Dismantle a defined component of existing construction, remove it from the Site, and dispose of it either as specified or in lawful manner.

B. Dispose: Remove from the Project Site in lawful manner.

C. Reinstall: Install a removed component of existing construction into new construction as indicated.

D. Remove: Dismantle a defined component of existing construction in a manner which protects and preserves the component for future use/installation; definition includes lawful disposal, unless otherwise specifically indicated to be reinstalled, salvaged, or other described action.

E. Salvage: Remove in a manner preserving the existing condition and integrity of the component, set aside, store and protect for future reinstallation.

1.03 REFERENCE STANDARDS

A. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate work with utility companies; notify before starting work and comply with their requirements; obtain required permits.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Site Plan: Showing:
   1. Vegetation to be protected.
   2. Areas for temporary and permanent placement of removed materials.

C. Demolition Plan: Submit demolition plan as specified by OSHA and local authorities.
   1. Indicate extent of demolition, removal sequence, bracing and shoring, and location and construction of barricades and fences.
   2. Identify demolition firm and submit qualifications.

D. Project Record Documents: Accurately record actual locations of capped and active utilities and subsurface construction.

1.06 QUALITY ASSURANCE

A. Demolition Firm Qualifications: Company specializing in the type of work required.
   1. Minimum of five years of documented experience.

PART 2 PRODUCTS -- NOT USED

PART 3 EXECUTION

3.01 SCOPE

A. Remove portions of existing building as indicated on Drawings.

B. Remove other items as specifically indicated on Drawings.

C. Remove items specifically indicated for salvage, relocation, and recycling.

3.02 GENERAL PROCEDURES AND PROJECT CONDITIONS

A. Comply with other requirements specified in Section 01 7000.

B. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
   1. Obtain required permits.
   2. Comply with applicable requirements of NFPA 241.
   3. Use of explosives is not permitted.
   4. Provide, erect, and maintain temporary barriers and security devices.
   5. Use physical barriers to prevent access to areas that could be hazardous to workers or the public.
   6. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
   7. Do not close or obstruct roadways or sidewalks without permit.
   8. Conduct operations to minimize obstruction of public and private entrances and exits; do not obstruct required exits at any time; protect persons using entrances and exits from removal operations.
   9. Obtain written permission from owners of adjacent properties when demolition equipment will traverse, infringe upon or limit access to their property.

C. Do not begin removal until receipt of notification to proceed from Owner.

D. Do not begin removal until existing elements to be salvaged or relocated have been removed.

E. Protect existing structures and other elements that are not to be removed.
   1. Provide bracing and shoring.
   2. Prevent movement or settlement of adjacent structures.
   3. Stop work immediately if adjacent structures appear to be in danger.

F. Minimize production of dust due to demolition operations; do not use water if that will result in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.

G. If hazardous materials are discovered during removal operations, stop work and notify Architect and Owner; hazardous materials include regulated asbestos containing materials, lead, PCB's, and mercury.

3.03 SELECTIVE DEMOLITION FOR ALTERATIONS

A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
   1. Verify that construction and utility arrangements are as indicated.
   2. Report discrepancies to Architect before disturbing existing installation.
   3. Beginning of demolition work constitutes acceptance of existing conditions that would be apparent upon examination prior to starting demolition.

B. Separate areas in which demolition is being conducted from other areas that are still occupied.
   1. Provide, erect, and maintain temporary dustproof partitions of construction specified in Section 01 5000 in locations indicated on Drawings.

C. Maintain weatherproof exterior building enclosure except for interruptions required for replacement or modifications; take care to prevent water and humidity damage.

D. Remove existing work as indicated and as required to accomplish new work.
   1. Remove rotted wood, corroded metals, and deteriorated masonry and concrete; replace with new construction specified.
   2. Remove items indicated on Drawings.

E. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove existing systems and equipment as indicated.
   1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components.
   2. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
   3. See Section 01 1000 for other limitations on outages and required notifications.

4. Verify that abandoned services serve only abandoned facilities before removal.
5. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification.

F. Protect existing work to remain.
1. Prevent movement of structure; provide shoring and bracing if necessary.
2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
3. Repair adjacent construction and finishes damaged during removal work.
4. Patch as specified for patching new work.

3.04 DEBRIS AND WASTE REMOVAL

A. Remove debris and trash from site.

B. Remove from site all materials not to be reused on site; do not burn or bury.

C. Leave site in clean condition, ready for subsequent work.

D. Clean up spillage and wind-blown debris from public and private lands.

END OF SECTION

SECTION 03 3000

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Interior floor repair and exterior paving slabs on grade.

B. Concrete reinforcement.

C. Joint devices associated with concrete work.

D. Miscellaneous concrete elements, including fencing foundations and monument sign foundations.

E. Underslab vapor retarder.

F. Concrete curing.

1.02 REFERENCE STANDARDS

A. ACI 117 - Specifications for Tolerances for Concrete Construction and Materials.

B. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete.

C. ACI 301 - Specifications for Structural Concrete.

D. ACI 302.1R - Guide to Concrete Floor and Slab Construction.

E. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete.

F. ACI 305R - Guide to Hot Weather Concreting.

G. ACI 308R - Guide to External Curing of Concrete.

H. ACI 309R - Guide for Consolidation of Concrete.

I. ACI 318 - Building Code Requirements for Structural Concrete and Commentary.

J. ACI 347R - Guide to Formwork for Concrete.

K. ACI SP-66 - ACI Detailing Manual.

L. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.

M. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.

N. ASTM C33/C33M - Standard Specification for Concrete Aggregates.

O. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.

P. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete.

Q. ASTM C150/C150M - Standard Specification for Portland Cement.

R. ASTM C171 - Standard Specification for Sheet Materials for Curing Concrete.

S. ASTM C173/C173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.

T. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete.

U. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.

V. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.

W. ASTM C1602/C1602M - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete.

X. ASTM D779 - Standard Test Method for Water Resistance of Paper, Paperboard, and Other Sheet Materials by the Dry Indicator Method.

Y. ASTM D8139 - Standard Specification for Semi-Rigid, Closed-Cell Polypropylene Foam, Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction.

Z. ASTM E1643 - Standard Practice for Selection, Design, Installation and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.

AA. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.

AB. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials.

AC. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials.

AD. CRSI (DA4) - Manual of Standard Practice.

AE. CRSI (P1) - Placing Reinforcing Bars.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
1. Coordinate placement of embedded items with erection of concrete formwork and placement of form accessories.
2. Coordinate the use and application of specified curing methods for slabs and floor surfaces with accepted flooring system manufacturers.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Submit manufacturers' data on all specified manufactured products showing compliance with specified requirements and installation instructions.
1. Curing Compounds: Provide data on method of removal in the event of incompatibility with floor covering adhesives.
2. Moisture Emission Reducing Curing and Sealing Compound: Provide manufacturers specifications and product data showing application requirements and limitations, requirements for establishing and maintaining specified warranty, and quality assurance requirements of manufacturer.
3. Under-Slab Vapor Retarder: Provide data on specified products, including all accessory components of vapor retarder system.

C. Mix Designs: Submit proposed mix design for each class of concrete specified. Include mix identification number (unique for each submitted mix), intended use of mix, air content, proportions of ingredients, aggregate analysis, cement brand and type, slump, water/cement ratio, and strength test reports for 7 and 28 day strengths.
1. Indicate proposed mix design complies with applicable requirements of ACI 301, Section 4 - Concrete Mixtures and Chapter 5 - Concrete Quality, Mixing and Placing.
2. Provide specific aggregate analysis for recycled aggregates proposed for use in concrete mixes.

D. Shop Drawings - Reinforcing: Comply with requirements of ACI SP-66. Include bar schedules, shapes of bent bars, spacing of bars, and location of splices.
1. Provide 1/4 inch scale elevations of all walls and grade beams with reinforcing shown.
2. Show splice locations, if any.

E. Samples: Submit samples of underslab vapor retarder to be used.

F. Manufacturer's Certificate: Provide written certification for each admixture actually used that admixtures contain no thiocyanates, and admixtures do not exceed 0.05 percent chloride ions.

1.05 QUALITY ASSURANCE

A. Perform work of this Section in accordance with ACI 117, ACI 301, and ACI 318.

B. Follow recommendations of ACI 301 when concreting during hot and cold weather.

PART 2 PRODUCTS

2.01 FORMWORK

A. Formwork Design and Construction: Comply with guidelines of ACI 347R to provide formwork that will produce concrete complying with tolerances of ACI 117, unless otherwise specified.

B. Forming Materials: Contractor's choice of standard products with sufficient strength to withstand hydrostatic head without distortion in excess of permitted tolerances.
   1. Limit concrete surface irregularities, designated as abrupt or gradual according to ACI 347R, as follows:
      a. Class A: 1/8 inch for smooth formed finish surfaces exposed to view.
      b. Class B: 1/4 inch for rough formed finished surfaces not exposed to view.
      c. Permissible irregularity is a cumulative value due to all sources including layout, plumbness, member size, formwork offsets, joints, and member levelness. Permissible irregularity also applies between adjacent concrete surfaces on opposite sides of construction joints, expansion joints, or shrinkage pour strip if present.
   2. Form Facing for Exposed Finish Concrete: Contractor's choice of materials that will provide smooth, stain-free final appearance where specified for smooth formed finish.
   3. Form Coating: Release agent that will not adversely affect concrete or interfere with application of coatings.

2.02 REINFORCEMENT MATERIALS

A. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi).
   1. Type: Deformed billet-steel bars.
   2. Finish: Unfinished, unless otherwise indicated.

B. Steel Welded Wire Reinforcement (WWR): Galvanized, plain type, ASTM A1064/A1064M.
   1. Form: Flat sheets.
   2. Mesh Size and Wire Gage: As indicated on Drawings.

C. Reinforcement Accessories:
   1. Tie Wire: Annealed, minimum 16 gauge, 0.0508 inch.
   2. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for adequate support of reinforcement during concrete placement.

2.03 CONCRETE MATERIALS

A. Cement: ASTM C150/C150M, Type IIA - Air Entraining Portland type.
   1. Acquire cement for entire project from same source.

B. Fine and Coarse Aggregates: ASTM C33/C33M.
   1. Acquire aggregates for entire project from same source.

C. Fly Ash: ASTM C618, Class C or F.
   1. Acquire all fly ash for entire project from same source.
   2. Limit use to 20 percent of cement content, by weight, unless otherwise specified.

D. Water: ASTM C1602/C1602M; clean, potable, and not detrimental to concrete.

2.04 ADMIXTURES

A. Do not use chemicals that will result in soluble chloride ions in excess of 0.05 percent by weight of cement.
   1. Use of calcium chloride is not permitted.

B. Use of admixtures will not relax cold weather placement requirements.

C. Admixtures:
   1. Air Entrainment Admixture: ASTM C260/C260M.

2.05 ACCESSORY MATERIALS

A. Underslab Vapor Retarder:
   1. Sheet Material: ASTM E1745, Class A; stated by manufacturer as suitable for installation in contact with soil or granular fill under concrete slabs. Single ply polyethylene is prohibited.
   2. Permeance: Maximum 0.01 as measured according to ASTM E96/E96M.
   3. Nominal Thickness: 10 mils.
   4. Accessory Products: Vapor retarder manufacturer's recommended tape, adhesive, mastic, prefabricated boots, etc., for sealing seams and penetrations.

2.06 BONDING AND JOINTING PRODUCTS

A. Bonding Agent: Polyvinyl acetate or acrylic base, re-wettable type.

B. Slab Isolation Joint Filler: 1/2 inch thick, height equal to slab thickness, with removable top section that will form 1/2 inch deep sealant pocket after removal.
   1. Material: ASTM D8139, semi-rigid, closed-cell polypropylene foam.
   2. Acceptable Products:
      a. Nomaco, Inc.; Nomaflex Expansion Joint Filler with Void Cap Option: www.nomaco.com/#sle.
      b. Substitutions: See Section 01 6000 - Product Requirements.

2.07 CURING MATERIALS

A. Curing Compound - Naturally Dissipating: Clear, water-based, liquid membrane-forming compound; complying with ASTM C309.
   1. Applications: Use at fluid-applied flooring, unless otherwise restricted by flooring system manufacturer.
   2. Product dissipates within 4 to 6 weeks.
   3. Provide product containing fugitive red dye.
   4. Acceptable Products:
      a. Dayton Superior Corporation; Resin Cure with Dye J11WD: www.daytonsuperior.com/#sle.
      b. Euclid Chemical Company; COLOR-CRETE CURE AND SEAL VOC: www.euclidchemical.com/#sle.
      c. Kaufman Products Inc; Thinfilm 420 Resin Base: www.kaufmanproducts.net/#sle.
      d. Nox-Crete Inc.; Res-Cure DH 100: www.nox-crete.com/#sle.
      e. SpecChem, LLC; SpecRez: www.specchemllc.com/#sle.
      f. W. R. Meadows, Inc; 1100-Clear: www.wrmeadows.com/#sle.
      g. Substitutions: See Section 01 6000 - Product Requirements.

B. Curing and Sealing Compound, Moisture Emission-Reducing, Membrane-Forming: Liquid, membrane-forming, clear sealer, for application to newly-placed concrete; capable of providing adequate bond for flooring adhesives, initially and over the long term; with sufficient moisture vapor impermeability to prevent deterioration of flooring adhesives due to moisture emission.
   1. Applications: Use this product to cure and seal all slabs to receive adhesively applied flooring.
   2. VOC Content: Less than 100 g/L.
   3. Acceptable Products:
      a. Allied Construction Technologies, Inc.; AC-Tech 2170 FC Vapor Reducing System: www.actechperforms.com.
      b. Creteseal Concrete Waterproofing Products, Inc.; Creteseal 2000: www.creteseal.com.
      c. Floor Seal Technology, Inc.; VaporSeal 309 System: www.floorseal.com.
      d. Nox-Crete Inc.; Cure & Seal 1200E: www.nox-crete.com/#sle.
      e. Substitutions: See Section 01 6000 - Product Requirements.

C. Cover Curing Sheets: ASTM C171; lay-flat sheets comprised of two layers of wet strength kraft paper with tri-dimensional reinforcing fibers completely embedded in high-grade asphalt; 72 inch wide rolls.
   1. Water Resistance: ASTM D779; more than 24 hours.
   2. Vapor Permeance: Maximum 0.20 according to ASTM E96/E96M, Procedure A.
   3. Acceptable Product:
      a. Fortifiber Building Systems Group; Orange Label Sisalkraft 280: www.fortifiber.com.
      b. Substitutions: See Section 01 6000 - Product Requirements.

D. Water: Potable, not detrimental to concrete.

2.08 CONCRETE MIX DESIGN - GENERAL

A. Proportioning Normal Weight Concrete: Comply with ACI 211.1 recommendations.

B. Concrete Strength: Establish required average strength for each type of concrete on the basis of field experience or trial mixtures, as specified in ACI 301.
   1. For trial mixtures method, employ independent testing agency acceptable to Architect for preparing and reporting proposed mix designs.

C. Admixtures: Add acceptable admixtures as recommended in ACI 211.1 and at rates recommended or required by manufacturer.

2.09 CONCRETE MIXES

A. Notes to Schedule of Concrete Mixes:
   1. Nomenclature: NW = Normal weight, AEA = Air entraining agent, MR-WR = Medium range water reducing admixture, MVRA = Moisture Vapor Reducing Admixture.
   2. W/C is the ratio of weight of water to weight of cementitious materials. The weight of water includes all free water in aggregate at the time of batching.

B. Normal Weight Structural Concrete:
   1. Applications: Foundations, slabs on grade, and fence footings.
   2. Compressive Strength, when tested in accordance with ASTM C39/C39M at 28 days: 4,000 pounds per square inch.
   3. Water-Cement Ratio: Maximum 45 percent by weight.
   4. Total Air Content: 5 to 7 percent, determined in accordance with ASTM C173/C173M.
   5. Maximum Slump: 4 inches.
   6. Maximum Aggregate Size: 3/4 inch.
   7. Notes: AEA.

2.10 MIXING

A. Transit Mixers: Comply with ASTM C94/C94M.
   1. Deliver concrete and discharge entire load within 1-1/2 hours, or before drum has turned 300 revolutions, whichever occurs first, after introduction of mixing water.
      a. When air temperature is between 85 and 90 degrees F, reduce mixing and delivery time from 1-1/2 hours to maximum 75 minutes.
      b. When air temperature is 90 degrees and above, reduce mixing and delivery time from 1-1/2 hours to maximum 60 minutes.
   2. During cold weather (below 45 degrees F), use heated water and aggregates if necessary to maintain concrete temperature between 60 degrees F and 90 degrees F.

B. Adding Water: If concrete arrives on-site with slump less than suitable for placement, do not add water that exceeds the maximum water-cement ratio or exceeds the maximum permissible slump.

C. Add water in accordance with ACI 304R, add at one time only, not more than 2 gal/cu yd of concrete, and provided the increase in slump does not exceed one inch.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify lines, levels, and dimensions before proceeding with work of this Section.

3.02 PREPARATION

A. Formwork: Comply with requirements of ACI 301. Design and fabricate forms to support all applied loads until concrete is cured, and for easy removal without damage to concrete.

B. Verify that forms are clean and free of rust before applying release agent.

3.03 INSTALLATION - VAPOR RETARDER

A. Install vapor retarder under interior slabs on grade according to manufacturer's instructions and ASTM E1643. Lap joints minimum 6 inches and seal watertight by taping edges and ends.

3.04 INSTALLATION - REINFORCEMENT AND OTHER EMBEDDED ITEMS

A. Fabricate concrete reinforcing in accordance with CRSI (DA4) - Manual of Standard Practice.
   1. Place reinforcement in accordance with CRSI (P1).

B. Comply with requirements of ACI 301. Clean reinforcement of loose rust and mill scale, and accurately position, support, and secure in place to achieve not less than minimum concrete coverage required for protection.

C. Install welded wire reinforcement in maximum possible lengths, and offset end laps in both directions. Splice laps with tie wire.

D. Verify that anchors, seats, plates, reinforcement and other items to be cast into concrete are accurately placed, positioned securely, and will not interfere with concrete placement.

3.05 PLACING CONCRETE

A. Place concrete in accordance with ACI 304R.

B. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.

C. Place concrete continuously without construction (cold) joints wherever possible; where construction joints are necessary, before next placement prepare joint surface by removing laitance and exposing the sand and sound surface mortar, by sandblasting or high-pressure water jetting.

D. Consolidate concrete placed in forms by mechanical vibrating equipment supplemented by hand spading, rodding, and tamping according to ACI 309R. Vibration of forms and reinforcing is not permitted.

3.06 SLAB JOINTING

A. Locate joints as indicated on Drawings.

B. Anchor joint fillers and devices to prevent movement during concrete placement.

C. Isolation Joints: Use preformed joint filler with removable top section for joint sealant, total height equal to thickness of slab, set flush with top of slab.
   1. Install wherever necessary to separate slab from other building members, including columns, walls, equipment foundations, footings, stairs, manholes, sumps, and drains.
   2. Separate piping, conduit, and similar penetrations through slabs on grade to allow free vertical movement of slab or penetrating element.

3.07 FLOOR FLATNESS AND LEVELNESS TOLERANCES

A. Maximum Variation of Surface Flatness:
   1. Exposed Concrete Floors: 1/4 inch in 10 feet.
   2. Under Seamless Resilient Flooring: 1/4 inch in 10 feet.
   3. Under Carpeting: 1/4 inch in 10 feet.

B. Corrective Measures:
   1. Correct defects by grinding or by removal and replacement of the defective work. Areas requiring corrective work will be identified. Re-measure corrected areas by the same process.

3.08 CONCRETE FINISHING

A. Repair surface defects, including tie holes, immediately after removing formwork.

B. Exposed Form Finish: Rub down or chip off and smooth fins or other raised areas 1/4 inch or more in height unless otherwise specified. Provide finish as follows:
   1. Remove all fins, projections, and other detrimental irregularities on surfaces to receive waterproofing systems; comply with waterproofing system manufacturer's requirements for surface preparation.

C. Concrete Slabs: Finish to requirements of ACI 302.1R, and as follows:
   1. Surfaces to Receive Adhesive-Applied Floor Coverings: "Steel trowel," non-burnished and free of ridges, as described in ACI 302.1R; adhesive-applied floor coverings include carpeting, resilient flooring, seamless flooring, thin set ceramic tile, and other specified flooring systems.
   2. Surfaces to Receive Standard Broom Finish: Immediately after float finishing, slightly roughen surface by brooming with fiber-bristle broom perpendicular to main traffic route, or as directed by Architect. Coordinate required final finish with Architect before application.
   3. Other Surfaces to Be Left Exposed: Trowel as described in ACI 302.1R, minimizing burnish marks and other appearance defects.

3.09 CURING AND PROTECTION

A. Comply with requirements of ACI 308R. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.
   1. Curing and Sealing Compound - Moisture Vapor Reducing: Strictly comply with curing compound manufacturer's requirements in all respects to achieve specified warranty.

B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.
   1. Normal Concrete: Not less than 7 days.
   2. High Early Strength Concrete: Not less than 4 days.

C. Formed Surfaces: Cure by moist curing with forms in place for full curing period.

D. Surfaces Not in Contact with Forms:
   1. Curing - Slabs and Floors To Receive Adhesive-Applied Flooring: Curing compounds and other surface coatings are usually considered unacceptable by flooring and adhesive manufacturers. Unless approved otherwise in writing by Architect and accepted flooring manufacturers, cure slabs and floors to receive adhesive-applied flooring using one of the following methods:
      a. Option 2 - Curing Compound: Cure slabs using specified naturally dissipating or moisture emission reducing curing compound; application method and rate in strict conformance with curing compound manufacturer's requirements to maintain specified warranty.
      b. Option 3 - Cover Curing: Start as soon as possible after slab surface is sufficiently set that it will not be marred by foot traffic. Keep continuously moist for not less than 7 days by application of specified cover curing sheets. Lay sheets flat, and in full contact with slab surface; lap edges minimum 6 inches. Protect from damage during curing period.
   2. Curing - Slabs and Floors Not Receiving Adhesive-Applied Flooring: Begin after initial curing but before surface is dry.
      a. Curing Compound - Naturally Dissipating: Apply specified curing compound in two coats at right angles, using application rate recommended by manufacturer.

3.10 DEFECTIVE CONCRETE

A. Defective Concrete: Concrete not complying with required lines, details, dimensions, tolerances or specified requirements.

B. Repair or replacement of defective concrete will be determined by the Architect. The cost of additional testing shall be borne by Contractor when defective concrete is identified.

C. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Architect for each individual area.

3.11 PROTECTION

A. Do not permit traffic over unprotected concrete floor surface until fully cured.

END OF SECTION

SECTION 03 3500

CONCRETE FLOOR FINISHING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface treatments for concrete floors and slabs, including:
   1. Clear sealer.

1.02 REFERENCE STANDARDS

A. ASTM C1315 - Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate the work with concrete floor placement and concrete floor curing.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's published data on each finishing product, including information on compatibility of different products and limitations.

C. Maintenance Data: Provide data on maintenance and renewal of applied finishes.

1.05 MOCK-UP

A. See Section 01 4000 - Quality Requirements for additional requirements.

B. Mock-up: For stained and sealed finish system, construct mock-up area under conditions similar to those that will exist during application, with coatings applied.
   1. Mock-Up Size: 10 feet square.
   2. Locate where directed.
   3. Mock-up may remain as part of the work.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's sealed packaging, including application instructions.

1.07 FIELD CONDITIONS

A. Special Protection of Floor Finish Substrates:
   1. Provide special protection of concrete surfaces to receive specified floor finishes to prevent detrimental damage that prevents proper application of floor finishes and production of intended results; also comply with other protection requirements where specified in related specification Sections.
   2. Provide temporary and removable protective coverings to completely protect floor surfaces.
   3. Protect floors, stairs, and other surfaces prepared under other Sections from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.
   4. Control activity in work area to prevent detrimental damage.

B. Maintain light level equivalent to a minimum 200 W light source at 8 feet above the floor surface over each 20 foot square area of floor being finished.

C. Do not finish floors until interior heating system is operational.

D. Maintain ambient temperature of 50 degrees F minimum.

PART 2 PRODUCTS

2.01 CONCRETE FLOOR FINISH APPLICATIONS

A. Unless otherwise indicated, all exposed concrete floors are to be finished using low gloss concrete sealer.
   1. Include specified aggregate additive to produce slip-resistance on sealed floor surfaces where specifically scheduled on Drawings.

2.02 FLOOR COATINGS

A. Low Gloss Clear Sealer: Liquid, membrane-forming, clear, non-yellowing acrylic; complying with ASTM C1315, Type 1, Class A.
   1. Vehicle: Water-based.
   2. Solids by Mass: 25 percent, minimum.
   3. VOC Content: OTC compliant.
   4. Acceptable Products:
      a. Kaufman Products Inc; Krystal 25 OTC, or Krystal 25 Emulsion: www.kaufmanproducts.net/#sle.
      b. SpecChem, LLC; Cure and Seal WB 25: www.specchemllc.com/#sle.
      c. W. R. Meadows, Inc; Decra-Seal OTC: www.wrmeadows.com/#sle.
      d. Substitutions: See Section 01 6000 - Product Requirements.

2.03 COATING ADDITIVES

A. Plastic Aggregate: Finely ground polymer for addition to coatings for slip resistance.
   1. Acceptable Products:
      a. Dayton Superior Corporation; Grip Aid: www.daytonsuperior.com/#sle.
      b. Euclid Chemical Company; EUCO GRIP: www.euclidchemical.com/#sle.
      c. SpecChem, LLC; Surface Grip: www.specchemllc.com/#sle.
      d. Substitutions: See Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that floor surfaces are acceptable to receive the work of this Section.

B. Verify that flaws in concrete have been patched and joints filled with methods and materials suitable for further finishes.

3.02 INSTALLATION - GENERAL

A. Apply materials in strict accordance with manufacturer's instructions.

3.03 COATING APPLICATION

A. Verify that surface is free of previous coatings, sealers, curing compounds, water repellents, laitance, efflorescence, fats, oils, grease, wax, soluble salts, residues from cleaning agents, and other impediments to adhesion.

B. Protect adjacent non-coated areas from drips, overflow, and overspray; immediately remove excess material.

C. Apply coatings in accordance with manufacturer's instructions, matching approved mock-ups for color, special effects, sealing and workmanship.

3.04 PROTECTION

A. Provide special protection of concrete surfaces which have received specified floor finishes to prevent detrimental damage to finished flooring surfaces; also comply with other protection requirements where specified in related specification Sections.

B. Control activity in work area to prevent detrimental damage.

END OF SECTION

SECTION 04 2613

UNIT MASONRY VENEER

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Concrete block.

B. Clay facing brick veneer.

C. Mortar and grout.

D. Reinforcement and anchorage.

E. Flashings.

F. Lintels.

G. Accessories.

1.02 REFERENCE STANDARDS

A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

B. ASTM A240/A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.

C. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.

D. ASTM A641/A641M - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.

E. ASTM A951/A951M - Standard Specification for Steel Wire for Masonry Joint Reinforcement.

F. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.

G. ASTM C67/C67M - Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile.

H. ASTM C90 - Standard Specification for Loadbearing Concrete Masonry Units.

I. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar.

J. ASTM C150/C150M - Standard Specification for Portland Cement.

K. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes.

L. ASTM C216 - Standard Specification for Facing Brick (Solid Masonry Units Made From Clay or Shale).

M. ASTM C270 - Standard Specification for Mortar for Unit Masonry.

N. ASTM C404 - Standard Specification for Aggregates for Masonry Grout.

O. ASTM C476 - Standard Specification for Grout for Masonry.

P. BIA Technical Notes No. 18A - Accommodating Expansion of Brickwork.

Q. BIA Technical Notes No. 20 - Cleaning Brickwork.

R. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Direct and coordinate placement of metal anchors supplied for installation under other Sections.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data for masonry units, fabricated wire reinforcement, mortar, and masonry accessories.

C. Samples: Submit four samples of facing brick units to illustrate color, texture, and extremes of color range.

D. Selection Samples: Submit pre-finished metal flashing manufacturer's chart or deck of available colors, for selection.

E. Manufacturer's Certificate: Certify that masonry units meet or exceed specified requirements.

1.05 QUALITY ASSURANCE

A. Comply with provisions of TMS 402/602, except where exceeded by requirements of Contract Documents.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

C. Basis of Design: Specifications are based on unit masonry types by specified basis of design manufacturer and product(s). Unit masonry types manufactured by other acceptable manufacturers are permitted, subject to compliance with specified requirements; and provided that deviations in design, weight, color, texture/pattern, and profile are minor, and do not detract substantially from the indicated design intent.
   1. Comply with requirements specified in Section 01 4000 and Section 01 6000.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.

PART 2 PRODUCTS

2.01 CONCRETE MASONRY UNITS (CMU)

A. Concrete Block: Comply with referenced standards and as follows:
   1. Size: Standard units with nominal face dimensions of 16 by 8 inches and nominal depth of 8 inches.
   2. Special Shapes: Provide non-standard blocks configured for corners and other detailed conditions.
   3. Load-Bearing Units: ASTM C90, normal weight.
      a. Hollow block.
      b. Exposed Faces: Manufacturer's standard gray color and texture.

2.02 BRICK UNITS

A. Facing Brick: ASTM C216, Type FBS Smooth, Grade SW.
   1. Non-efflorescing when tested in accordance with ASTM C67/C67M.
   2. Actual Size: As indicated on Drawings.
   3. Special Shapes: Molded units as required by conditions indicated, unless standard units can be sawn to produce equivalent effect.
      a. Provide matching solid units for use at ends of soldier courses.
   4. Basis of Design Manufacturer for Specified Colors: Summit Brick & Tile Co.; www.summitbrick.com.
      a. Color: Match existing.

2.03 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C150/C150M, Type I.
   1. Not more than 0.60 percent alkali.
   2. Hydrated Lime: ASTM C207, Type S.
   3. Mortar Aggregate: ASTM C144.
   4. Grout Aggregate: ASTM C404.

B. Water: Clean and potable.

C. Admixtures: Not permitted unless specified, or requested by Contractor in writing and approved in writing by Architect.

2.04 REINFORCEMENT AND ANCHORAGE

A. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi), deformed billet bars; uncoated.

B. Single Wythe Joint Reinforcement: ASTM A951/A951M.
1. Type: Ladder at CMU; truss at brick veneer.
2. Material: ASTM A1064/A1064M steel wire, mill galvanized to ASTM A641/A641M, Class 3.
3. Size: 0.1483 inch side rods with 0.1483 inch cross rods; width as required to provide not less than 5/8 inch of mortar coverage on each exposure.

C. Two-Piece Wall Ties: Formed steel wire, 0.1875 inch thick, adjustable, eye and pintle type, hot dip galvanized to ASTM A 153/A 153M, Class B, sized to provide not less than 5/8 inch of mortar coverage from masonry face and to allow vertical adjustment of up to 1-1/4 inch; self-sealing head flange.
1. Acceptable Product:
a. Wire-Bond; Sure-Tie or Tapcon Sure-Tie: www.wirebond.com.
b. Substitutions: See Section 01 6000 - Product Requirements.

D. Masonry Veneer Anchors: 2-piece anchors that permit differential movement between masonry veneer and structural backup, hot dip galvanized to ASTM A153/A153M, Class B.
1. Anchor Plates: Not less than 0.075 inch thick, designed for fastening to structural backup through sheathing by two fasteners; provide design with legs that penetrate sheathing and insulation to provide positive anchorage.
2. Wire Ties: Manufacturer's standard shape, 0.1875 inch thick.
3. Vertical Adjustment: Not less than 3-1/2 inches.

2.05 FLASHINGS

A. Stainless Steel/Polymer Fabric Drainage Plane Flashing: ASTM A240/A240M; 2 mil type 304 stainless steel sheet bonded between one sheet of polymer fabric and one sheet of non-woven drainage material.
1. Accessories: Provide all accessory compoments required by manufacturer for complete system, including termination bars, seaming tapes, and similar components.
2. Acceptable Manufacturer:
a. York Manufacturing, Inc.; Flash-Vent SS: www.yorkmfg.com.
b. Substitutions: See Section 01 6000 - Product Requirements.

B. Lap Sealants and Tapes: As recommended by flashing manufacturer; compatible with membrane and adhesives.

2.06 ACCESSORIES

A. Weeps and Cavity Vents: Molded PVC grilles, insect resistant.
1. Width: Match specified mortar joint thickness; 3/8 inch, unless otherwise indicated.
2. Height: Match height of applicable masonry unit, plus 3/8 inch.
3. Depth: Match depth of applicable masonry unit, plus 1/4 inch.
4. Color(s): As selected by Architect from manufacturer's full range.

B. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.
1. Acceptable Product:
a. ProSoCo, Inc.; Safety Clean: www.prosoco.com.
b. Substitutions: See Section 01 6000 - Product Requirements.

2.07 STEEL ACCESSORIES

A. Steel Ledge Angles: Specified in Section 05 5000.

2.08 MORTAR AND GROUT MIXES

A. Mortar for Unit Masonry: ASTM C270, using the Property Specification.
1. Exterior Non-loadbearing Masonry: Type N.

B. Grout: ASTM C476; consistency required to fill completely volumes indicated for grouting; fine grout for spaces with smallest horizontal dimension of 2 inches or less; coarse grout for spaces with smallest horizontal dimension greater than 2 inches.

C. Mixing: Use mechanical batch mixer and comply with referenced standards.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive masonry.

B. Verify that related items provided under other Sections are properly sized and located.

C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

D. Verify that weather barrier is installed according to Section 07 2500.

3.02 PREPARATION

A. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.

3.03 COLD AND HOT WEATHER REQUIREMENTS

A. Comply with requirements of TMS 402/602 or applicable building code, whichever is more stringent.

3.04 COURSING

A. Establish lines, levels, and coursing indicated. Protect from displacement.

B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.

C. Concrete Masonry Units:
   1. Bond: Running.
   2. Coursing: One unit and one mortar joint to equal 8 inches.
   3. Mortar Joints: Concave.

D. Brick Units:
   1. Bond: Stacked; match existing.
   2. Coursing: Three units and three mortar joints to equal 8 inches.
   3. Mortar Joints: Concave.

3.05 PLACING AND BONDING

A. Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.

B. Lay hollow masonry units with face shell bedding on head and bed joints.

C. Buttering corners of joints or excessive furrowing of mortar joints is not permitted.

D. Remove excess mortar and mortar smears as work progresses.

E. Interlock intersections and external corners.

F. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.

G. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.

3.06 WEEPS/CAVITY VENTS

A. Install weeps in veneer and cavity walls at maximum 24 inches on center horizontally above through-wall flashing, above shelf angles and lintels, at bottom of walls, and rowlock/belt courses where indicated, unless otherwise specified.
   1. Space weeps maximum 16 inches on center where through-wall flashings are installed directly below rowlock courses, belt courses, precast concrete courses, and similar locations.

B. Position weep/cavity vent tabs to extend maximum 1/8 inch beyond outside face of veneer masonry, but not less than 1/16 inch.

3.07 REINFORCEMENT AND ANCHORAGE - MASONRY VENEER

A. Masonry Back-Up: Embed anchors to bond veneer at maximum 16 inches on center vertically and 36 inches on center horizontally. Place additional anchors at perimeter of openings and ends of panels, so maximum spacing of anchors is 8 inches on center.

3.08 MASONRY FLASHINGS

A. Whether or not specifically indicated, install masonry flashing to divert water to exterior at all locations where downward flow of water will be interrupted.
   1. Extend flashings full width at such interruptions and at least 6 inches, minimum, into adjacent masonry or turn up at least 12 inches, minimum, to form watertight pan at non-masonry construction. Use continuous lengths of flashing material in each individual opening wherever possible; minimize seams.
   2. Form end dams at sides of flashing openings as recommended by flashing manufacturer for indicated conditions of installation and service.
   3. Seal top edge of flashings with manufacturer's required termination bar and continuous sealant bead at top edge of termination bar.
   4. Install 1 inch fillet bead of liquid membrane or mastic at changes in plane to fully support membrane at those locations.
   5. Remove or cover protrusions or sharp edges that could puncture flashings.
   6. Tape seal butted seams and penetrations of flashing before covering with mortar.

B. Install manufactured through-wall flashings in conjunction with manufacturer's required accessories, including web spacer/bridge units, termination bars, drainage fabrics, and similar items to produce a complete, properly functioning installation.

C. Extend metal flashings with straight edge to within 1/8 inch of exterior face of masonry veneer; do not extend flashing edge beyond outside face of masonry veneer.

3.09 GROUTED COMPONENTS

A. Reinforce bond beams as indicated on Drawings.

B. Lap splices minimum 24 bar diameters.

C. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of dimensioned position.

D. Place and consolidate grout fill without displacing reinforcing.

E. Grout solid all hollow concrete unit masonry located below grade, and at other locations indicated.

3.10 CONTROL AND EXPANSION JOINTS

A. General: Comply with general requirements of BIA Technical Notes No. 18A.

B. Size and locate control joints as indicated on Drawings; if not shown, 3/8 inch wide; verify all joint locations with Architect.
   1. Spacing - General: Maximum 25 feet, except as otherwise indicated on Drawings for closer spacing or other conditions as specified below.
      a. Provide sealed expansion joint at all internal corners of only non-structural masonry veneer, whether or not specifically noted or detailed.
      b. Provide sealed expansion joint within 15 feet of external corners of only non-structural masonry veneer.

C. Do not continue horizontal joint reinforcement through control or expansion joints.

D. Locate expansion joints as indicated on Drawings.

3.11 TOLERANCES

A. Install concrete unit masonry within the site tolerances found in TMS 402/602.

B. Brick Veneer Masonry Tolerances:
   1. Maximum Variation From Unit to Adjacent Unit: 1/16 inch.
   2. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft and 1/2 inch in 20 ft or more.
   3. Maximum Variation from Plumb: 1/4 inch per story non-cumulative; 1/2 inch in two stories or more.
   4. Maximum Variation from Level Coursing: 1/8 inch in 3 ft and 1/4 inch in 10 ft; 1/2 inch in 30 ft.
   5. Maximum Variation of Mortar Joint Thickness: Head joint, minus 1/8 inch, plus 1/8 inch.

3.12 CUTTING AND FITTING

A. Obtain approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

3.13 CLEANING

A. General: Comply with general requirements of BIA Technical Notes No. 20.

B. Remove excess mortar and mortar droppings.

C. Replace defective mortar. Match adjacent work.

D. Clean soiled surfaces with specified cleaning solution, at low pressure or by hand methods only; do not introduce excessive moisture into masonry wall surfaces during cleaning operations.

E. Use non-metallic tools and stiff brushes in cleaning operations.

3.14 PROTECTION

A. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.
   1. Install required protection of installed work at the end of each work day.

END OF SECTION

SECTION 05 1200

STRUCTURAL STEEL FRAMING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Structural steel framing; limited applications as indicated on Drawings.

1.02 REFERENCE STANDARDS

A. AISC (MAN) - Steel Construction Manual.

B. AISC 303 - Code of Standard Practice for Steel Buildings and Bridges.

C. AISC S348 - Specification for Structural Joints Using ASTM A325 or A490 Bolts.

D. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination.

E. AWS D1.1/D1.1M - Structural Welding Code - Steel.

F. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer.

G. SSPC-SP 2 - Hand Tool Cleaning.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings:
   1. Indicate profiles, sizes, spacing, locations of structural members, openings, attachments, fasteners, and connections.
   2. Indicate welded connections with AWS A2.4 welding symbols. Indicate net weld lengths.
   3. Indicate type, size, and length of bolts, distinguishing between shop and field bolts; identify pretensioned and slip-critical high-strength bolted connections.

C. Manufacturer's Mill Certificate: Certify that products meet or exceed specified requirements.

D. Product Test Reports:
   1. Bolts, nuts, and washers including mechanical properties and chemical analysis.
   2. Direct-tension indicators.
   3. Tension-control, high-strength bolt-nut-washer assemblies.
   4. Shop primers.

1.04 QUALITY ASSURANCE

A. Fabricate structural steel members in accordance with AISC (MAN) "Steel Construction Manual."

B. Fabricator: Company specializing in performing the work of this Section with minimum five years of documented experience.
   1. Qualifications: A qualified steel fabricator that participates in AISC Quality Certification Program and is designated an AISC-Certified Plant, Category STD.
   2. Fabricator Without AISC Certification:
      a. Provide documentation on minimum five comparable projects, including Project name, General Contractor contact information, number of stories, square footage, and steel tonnage.
      b. Provide QA/QC plan documentation.
      c. Provide welding procedure (WPS) documentation.

C. Erector: Company specializing in performing the work of this Section with minimum five years of documented experience.
   1. Qualifications: A qualified steel erector that participates in AISC Quality Certification Program and is designated an AISC-Certified Erector, Category CSE.
   2. Erector Without AISC Certification:
      a. Provide documentation on minimum five comparable projects, including Project name, General Contractor contact information, number of stories, square footage, and steel tonnage.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.
   1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.
   1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
   2. Clean and relubricate bolts and nuts that become dry or rusty before use.
   3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F1852 fasteners and for retesting fasteners after lubrication.

PART 2 PRODUCTS

2.01 MATERIALS

A. Steel Materials, Shapes, Connectors: As specified on structural Drawings.

B. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

C. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

2.02 FABRICATION

A. Fabricate structural steel members in accordance with AISC S303 specifications.

B. Shop fabricate to greatest extent possible.

C. Account for distortion and shrinkage due to welding processes as part of detailing and fabrication procedures, both in the shop and in the field.

D. Provide connections as shown or noted on Drawings; if not shown or noted, provide Standard Framed Beam Connections as shown in AISC (MAN).
   1. Combination of bolts and welds to transmit stress in the same faying surface of any connection is not permitted.
   2. Provide welded or bolted shop connectors using high-strength bolts.
   3. Field Connections: Bolt field connections, except where welded connections are specifically indicated.
      a. Provide high-strength bolts for principal connections including all beam-to-beam and all beam-to-column connections.
      b. Provide high-strength or unfinished bolts for connections of secondary framing members including girts and other framing members taking only nominal stresses.

E. Mark all members in protected, plainly visible locations in accordance with reference numbers on setting diagrams. Determine and mark the member work point at each end of columns in the shop with a center punch or other acceptable means. Place marking on the flanges and web at each end of columns. Define work point in accordance with AISC (MAN).

F. Finish work as specified and indicated on Drawings, true and free from twists, kinks, buckles, open joints, and other defects.

G. Perform necessary cutting, fitting, and drilling to accommodate other trades, and secure correct information from other trades before and after steel is delivered. Cutting or drilling will not be permitted on the site without approval of Architect.

H. Completely assemble and weld sub-assemblies with milled surfaces before welding.

I. Welding: Comply with AISC specifications and AWS standards. Provide 3/16 inch continuous fillet welds, but not less than AISC minimum based on thickness of parts joined for welds not specified.

J. Splices: Splicing of members to obtain the required lengths is not permitted without prior approval of Architect, unless specifically detailed on Drawings.

K. Substitutions: Where exact sizes and weights specified are not readily available, secure Architect's acceptance of suitable sizes in sufficient time to prevent delay due to substitutions.

2.03 FINISH

A. Prepare structural component surfaces in accordance with SSPC-SP 2.

B. Shop prime structural steel members unless otherwise indicated; do not prime surfaces that will be fireproofed, field welded, in contact with concrete, or high strength bolted.
   1. Immediately after surface preparation, apply primer paint at a rate to provide uniform dry film thickness of 1.0 mils.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that conditions are appropriate for erection of structural steel and that the work may properly proceed.

3.02 ERECTION

A. Erect structural steel in compliance with applicable AISC S303 requirements.

B. Align the various members forming a complete frame or structure after assembly and adjust accurately before fastening.

C. Measure and adjust for distortion and shrinkage of field welded assemblies as erection proceeds.

D. Allow for erection loads and provide sufficient temporary bracing to maintain structure in safe condition, plumb, and in true alignment until completion of erection and installation of permanent bracing.

E. Clean bearing surfaces for base plates and roughen to improve bond. Clean bottom surface of base plates.

F. Set base, bearing plates, and leveling plates level and at correct elevations. Temporarily support on steel wedges or shims until supported members are plumbed and grouting is completed. Tighten anchor bolts after supported members have been positioned and plumbed. Cut protruding bearing pads or shims back flush with edge of base plates prior to grouting.

G. Field weld components indicated on Drawings.

H. Use carbon steel bolts only for temporary bracing during construction, unless otherwise specifically permitted on Drawings. Install high-strength bolts in accordance with AISC S348.

I. Provide bolts of sufficient length to allow at least two full threads beyond nut after tightening.

J. Provide bearing-type connections, with threads excluded from shear planes, unless otherwise shown or indicated.

K. Provide slip critical type connections where shown on Drawings, complying with AISC S348.

L. Install lock nuts on slip connections and nick threads or tack weld nuts.

M. Where bolts will be exposed-to-view, space at regular intervals, in uniform patterns.

N. High-Strength Bolts: Install high-strength bolts using types and grades as specified for type of bolt and type of joint indicated on Drawings.
   1. Joint Types: Provide snug tightened, pretensioned, and slip critical joints.

O. Do not field cut or alter structural members without approval of Architect.

P. After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete.

3.03 TOLERANCES

A. Comply with requirements of Chapter 10 of AISC S303. Measure conformance at mean operating temperature of 70 degrees F. Compensate for difference in temperature at time of erection.

3.04 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 01 4000 - Quality Requirements.

B. Inspect in accordance with AISC (MAN).

C. Field Inspection: Assure that the work conforms to specified requirements, and include:
   1. Inspection of field welding.
   2. Verification of proper fit and alignment.
   3. Verification that Contractor's erection procedures adequately correct for distortion and shrinkage in field welded assemblies and connections. Measure weld shrinkage at all groove welded column splices. Submit reports of measurements to the Architect within two days of completion of welding.

D. Welding Inspection: Assure that the work conforms to specified requirements, and include:
   1. Verification that electrodes used for manual shielded metal-arc welding and the electrodes and flux used for submerged arc welding conform to specified requirements.
   2. Verification that the approved welding procedure and the approved welding sequence are followed without deviation, unless specific approval for change is obtained from the Architect.
   3. Visual inspection on 100 percent of fillet welds.

3.05 CLEANING

A. Clean erected structural steel members of field-applied markings, soil, and mud in accordance with Section 01 7000.

END OF SECTION

SECTION 05 5000

METAL FABRICATIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Shop fabricated steel items.
   1. Bollards.
   2. Ledge angles at brick masonry veneer.
   3. Rooftop unit steel frame support assemblies.
   4. Wall supports.
   5. Firestopping sleeves.

1.02 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.

B. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

C. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates.

D. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.

E. ASTM C230/C230M - Flow Table for Use in Tests of Hydraulic Cement.

F. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).

G. AWS D1.1/D1.1M - Structural Welding Code - Steel.

H. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer.

I. SSPC-SP 2 - Hand Tool Cleaning.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.
   1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.

1.04 QUALITY ASSURANCE

A. Fabricator Qualifications:
   1. A company specializing in manufacturing products specified in this Section, with not less than ten years of documented experience.

PART 2 PRODUCTS

2.01 MATERIALS - STEEL

A. Steel Sections: ASTM A36/A36M.

B. Steel Tubing: ASTM A501/A501M hot-formed structural tubing.

C. Plates: ASTM A283/A283M.

D. Pipe: ASTM A53/A53M, Grade B Schedule 40, black finish.

E. Mechanical Fasteners: Same material as or compatible with materials being fastened; type consistent with design and specified quality level.

F. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

G. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

2.02 FABRICATION

A. Fit and shop assemble items in largest practical sections, for delivery to site.

B. Fabricate items with joints tightly fitted and secured.

C. Continuously seal joined members by continuous welds.

D. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

E. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.

F. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.03 FABRICATED ITEMS

A. Provide and install items shown on Drawings with anchorage and attachments necessary for installation.

B. The following is a list of principal items only. Refer to Drawing details for items not specifically scheduled:
1. Bollards: Steel pipe, concrete filled, crowned cap, as detailed; prime paint finish.
   a. Color: Paint Safety Yellow (RAL 1023) or as specified by Owner requirements.
2. Ledge Angles at Brick Masonry Veneer: As detailed; prime paint finish. Supply to applicable unit masonry Section for installation.
3. Rooftop Unit Steel Frame Support Assemblies: As detailed; prime paint finish.
4. Wall Supports: 3 by 3 inch square steel tube, as detailed, prime paint finish.
5. Firestopping Sleeves: Comply with requirements of Section 07 8400, and supply to that Section for installation; unfinished.

2.04 ACCESSORIES

A. Non-Shrink Grout: ASTM C1107/C1107M, Grade B; pre-mixed compound consisting of non-metallic aggregate, cement, and manufacturer's specified water reducing and plasticizing agents; non-staining, non-gas-forming, containing no chlorides; plastic consistency as measured according to ASTM C230/C230M; capable of developing minimum compressive strength of 10,000 psi in 28 days.

2.05 FINISHES - STEEL

A. General:
1. Prepare surfaces to be primed in accordance with SSPC-SP 2, or as recommended by finish coating manufacturer.
2. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

B. Prime paint all steel items, unless otherwise specified.
1. Exceptions: Do not prime surfaces in direct contact with concrete, where field welding is required, and items to be covered with sprayed fireproofing.
2. Prime Painting: One coat.

2.06 FABRICATION TOLERANCES

A. Squareness: 1/8 inch maximum difference in diagonal measurements.

B. Maximum Offset Between Faces: 1/16 inch.

C. Maximum Misalignment of Adjacent Members: 1/16 inch.

D. Maximum Bow: 1/8 inch in 48 inches.

E. Maximum Deviation From Plane: 1/16 inch in 48 inches.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION

A. Clean and strip primed steel items to bare metal where site welding is required.

B. Supply setting templates to the appropriate entities for steel items required to be cast into concrete or embedded in masonry.

3.03 INSTALLATION

A. Install items plumb and level, accurately fitted, free from distortion or defects.

B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

C. Field weld components indicated on Drawings.

D. Perform field welding in accordance with AWS D1.1/D1.1M.

E. Obtain approval prior to site cutting or making adjustments not scheduled.

F. After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete.

3.04 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch.

C. Maximum Out-of-Position: 1/4 inch.

END OF SECTION

SECTION 05 5200

METAL RAILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Free-standing railings at steps and ramps.

B. Structural design of railing systems and anchorage to supporting structure.

1.02 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design.

B. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

C. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.

D. ASTM E935 - Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings.

E. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination.

F. AWS D1.1/D1.1M - Structural Welding Code - Steel.

G. NOMMA - National Ornamental & Miscellaneous Metals Association; www.nomma.org.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate profiles, sizes, connection attachments, anchorage, size and type of fasteners, and accessories.
   1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.

1.04 QUALITY ASSURANCE

A. Structural Designer Qualifications: Professional Structural Engineer experienced in design of this work and licensed in Colorado, or personnel under direct supervision of such an engineer.

B. Fabricator Qualifications:
   1. A company specializing in manufacturing products specified in this section, with not less than ten years of documented experience.

PART 2 PRODUCTS

2.01 RAILINGS - GENERAL REQUIREMENTS

A. Design, fabricate, and test railing assemblies in accordance with the most stringent requirements of applicable local code.
   1. Distributed Loads: Design railing assembly, wall rails, and attachments to resist distributed force of 50 pounds per linear foot applied to the top of the assembly and in any direction, without damage or permanent set.
   2. Concentrated Loads: Design railing assembly, wall rails, and attachments to resist a concentrated force of 200 pounds applied at any point on the top of the assembly and in any direction, without damage or permanent set.

B. Allow for expansion and contraction of members and building movement without damage to connections or members.

C. Dimensions: See Drawings for configurations and heights.

D. Provide anchors and other components as required to attach to structure, made of same materials as railing components unless otherwise indicated; where exposed fasteners are unavoidable provide flush countersunk fasteners.

E. Provide welding fittings to join lengths, seal open ends, and conceal exposed mounting bolts and nuts, including but not limited to elbows, T-shapes, splice connectors, flanges, escutcheons, and wall brackets.

F. Welded Joints: Make visible joints butt tight, flush, and hairline; use methods that avoid discoloration and damage of finish; grind smooth, polish, and restore to required finish.
   1. Ease exposed edges to a small uniform radius.
   2. Welded Joints:
      a. Carbon Steel: Perform welding in accordance with AWS D1.1/D1.1M.

2.02 STEEL RAILING SYSTEM

A. Steel Tube: ASTM A500/A500M, Grade B cold-formed structural tubing.

B. Steel Pipe: ASTM A53/A53M, Grade B Schedule 40, black finish.

C. Welding Fittings: Factory- or shop-welded from matching pipe or tube; seams continuously welded; joints and seams ground smooth.

2.03 FABRICATION

A. Accurately form components to suit specific project conditions and for proper connection to building structure.

B. Fit and shop assemble components in largest practical sizes for delivery to site.

C. Fabricate components with joints tightly fitted and secured. Provide spigots and sleeves to accommodate site assembly and installation.

D. Welded Joints:
   1. Exterior Components: Continuously seal joined pieces by intermittent welds and plastic filler. Drill condensate drainage holes at bottom of members at locations that will not encourage water intrusion.
   2. Interior Components: Continuously seal joined pieces by intermittent welds and plastic filler.
   3. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.
      a. Comply with NOMMA voluntary guidelines for joint finishes; Finish #2 - completely sanded joint, some undercutting and pinholes acceptable.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION

A. Clean and strip primed steel items to bare metal where site welding is required.

B. Supply items required to be cast into concrete with setting templates, for installation as work of other sections.

C. Apply one coat of bituminous paint to concealed aluminum surfaces that will be in contact with cementitious or dissimilar materials.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install components plumb and level, accurately fitted, free from distortion or defects, with tight joints.

C. Install railings in compliance with ADA Standards for accessible design at applicable locations.

D. Anchor railings securely to structure.

3.04 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per floor level, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch.

C. Maximum Out-of-Position: 1/4 inch.

END OF SECTION

SECTION 06 1053

MISCELLANEOUS ROUGH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Preservative treated wood materials.

B. Fire retardant treated wood materials.

C. Concealed wood blocking, nailers, and supports.

1.02 REFERENCE STANDARDS

A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

C. AWPA U1 - Use Category System: User Specification for Treated Wood.

D. PS 1 - Structural Plywood.

E. PS 20 - American Softwood Lumber Standard.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

1.04 DELIVERY, STORAGE, AND HANDLING

A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.

B. Fire Retardant Treated Wood: Prevent exposure to precipitation during shipping, storage, and installation.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
   1. Species: Douglas Fir-Larch or Hem-Fir.
   2. Grading Agency: Grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee (www.alsc.org) and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.

2.02 DIMENSION LUMBER FOR CONCEALED APPLICATIONS

A. Sizes: Nominal sizes as indicated on drawings, S4S.

B. Moisture Content: S-dry or MC19.

C. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
   1. Lumber: S4S, No. 2 or Standard Grade.
   2. Boards: Standard or No. 3.

2.03 CONSTRUCTION PANELS

A. Other Applications:
   1. Plywood Concealed From View But Located Within Exterior Enclosure: PS 1, C-C Plugged or better, Exterior grade.
   2. Plywood Exposed to View But Not Exposed to Weather: PS 1, A-D, or better.
   3. Other Locations: PS 1, C-D Plugged or better.

2.04 ACCESSORIES

A. Fasteners and Anchors:
   1. Metal and Finish: Hot-dipped galvanized steel complying with ASTM A153/A153M for high humidity and preservative-treated wood locations, unfinished steel elsewhere.
   2. Anchors: Toggle bolt type for anchorage to hollow masonry.

2.05 FACTORY WOOD TREATMENT

A. Treated Lumber and Plywood: Comply with requirements of AWPA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.
   1. Fire-Retardant Treated Wood: Mark each piece of wood with producer's stamp indicating compliance with specified requirements.
   2. Preservative-Treated Wood: Provide lumber and plywood marked or stamped by an ALSC-accredited testing agency, certifying level and type of treatment in accordance with AWPA standards.

B. Fire Retardant Treatment:
   1. Interior Type: AWPA U1, Use Category UCFA, Commodity Specification H, low temperature, low hygroscopic type, chemically treated and pressure impregnated; capable of providing a maximum flame spread index of 25 when tested in accordance with ASTM E84, with no evidence of significant combustion when test is extended for an additional 20 minutes.
      a. Kiln dry wood after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.
      b. Interior rough carpentry items are to be fire retardant treated.
      c. Treat rough carpentry items as indicated.
      d. Do not use treated wood in applications exposed to weather or where the wood may become wet.

C. Preservative Treatment:
   1. Preservative Pressure Treatment of Lumber Above Grade: AWPA U1, Use Category UC3B, Commodity Specification A using waterborne preservative to 0.10 lb/cu ft retention, minimum.
      a. Kiln dry lumber after treatment to maximum moisture content of 19 percent.
      b. Treat lumber in contact with roofing, flashing, or waterproofing.
      c. Treat lumber in contact with masonry or concrete.
      d. Treat lumber less than 18 inches above grade.
      e. Treat lumber in other locations as indicated.

PART 3 EXECUTION

3.01 INSTALLATION - GENERAL

A. Select material sizes to minimize waste.

B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.

C. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

3.02 BLOCKING, NAILERS, AND SUPPORTS

A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.

B. In metal stud walls, provide continuous blocking around door and window openings for anchorage of frames, securely attached to stud framing.

C. In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is explicitly indicated.

D. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.

E. Provide the following specific nonstructural framing and blocking:
   1. Cabinets and shelf supports.
   2. Handrails.
   3. Grab bars.
   4. Towel and bath accessories.
   5. Wall-mounted door stops.
   6. Wall mounted visual display units.
   7. Wall paneling and trim.
   8. Toilet partitions.
   9. Other items as indicated on Drawings.

3.03 ROOF-RELATED CARPENTRY

A. Coordinate installation of roofing carpentry with deck construction, framing of roof openings, and roofing assembly installation.

B. Provide wood curb at roof openings except where prefabricated curbs are specified and where specifically indicated otherwise. Form corners by alternating lapping side members.

3.04 SITE APPLIED WOOD TREATMENT

A. Apply preservative treatment compatible with factory applied treatment at site-sawn cuts, complying with manufacturer's instructions.

B. Allow preservative to dry prior to erecting members.

3.05 CLEANING

A. Waste Disposal:
   1. Comply with applicable regulations.
   2. Do not burn scrap on project site.
   3. Do not burn scraps that have been pressure treated.
   4. Do not send materials treated with pentachlorophenol, CCA, or ACA to co-generation facilities or “waste-to-energy” facilities.

B. Do not leave wood, shavings, sawdust, etc. on the ground or buried in fill.

C. Prevent sawdust and wood shavings from entering the storm drainage system.

END OF SECTION

SECTION 06 2000

FINISH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Interior finish carpentry items, including:
   1. Wood base, casings, and trim.
   2. Other items as specified in this Section and as indicated on Drawings.

1.02 REFERENCE STANDARDS

A. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials.

B. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards.

C. HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood.

D. NHLA G-101 - Rules for the Measurement & Inspection of Hardwood & Cypress.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.
   1. Scale of Drawings: 1-1/2 inch to 1 foot, minimum.
   2. Provide the information required by AWI/AWMAC/WI (AWS).

C. Samples: Submit two samples of each type of wood trim 12 inch long, illustrating profiles and completed finishes.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Store finish carpentry items under cover, elevated above grade, and in a dry, well-ventilated area not exposed to heat or sunlight.
   1. Store finish carpentry items in installation areas. If finish carpentry items must be stored in other than installation areas, store only where environmental conditions meet requirements specified for installation areas.
   2. Stack lumber and provide for adequate air circulation within and around stacks and under temporary coverings.
   3. Protect from moisture damage.

B. Handle materials and products to prevent damage to edges, ends, or surfaces.

1.05 ENVIRONMENTAL CONDITIONS

A. Comply with specified standard and as additionally specified.

B. Do not deliver finish carpentry items until environmental conditions meet specified requirements for installation areas.

C. Do not deliver or install finish carpentry items until building is enclosed and weatherproof, wet work in installation areas is complete and nominally dry, and building's environmental control systems are operating and will maintain temperature and relative humidity at designed occupancy levels throughout the remainder of the construction period.

PART 2 PRODUCTS

2.01 FINISH CARPENTRY ITEMS

A. Quality Standard - General: Premium Grade, in accordance with AWI/AWMAC/WI (AWS), unless otherwise specified for each carpentry item.

B. Interior Woodwork Items:
   1. Moldings, Bases, Casings, and Miscellaneous Trim: Hardwood lumber; prepare for stain and transparent finish.

2.02 LUMBER MATERIALS

A. Hardwood Lumber: Species as specified on Drawings, plain or quarter sawn, maximum moisture content of 6 percent according to ASTM D4442; with flat grain, of quality suitable for transparent finish.
   1. Grading: In accordance with NHLA G-101 Grading Rules; www.nhla.org.

2.03 SHEET MATERIALS

A. Hardwood Plywood: Face species as specified on Drawings, plain sawn, balance matched, veneer core; HPVA HP-1, Front Face Grade AA, Back Face Grade 1, glue type as recommended for application.

2.04 FASTENINGS

A. Fasteners: Of size and type to suit application; galvanized finish.

B. Concealed Joint Fasteners: Threaded steel.

2.05 ACCESSORIES

A. Lumber for Shimming and Blocking: Softwood lumber of fir or pine species.

B. Primer: Alkyd primer sealer.

C. Wood Filler: Latex base, tinted to match surface finish color.

2.06 FABRICATION

A. Shop assemble work for delivery to site, permitting passage through building openings.

B. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify adequacy of backing and support framing.

B. Verify mechanical, electrical, and building items affecting work of this Section are placed and ready to receive this work.

3.02 INSTALLATION

A. Install custom fabrications in accordance with AWI/AWMAC/WI (AWS) requirements for grade indicated.

B. Set and secure materials and components in place, plumb and level.

C. Carefully scribe work abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim to conceal larger gaps.

D. Install components with finish nails at maximum 8 inch on center.

E. Install finish carpentry items with minimum number of joints practical, using full length pieces from maximum lengths of lumber available. Do not use individual pieces less than 24 inches long, except where necessary.
   1. Stagger joints in adjacent and related standing and running trim.
   2. Cope at returns and miter at corners to produce tight-fitting joints with full surface contact throughout the length of joints.
   3. Plane back surfaces of casings as required to provide uniform thickness and flush finished surfaces across joints.

F. Install trim after finishing of substrate surfaces is complete.

G. Pre-drill pilot holes in hardwood carpentry items before fastening to prevent splitting. Securely fasten to prevent warping or movement.

3.03 PREPARATION FOR SITE FINISHING

A. Set exposed fasteners. Apply wood filler in exposed fastener indentations. Sand work smooth.

B. Site Finishing: See Section 09 9300.

3.04 TOLERANCES

A. Maximum Variation from True Position: 1/16 inch.

B. Maximum Offset from True Alignment with Abutting Materials: 1/32 inch.

3.05 PROTECTION

A. Protect installed finish carpentry items from damage due to subsequent construction operations.

END OF SECTION

SECTION 06 4100

ARCHITECTURAL WOOD CASEWORK

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Specially fabricated cabinet and casework units.

B. Hardware.

C. Factory finishing.

D. Preparation for installing utilities.

1.02 RELATED REQUIREMENTS

A. Section 12 3600 - Countertops.

1.03 REFERENCE STANDARDS

A. AAMA 612 - Voluntary Specification, Performance Requirements, and Test Procedures for Combined Coatings of Anodic Oxide and Transparent Organic Coatings on Architectural Aluminum.

B. BHMA A156.9 - American National Standard for Cabinet Hardware.

C. NEMA LD 3 - High-Pressure Decorative Laminates.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate fabrication schedule with construction progress to avoid delaying the Work.
   1. Field verify critical dimensions and clearances prior to fabrication of casework items; assure that field conditions are as required to comply with indicated design requirements.
   2. Verify accurate field measurements in installation areas before wall cavities are enclosed; verify locations of concealed framing, blocking, reinforcements, and furring that support woodwork; record measurements on shop drawings.
   3. Where field measurements cannot be made without delaying work, establish required dimensions and maintain those dimensions for fabrication of woodwork.
   4. Coordinate construction to ensure that actual dimensions correspond to established required dimensions.
   5. Coordinate cabinet spacing and clearances to ensure that doors and drawers do not conflict with each other.
   6. Coordinate cabinet opening and spacing requirements with approved appliances and plumbing fixtures.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.
   1. Scale of Drawings: 1-1/2 inch to 1 foot, minimum.
   2. Provide information as required by AWI/AWMAC/WI (AWS).
   3. Shop drawings are required to be generated as separate digital drawings specific to this Project, not utilizing Architect's digital drawing files in any manner; comply with other restrictions on use of Architect's digital drawing files specified in Section 01 3000.
   4. Show all adjacent construction including abutting walls, columns and similar elements affecting casework installation.

C. Product Data: Provide data for hardware accessories.

D. Samples: Submit actual samples of architectural cabinet face construction, minimum 12 inches square, illustrating proposed cabinet substrate and finish.

1.06 QUALITY ASSURANCE

A. Fabricator Qualifications: Company specializing in fabricating the products specified in this Section with minimum five years of documented experience.
   1. Single Source Responsibility: Provide and install this work from single fabricator.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver casework items to installation areas only after clean, well ventilated, and temperature-controlled installation areas are available. Do not deliver casework items to installation areas until painting and similar operations are complete in those areas.

B. Protect units from moisture and impact damage during transit, delivery, and storage; use protective covers during delivery, storage, and handling operations.

1.08 FIELD CONDITIONS

A. Do not deliver or install casework items until building is enclosed and weatherproof, and building's environmental control systems are operating and will maintain temperature and relative humidity at designed occupancy levels throughout the remainder of the construction period.

B. During and after installation of custom cabinets, maintain temperature and humidity conditions in building spaces at same levels planned for occupancy.

PART 2 PRODUCTS

2.01 WOOD CASEWORK AND CABINETS

A. Quality Standard - General: Grades as indicated or specified, in accordance with AWI/AWMAC/WI (AWS).
   1. Wood Veneer Faced Cabinets:
      a. Quality Standard: Premium Grade, unless noted otherwise.
   2. Plastic Laminate Faced Cabinets:
      a. Quality Standard: Custom Grade, unless noted otherwise.

2.02 LAMINATE MATERIALS

A. Thermally Fused Laminate (TFL): Melamine resin, NEMA LD 3, Type VGL laminate panels.

B. High Pressure Decorative Laminate (HPDL): NEMA LD 3, types as recommended for specific applications.

2.03 COUNTERTOPS

A. Countertops: See Section 12 3600.

2.04 ACCESSORIES

A. Adhesive: Type recommended by fabricator to suit application.
   1. General: Comply with volatile organic compound (VOC) content and emissions restrictions, and composite wood emissions standard requirements, specified in Section 01 6116 - VOC Content and Emissions Restrictions.

B. Decorative Trim Accessories: Aluminum extrusions; profiles and configurations as indicated on Drawings; depth as required for secure anchoring to sub-panel substrates before application of finish panels; integral mounting flanges.
   1. Include required intersection, mitered corner, and termination trim accessories.
   2. Natural Anodized Finish with Organic Seal: AAMA 612 Clear anodic coating with non-aqueous electro-deposited organic seal; not less 0.7 mils thick.
   3. Basis of Design Manufacturer:
      a. Gordon Interior Specialties, division of Gordon, Inc.: www.gordoninteriors.com.
      b. Substitutions: See Section 01 6000 - Product Requirements.

4. Other Acceptable Manufacturers:
    a. Fry Reglet Corp.: www.fryreglet.com.
    b. MM Systems Corporation: www.mmsystemscorp.com.
    c. Pittcon Industries: www.pittconindustries.com.
    d. Substitutions: See Section 01 6000 - Product Requirements.

C. Fasteners: Size and type to suit application.

D. Bolts, Nuts, Washers, Lags, Pins, and Screws: Of size and type to suit application; galvanized or chrome-plated finish in concealed locations and stainless steel or chrome-plated finish in exposed locations.

E. Concealed Joint Fasteners: Threaded steel.

2.05 HARDWARE

A. Hardware: BHMA A156.9, types as recommended by fabricator for quality grade specified, unless otherwise specified in this Section.

B. Drawer and Door Pulls: As specified on Drawings.

C. Cabinet Locks: Keyed cabinet-grade lock, two keys per lock, steel with satin finish.
1. Finish: Selected from manufacturer's standard line.

D. Drawer Slides:
1. Type: Full extension with overtravel.
2. Static Load Capacity: Commercial grade.
3. Mounting: Side mounted.
4. Stops: Integral type.
5. Finish: Selected from manufacturer's standard line.
6. Features: Provide self-closing/stay-closed/soft-close type.

E. Hinges: European style concealed, self-closing type, steel with satin finish.
1. Finish: Selected from manufacturer's standard line.
2. Features: Provide self-closing/stay-closed/soft-close type.

F. Door Bumpers: Drilled-in, clear, soft plastic.

2.06 FABRICATION

A. Assembly: Shop assemble cabinets for delivery to site in units easily handled and to permit passage through building openings.

B. Edging: Fit shelves, doors, and exposed edges with specified edging. Do not use more than one piece for any single length.

C. Fitting: When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide matching trim for scribing and site cutting.

D. Plastic Laminate: Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Locate counter butt joints minimum 2 feet from sink cut-outs.
1. Apply laminate backing sheet to reverse side of plastic laminate finished surfaces.
2. Apply thermally fused laminate to inside of cabinets on exposed and semi-exposed surfaces, and to shelving surfaces.

E. Matching Wood Grain: Comply with requirements of quality standard for specified Grade and as follows:
1. Provide balance matched panels at each elevation.
2. Provide sequence matching across each elevation.

F. Provide cutouts for plumbing fixtures. Verify locations of cutouts from on-site dimensions. Prime paint cut edges.

2.07 SHOP FINISHING

A. Sand work smooth and set exposed nails and screws.

B. Finish work in accordance with AWI/AWMAC/WI (AWS), Section 5 - Finishing for grade specified and as follows:
   1. Transparent:
      a. System - 12, Polyurethane, Water-based.
      b. Stain: As selected by Architect.
      c. Sheen: As specified on Drawings.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify adequacy of backing and support framing.

B. Verify location and sizes of utility rough-in associated with work of this Section.

C. Verify critical clearances and dimensions prior to installation of casework items.

3.02 INSTALLATION

A. Install work in accordance with AWI/AWMAC/WI (AWS) requirements for grade indicated.

B. Set and secure custom cabinets in place, assuring that they are rigid, plumb, and level.

C. Use fixture attachments in concealed locations for wall mounted components.

D. Use concealed joint fasteners to align and secure adjoining cabinet units.

E. Carefully scribe casework abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim for this purpose.

F. Secure cabinets to floor using appropriate angles and anchorages.

G. Secure full height cabinets, shelving units, and similar casework items exceeding 60 inches in height to floor using appropriate angles and anchorages.

3.03 ADJUSTING

A. Adjust moving or operating parts to function smoothly and correctly.

3.04 CLEANING

A. Clean casework, counters, shelves, hardware, fittings, and fixtures.

3.05 PROTECTION

A. Protect installed casework items from damage due to subsequent construction operations.

END OF SECTION

SECTION 06 6420

DECORATIVE ARCHITECTURAL PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fabricated architectural panels.

B. Mounting and fastening systems.

1.02 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data:
   1. Provide data on panel specified panel products.
   2. Provide data and installation instructions for attachment hardware, finish hardware, and suspension system.

C. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.
   1. Minimum Scale of Detail Drawings: 1-1/2 inch to 1 foot.

D. Samples: Submit two samples of each specified panel product, 12 x 12 inch in size illustrating panel features and colors.

1.04 QUALITY ASSURANCE

A. Fabricator Qualifications: Company specializing in fabricating the products specified in this Section with minimum five years of documented experience.

B. Basis of Design: Specifications are based on panel types by specified basis of design manufacturer and product(s). Panel types manufactured by other acceptable manufacturers are permitted, subject to compliance with specified requirements; and provided that deviations in design, weight, and profile are minor, and do not detract substantially from the indicated design intent.
   1. Comply with requirements specified in Section 01 4000 and Section 01 6000.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect work from moisture and mechanical damage.

1.06 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design Manufacturer:
   1. Manufacturer and product as specified on Drawings.
   2. Substitutions: See Section 01 6000 - Product Requirements.

2.02 DECORATIVE ARCHITECTURAL PANELS

A. Resin Composite Decorative Panels:
   1. Proprietary type, with integral coloring, stain resistant to domestic chemicals and cleaners.
   2. Thickness: As specified on Drawings.

3. Sizes and Configurations: As indicated on Drawings.
4. Fire Resistance: ASTM E84; flame spread 35 maximum, smoke development index 15 maximum.

2.03 MOUNTINGS AND FASTENINGS

A. Mounting Hardware: Satin aluminum, multi-purpose mounting hardware system as specified on Drawings.

B. Fasteners: Of size and type to suit application; satin aluminum finish in exposed locations.

2.04 FABRICATION

A. Shop fabricate panels for delivery to site.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify adequacy of backing and support framing.

3.02 INSTALLATION

A. Set and secure materials and components in place, plumb and level.

B. Carefully scribe work abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim to conceal larger gaps.

C. Install stand-off hardware in accordance with manufacturer's instructions.

3.03 TOLERANCES

A. Maximum Variation from True Position: 1/16 inch.

B. Maximum Offset from True Alignment with Abutting Materials: 1/32 inch.

END OF SECTION

SECTION 07 0150.31

TPO MEMBRANE ROOFING REPAIR

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Repair of existing thermoplastic roofing membrane.

B. Insulation, flat and tapered.

C. Deck sheathing.

D. Cover boards.

E. Flashings.

1.02 REFERENCE STANDARDS

A. ANSI/SPRI/FM 4435/ES-1 - Test Standard for Edge Systems Used with Low Slope Roofing Systems.

B. ASCE 7 - Minimum Design Loads for Buildings and Other Structures.

C. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.

D. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.

E. ASTM D6878/D6878M - Standard Specification for Thermoplastic Polyolefin Based Sheet Roofing.

F. ASTM E108 - Standard Test Methods for Fire Tests of Roof Coverings.

G. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.

H. ASTM G153 - Standard Practice for Operating Enclosed Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials.

I. FM (AG) - FM Approval Guide.

J. FM 4450 - Class I Insulated Steel Roof Decks.

K. FM 4474 - American National Standard for Evaluating the Simulated Wind Uplift Resistance of Roof Assemblies Using Static Positive and/or Negative Differential Pressures; 2004.

L. FM 4470 - Approval Standard for Single-Ply, Polymer-Modified Bitumen Sheet, Built-Up Roof (BUR) and Liquid Applied Roof Assemblies for use in Class 1 and Noncombustible Roof Deck Construction.

M. FM 4880 - Approval Standard for Class 1 Fire Rating of Building Panels or Interior Finish Materials.

N. FM DS 1-28 - Wind Design.

O. NRCA (RM) - The NRCA Roofing Manual.

P. UL 1256 - Fire Test of Roof Deck Constructions.

Q. UL 1897 - Uplift Tests for Roof-Covering Systems; Underwriters Laboratories Inc.

R. UL 580 - Standard for Tests for Uplift Resistance of Roof Assemblies.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate with installation of associated counterflashings and roof drainage components installed under other Sections as the work of this Section proceeds.

B. Preinstallation Meeting: Convene one week before starting work of this Section.
   1. Convene under general provisions of Section 01 7000.
   2. Notify Owner, who may request attendance by an independent roofing consultant.

3. Require attendance of parties directly concerned with the work of this Section, including those who are required to coordinate with the work, and those who are required to protect the work upon completion. Include the manufacturer's technical representative.
4. Review preparation and installation procedures and coordinating and scheduling required with related work.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data indicating membrane materials, flashing materials, insulation, and fasteners.

C. Shop Drawings: Submit drawings that indicate joint or termination detail conditions, conditions of interface with other materials, setting plan for tapered insulation, and mechanical fastener layout.
1. Shop drawings are required to represent project-specific conditions, and prepared specifically for this project; shop drawings will not be accepted for review if drawings only include manufacturer's "standard" details.
2. Clearly indicate corner and perimeter wind zones as defined by ASCE 7 and FM (AG), and associated roofing components required to comply with specified wind-resistance requirements.

D. Manufacturer's Field Reports: Indicate procedures followed, ambient temperatures, humidity, wind velocity during application, and supplementary instructions given.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Obtain roofing materials including sheets, adhesives, system accessories, and flexible flashings from a single manufacturer who publishes complete information on the specified system, and which has produced the specified system successfully for a minimum of five years. Provide materials and accessories not manufactured by the membrane manufacturer from sources acceptable to the membrane manufacturer, complying with warranty provisions.

B. Installer Qualifications: Company specializing in performing the work of this Section with at least three years of documented experience and approved by manufacturer.
1. Provide current manufacturer's written certification of proposed installer before start of roofing work.

C. Obtain periodic and final inspection of completed roofing installation by roofing manufacturer for acceptance and warrantability.

1.06 REGULATORY REQUIREMENTS

A. Conform to applicable Building Code requirements for roof insulation in conjunction with roof assembly classifications.

B. Provide insulation materials which are identical to those whose fire performance characteristics have been determined by UL or other testing agency acceptable to jurisdictional authorities.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's original containers, dry and undamaged, with seals and labels intact.

B. Store materials in weather protected environment, clear of ground and moisture.

C. Ensure storage and staging of materials does not exceed static and dynamic load-bearing capacities of roof decking.

D. Protect foam insulation from direct exposure to sunlight.

1.08 FIELD CONDITIONS

A. Do not apply roofing membrane during unsuitable weather.

B. Do not apply roofing membrane when ambient temperature is below 40 degrees F or above 100 degrees F.

C. Do not apply roofing membrane to damp or frozen deck surface or when precipitation is expected or occurring.

D. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed the same day.

E. Schedule applications so that no partially completed sections of roof are left exposed at end of workday.

1.09 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

B. System Warranty: Provide manufacturer's system warranty agreeing to repair or replace roofing that leaks or is damaged due to wind or other natural causes under conditions and remaining duranbtion of existing warranty.
   1. Include coverage of roofing system and insulation materials provided by membrane manufacturer, including installation, resulting from failure to resist penetration of moisture, and failure to comply with specified performance requirements.
   2. For repair and replacement include costs of both material and labor in warranty.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturer of Existing Roofing Membrane Materials:
   1. Carlisle Roofing Systems, Inc.: www.carlisle-syntec.com/#sle.
   2. Substitutions: See Section 01 6000 - Product Requirements.

2.02 ROOFING ASSEMBLIES

A. Thermoplastic Membrane Roofing: One ply membrane, fully adhered, over insulation.

B. Roofing Assembly Requirements:
   1. General: Provide installed roofing membrane and base flashing system that will remain watertight, will not permit the passage of water, and resist specified uplift pressures, thermally induced movement, and exposure to weather, without failure.
   2. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by roofing membrane manufacturer based on testing and field experience.
   3. Uplift Pressure Resistance: Provide installed insulation, roofing membrane, and base flashing system that will resist uplift pressures calculated according to ASCE 7 and applicable building code requirements, as demonstrated by manufacturer’s independent testing.
      a. Fully Adhered Roofing: Tested in accordance with FM 4474, UL 580, or UL 1897.
   4. Factory Mutual (FM) Listing: Provide membrane, base flashings, and component materials that comply with requirements in FM DS 1-28 and FM 4450 as part of a roofing system, and that are listed by FM for Class I or non-combustible construction, as applicable. Identify materials with FM markings.
      a. Windstorm Classification: Class I-90 minimum, or as otherwise required by local code.
      b. Hail Resistance: SH.
   5. Fire-Test Response Characteristics: Provide roofing materials with fire-resistance-response characteristics as determined by testing identical products by UL, FM, or other independent testing agency acceptable to jurisdictional authority, according to following test methods. Identify materials with applicable testing agency markings.
      a. ASTM E108, Class A; for application and slopes indicated.
      b. ASTM E119; fire-resistance-rated roof assemblies of which roofing materials are a part.
   6. Physical Properties: Demonstrate physical integrity over working life of roof based on 2,000 hours of exposure to accelerated weathering tests in accordance with ASTM G153.
   7. Impact Resistance: Comply with FM 4470; Section 5.5 "Resistance to Foot Traffic Test."
   8. Edge Securement: Tested in accordance with ANSI/SPRI/FM 4435/ES-1, RE-1, RE-2, and RE-3 as applicable to positive and negative design wind pressure as defined by applicable code.

2.03 MEMBRANE ROOFING AND ASSOCIATED MATERIALS

A. Membrane Roofing Materials:
   1. TPO: Thermoplastic polyolefin (TPO) complying with ASTM D6878/D6878M, sheet contains reinforcing fabrics or scrims.
      a. Thickness: 60 mil, 0.060 inch, minimum.
   2. Color: White.

B. Seaming Materials: As recommended by membrane manufacturer.

C. Flexible Flashing Material: Material recommended by membrane manufacturer.

2.04 DECK SHEATHING AND COVER BOARD

A. Deck Sheathing and Cover Board: Glass-mat faced gypsum panels complying with ASTM C1177/C1177M.
   1. Thickness: 1/2 inch, fire-resistant.

2.05 INSULATION

A. Polyisocyanurate (ISO) Board Insulation: Rigid cellular foam, complying with ASTM C1289; aged r-values in accordance with Long Term Thermal Resistance (LTTR) Method.
   1. Comply with UL 1256, and FM 4450, and FM 4880 as applicable.
   2. Type II; Class 2 - Faced with coated polymer-bonded glass fiber mat facers on both major surfaces of core foam.
      a. Compressive Strength: Grade 2 - 20 psi (138 kPa), minimum.
      b. Thermal Resistance, R-value: At 1-1/2 inches thick; Class 1, Grades 1-2-3, 8.4 (1.48), minimum, at 75 degrees F.
   3. Board Size: 48 by 48 inch, unless larger boards are permitted for specified attachment method.
   4. Total Primary Board Thickness: As indicated on Drawings.
   5. Board Edges: Square.
   6. Acceptable Product: Approved for use in specified roofing system by roofing system manufacturer.

B. Tapered Insulation System: Provide isocyanurate foam tapered units where indicated in conjunction with other non-tapered boards.
   1. Cricket Slope: 1/2 inch per foot.
   2. Sumps at Roof Drains: 1/2 inch per foot.
   3. All Other Areas: 1/4 inch per foot minimum.

2.06 ACCESSORIES

A. Stack Boots: Prefabricated flexible boot and collar for pipe stacks through membrane; same material as membrane.

B. Deck Sheathing Fasteners: Appropriate for purpose intended and approved by roofing manufacturer.
   1. Length as required for thickness of insulation material and penetration of deck substrate, with metal washers.

C. Membrane Adhesive: As recommended by membrane manufacturer.

D. Surface Conditioner for Adhesives: Compatible with membrane and adhesives.

E. Cleaners: As recommended by adhesive manufacturer, compatible with membrane.

F. Insulation Adhesive: As recommended by insulation manufacturer.
   1. Comply with volatile organic compound (VOC) content and emissions restrictions specified in Section 01 6116 - VOC Content and Emissions Restrictions.

G. Sealants: As recommended by membrane manufacturer.
   1. Comply with volatile organic compound (VOC) content and emissions restrictions specified in Section 01 6116 - VOC Content and Emissions Restrictions.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces and site conditions are ready to receive work.

B. Verify deck is supported and secure.

C. Verify deck is clean and smooth, flat, free of depressions, waves, or projections, properly sloped and suitable for installation of roof system.

D. Verify deck surfaces are dry and free of snow or ice.

E. Verify that roof openings, curbs, and penetrations through roof are solidly set, and cant strips are in place.

3.02 PREPARATION - METAL DECK

A. Install deck sheathing on metal deck:
   1. Lay with long side at right angle to flutes; stagger end joints; provide support at ends.
   2. Cut sheathing cleanly and accurately at roof breaks and protrusions to provide smooth surface.
   3. Tape joints.
   4. Mechanically fasten sheathing to roof deck, in accordance with roofing manufacturer's instructions and specified wind uplift requirements.
      a. Over applicable roof repair areas, fasten sheathing using minimum 8 fasteners with washers per sheathing board.

3.03 INSTALLATION, GENERAL

A. Perform work in accordance with manufacturer's instructions and NRCA (RM) applicable requirements.

B. Do not apply roofing membrane during cold or wet weather conditions.

C. Do not apply roofing membrane when ambient temperature is outside the temperature range recommended by manufacturer.

D. Do not apply roofing membrane to damp or frozen deck surface or when precipitation is expected or occurring.

E. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed the same day. Dry-in edges of exposed roofing system installations at the end of each work day. If damage occurs, remove all damaged materials completely and replace with new dry materials.

F. Remove and discard insulation and cover board materials that have been exposed to water or moisture.

3.04 INSTALLATION - VAPOR RETARDER AND INSULATION, UNDER MEMBRANE

A. Attachment of Insulation: Embed each layer of insulation and cover board in adhesive in full contact, in accordance with roofing and insulation manufacturers' instructions.

B. Lay subsequent layers of insulation with joints staggered minimum 6 inches from joints of preceding layer.

C. Place tapered insulation to the required slope pattern in accordance with manufacturer's instructions.
   1. Install tapered boards over primary flat insulation boards; maintain smooth transition at changes of slope.

D. On metal deck, place boards parallel to flutes with insulation board edges bearing on deck flutes.

E. Lay boards with edges in moderate contact without forcing. Cut insulation to fit neatly to perimeter blocking and around penetrations through roof.

F. Do not apply more insulation than can be covered and made watertight with membrane in same day.

3.05 INSTALLATION - MEMBRANE

A. Roll out membrane and allow to relax, free from wrinkles or tears, before adhering to substrates. Place sheet into place without stretching.

B. Shingle joints on sloped substrate in direction of drainage. Avoid "T" seams; patch "T" seams with 12 x 12 inch square membrane patch and completely seal as recommended by manufacturer.

C. Minimize seams in general, and wrinkles, fishmouths, and bubbles where possible.

D. Fully Adhered Application: Apply adhesive to substrate at rate recommended by manufacturer for specified performance requirements. Fully embed membrane in adhesive except in areas directly over or within 3 inches of expansion joints. Fully adhere one roll before proceeding to adjacent rolls.

E. Overlap edges and ends and seal seams by heat welding, minimum 3 inches. Seal permanently waterproof. Apply uniform bead of sealant to joint edge.

F. At intersections with vertical surfaces:
   1. Install membrane up parapet walls continuously, and extend over top of parapet walls, and turn down over cap nailer minimum 1 inch, as detailed on Drawings and as required by roofing manufacturer's requirements.
   2. Extend membrane up a minimum of 8 inches onto vertical surfaces.
   3. Fully adhere flexible flashing over membrane and up to nailing strips; minimum 8 inches vertically, unless roofing manufacturer's recommendations require greater dimension.

G. Around roof penetrations, seal flanges and flashings with flexible flashing.

3.06 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements for additional requirements.

B. Owner will provide testing services in accordance with Section 01 4000 - Quality Requirements. Contractor to provide temporary construction and materials for testing.

C. Require site attendance of roofing and insulation material manufacturers periodic during installation of the Work.

3.07 CLEANING

A. See Section 01 7000 - Execution and Closeout Requirements for additional requirements.

B. Remove bituminous markings from finished surfaces.

C. In areas where finished surfaces are soiled by work of this Section, consult manufacturer of surfaces for cleaning advice and comply with their documented instructions.

D. Repair or replace defaced or damaged finishes caused by work of this Section.

3.08 PROTECTION

A. Protect installed roofing and flashings from construction operations.

B. Where traffic must continue over finished roof membrane, protect surfaces using durable materials.

END OF SECTION

SECTION 07 6200

SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fabricated sheet metal items, including flashings and counterflashings.

B. Sealants for joints within sheet metal fabrications.

1.02 REFERENCE STANDARDS

A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

B. ASTM C920 - Standard Specification for Elastomeric Joint Sealants.

C. ASTM D4479/D4479M - Standard Specification for Asphalt Roof Coatings - Asbestos-Free.

D. SMACNA (ASMM) - Architectural Sheet Metal Manual.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate with roofing work for scheduling installation of counterflashing, rain drainage and similar items related to roofing.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.

1.05 QUALITY ASSURANCE

A. Perform work in accordance with SMACNA (ASMM) requirements and standard details, except as otherwise indicated.

B. Fabricator and Installer Qualifications: Company specializing in sheet metal work with three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.

B. Prevent contact with materials that could cause discoloration or staining.

PART 2 PRODUCTS

2.01 SHEET METAL FLASHING AND TRIM ASSEMBLIES

A. Flashing Assemblies:
   1. Capable of withstanding structural movement, thermally induced movement, and exposure to wind and weather without failure or permanent deformation.
   2. Physically protect roofing systems, roof accessories, and other building elements and systems from damage that would permit water leakage into building enclosure assemblies under all weather conditions.

2.02 SHEET MATERIALS

A. Galvanized Steel: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 24 gauge, 0.0239 inch thick base metal.
   1. Applications: Flashings and counterflashings at roofing locations, concealed from public view, and similar locations.

2.03 FABRICATION

A. Form sections true to shape, accurate in size, square, and free from distortion or defects.

B. Fabricate cleats and starter strips of same material as exposed sheet, one gage thickness heavier than exposed sheet, and interlockable with exposed sheet.
   1. Provide continuous cleat strips for metal copings and flashings.

C. Form pieces in longest possible lengths.

D. Hem exposed edges on underside 1/2 inch; miter and seam corners.

E. Fabricate corners from one piece with minimum 18 inch long legs; seam for rigidity, seal with sealant.

F. Fabricate vertical faces with bottom edge formed outward 1/4 inch and hemmed to form drip.

G. Fabricate flashings to allow toe to extend minimum 2 inches over roofing terminations. Return and brake edges.

H. Roof Equipment Supports: Cover raised bases and equipment supports with specified galvanized steel sheet. Fabricate with one inch riveted and soldered flat seams. Extend counterflashings over roof base flashings 4 inches minimum, and fold back bottom edge 1/2 inch. Where metal is penetrated for bolt or other fastener connections, use 4 lb sheet lead washers 2 inches larger than fastener hole.
   1. Comply with SMACNA (ASMM) Figure 8-11.

2.04 ACCESSORIES

A. Fasteners: Same material and finish as flashing metal, with soft neoprene washers.

B. Primer: Zinc chromate type.

C. Protective Backing Paint: Asphaltic mastic, ASTM D4479/D4497M, Type I.

D. Concealed Sealants: Non-curing butyl sealant; compatible with metals and roofing system membranes.

E. Exposed Sealants: ASTM C920; elastomeric sealant, with minimum movement capability as recommended by manufacturer for substrates to be sealed; color to match adjacent material.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.

B. Verify roofing termination and base flashings are in place, sealed, and secure.

C. Metal Wall Caps and Copings: Verify that wood grounds and nailing boards are secured to building framing sufficiently to resist specified pull-off resistance requirements.

3.02 PREPARATION

A. Install starter and edge strips, and cleats before starting installation.

B. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil.

3.03 INSTALLATION - GENERAL

A. Conform to Drawing details; if not detailed on Drawings, comply with standard details of the following:
   1. Steel Sheet Metal: SMACNA (ASMM).

B. Lapped Seams - General: Overlap seams 4 inches, and seal with two continuous beads of non-curing butyl sealant spaced 2 inches apart and located 1 inch from end of each metal sheet.

C. Secure flashings in place using concealed fasteners, and use exposed fasteners only where permitted.

D. Apply compatible sealant between metal flashings and roofing system flashings.

E. Isolate sheet metal from cementitious materials and dissimilar metals with underlayment or protective coating that is compatible with all other materials with which it will come in contact.

F. Fit flashings tight in place; make corners square, surfaces true and straight in planes, and lines accurate to profiles.

G. Seal metal joints watertight.

END OF SECTION

SECTION 07 8400

FIRESTOPPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Firestopping systems, materials, and accessories.

B. Firestopping at electrical junction boxes in fire-rated walls.

C. Firestopping of all penetrations and interruptions to fire rated assemblies, whether indicated on Drawings or not, and other openings indicated.

D. Contractor's responsibility for determining required scope of firestopping system work, and for determining applicable tested/listed systems for the entire project, and for securing jurisdictional authority approval of firestopping systems.

1.02 REFERENCE STANDARDS

A. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation.

B. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems.

C. ASTM E1399 - Standard Test Method for Cyclic Movement and Measuring the Minimum and Maximum Joint Widths of Architectural Joint Systems.

D. ASTM E2837 - Standard Test Method for Determining the Fire Resistance of Continuity Head-of-Wall Joint Systems Installed Between Rated Wall Assemblies and Nonrated Horizontal Assemblies.

E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

F. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.

G. IFC (GUIDE) - International Firestop Council Recommended Guidelines for Evaluating Firestop Systems Engineering Judgements.

H. ITS (DIR) - Directory of Listed Products.

I. FCIA - Firestop Contractors International Association Manual of Practice.

J. FM (AG) - FM Approval Guide.

K. UL 1479 - Standard for Fire Tests of Penetration Firestops.

L. UL 2079 - Standard for Tests for Fire Resistance of Building Joint Systems.

M. UL (DIR) - Online Certifications Directory.

N. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials.

O. UL 1479 - Standard for Fire Tests of Through-Penetration Firestops.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate installation of firestopping systems with affected trades and adjacent work.

B. Sequencing: Sequence work to permit firestopping materials to be installed after adjacent and surrounding work is complete.
   1. Do not cover or conceal firestopping installations until Owner's inspection agency and jurisdictional authority have inspected each installation.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Schedule of Firestopping: List each type of penetration, fire rating of the penetrated assembly, and firestopping test or design number.

C. Product Data: Provide data on product characteristics, performance ratings, and limitations.

D. Manufacturer's Installation Instructions: Indicate preparation and installation instructions.

E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

F. Jurisdictional Authority Submittal: After review and approval of specified submittals by Architect, submit to jurisdictional authority and local fire department complete product data indicating proposed product characteristics, performance characteristics, limitation criteria, and documentation of proposed firestop materials and systems for actual project conditions.
   1. Include manufacturer's complete installation instructions and UL Design or other approved testing agency data sheets for each proposed firestop system.
   2. Include complete test data forms or jurisdictional acceptance for proposed assemblies not conforming to specific UL Design numbers or other approved testing agency system designs.
   3. Submit certificate from authority having jurisdiction indicating approval of materials and systems to be used, with one complete copy, for information only, of the approved jurisdictional authority submittal.

G. Installer's qualification statement.

1.05 QUALITY ASSURANCE

A. Fire Testing: Provide firestopping assemblies of designs that provide the scheduled fire ratings when tested in accordance with methods indicated.
   1. Listing in UL (FRD), FM (AG), or ITS (DIR) will be considered as constituting an acceptable test report.
   2. Valid evaluation report published by ICC Evaluation Service, Inc. (ICC-ES) at www.icc-es.org will be considered as constituting an acceptable test report.
   3. Submission of actual test reports is required for assemblies for which none of the above substantiation exists.

B. Installer Qualifications: Company specializing in performing the work of this Section and:
   1. Trained by manufacturer.
   2. Approved by Factory Mutual Research Corporation under FM 4991, or meeting any two of the following requirements:
      a. Verification of minimum three years documented experience installing work of this type.
      b. Verification of at least five satisfactorily completed projects of comparable size and type.
      c. Licensed by local authorities having jurisdiction (AHJ).

C. Obtain firestop systems for each type and condition of penetration from a single manufacturer; intermixing of system components for each type and condition of penetration by different manufacturers is not permitted.

D. Listed and tested assemblies and systems must be utilized, if they exist, before alternative systems requiring Engineering Judgement (EJ) or Equivalent Fire Resistance Rated Assembly (EFRRA) will be considered. Comply with IFC (GUIDE) and FCIA for EJ and EFRRA design and submittal requirements.

1.06 DELIVERY, STORAGE, AND PROTECTION

A. Deliver materials in original unopened containers identified with manufacturer's brand designation and applicable UL label.

B. Do not use damaged or expired materials.

1.07 FIELD CONDITIONS

A. Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation; maintain minimum temperature before, during, and for three days after installation of materials.

B. Provide ventilation in areas where solvent-cured materials are being installed.

1.08 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Include agreement to repair or replace joint sealers which fail in joint adhesion, extrusion resistance, migration resistance, general durability, or apparent deterioration beyond manufacturer's printed limitations for stipulated warranty period from Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturers:
1. 3M Fire Protection Products: www.3m.com/firestop.
2. A/D Fire Protection Systems Inc.: www.adfire.com.
3. Everkem Diversified Products, Inc.: www.everkemproducts.com/#sle.
4. GCP Applied Technologies: www.gcpat.com.
5. Hilti, Inc.: www.us.hilti.com/#sle.
6. Nelson FireStop Products: www.nelsonfirestop.com.
7. Pecora Corporation: www.pecora.com.
8. RectorSeal: www.rectorseal.com.
9. Specified Technologies Inc.: www.stifirestop.com/#sle.
10. Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com/#sle.
11. USG: www.usg.com.
12. Substitutions: See Section 01 6000 - Product Requirements.

2.02 MATERIALS - GENERAL

A. Firestopping Materials: Any materials meeting requirements specified.
1. Comply with ASTM E814, UL 1479, and UL 2079 as applicable to achieve indicated fire ratings.
2. General: Comply with volatile organic compound (VOC) content and emissions restrictions specified in Section 01 6116 - VOC Content and Emissions Restrictions.

B. Mold and Mildew Resistance: Provide firestoppping materials with mold and mildew resistance rating of zero(0) in accordance with ASTM G21.

C. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Provide type of materials as required for tested firestopping assembly.

D. Fire Ratings: Refer to Drawings for required systems and ratings.

2.03 FIRESTOPPING ASSEMBLY REQUIREMENTS

A. General: Use firestopping systems which are acceptable for those applications for which they are specifically designed. Use of other UL listed systems is Contractor's Option, subject to compliance with specified performance, regulatory, and quality assurance requirements.
1. Where there is no specific tested and classified firestop system for an indicated condition, obtain from the firestopping system manufacturer an Engineering Judgement (EJ) or Equivalent Fire Resistance Rated Assembly (EFRRA) according to IFC (GUIDE) and FCIA.

B. Scope: Install firestopping at all locations requiring protected openings where piping, conduit, cables, sleeves, ductwork and similar items penetrate fire-resistive, fire-rated, and smoke assemblies, including but not limited to:
1. Penetrations through wall, floor, and roof assemblies, including empty openings and openings containing penetrations.
2. Membrane penetrations where items penetrate one side of the barrier assembly.
3. Joints, through-penetrations, and membrane penetrations in smoke-rated assemblies.

C. Head-of-Wall (HW) Joint System Firestopping at Joints Between Fire-Rated Wall Assemblies and Non-Rated Horizontal Assemblies: Use system that has been tested according to ASTM E2837 to have fire resistance F Rating equal to required fire rating of wall assembly.
1. Movement: Provide systems that have been tested to show movement capability as indicated.

D. Through Penetration Firestopping: Use system that has been tested according to ASTM E814 to have fire resistance F Rating equal to required fire rating of penetrated assembly.
   1. Temperature Rise: Provide systems that have been tested to show T Rating as indicated.
   2. Air Leakage: Provide systems that have been tested to show L Rating as indicated.
   3. Watertightness: Provide systems that have been tested to show W Rating as indicated.
   4. Listing by FM (AG), ITS (DIR), UL (DIR), or UL (FRD) in their certification directories will be considered evidence of successful testing.

E. Fire Rated Construction: Maintain barrier and structural floor fire resistance ratings including resistance to cold smoke at all penetrations, connections with other surfaces and types of construction, at separations required to permit building movement and sound or vibration absorption, and at other construction gaps.

F. Other General Characteristics:
   1. Surface Burning: ASTM E84 and UL 723; flame spread less than 25, smoke developed less than 450.
   2. Air Leakage of Perimeter Firestopping Barriers and Penetrations: UL 2079; L-rating less than 2.0 cfm/sf or 5.0 cfm/lf as applicable to the type and location of joint.
   3. Durability and Longevity: Permanent.
   4. Side Effects During Installation: Non-toxic.
   5. Side Effects Under Fire Exposure: Non-toxic.
   6. Long Term Side Effects: None.

2.04 MATERIALS

A. Putty Compound: 100 percent solids intumescent or vinyl-type formulation, free of asbestos, silicones, solvents, halogens, PCB's, and inorganic fibers; flame spread/smoke developed rating 0/0 when tested in accordance with ASTM E84; paintable, not sensitive to freezing after set.

B. Sealant Compound: One-part intumescent, endothermic, ablative, or elastomeric acrylic water-based calking material required by applicable UL Design; flame spread/smoke developed rating 0/0 when tested in accordance with ASTM E84.

C. Spray-Applied Compound: Water-based, flexible coating which drys to form a flexible seal; tested in accordance with ASTM E1399, complying with wind sway and thermal category, 500 cycles at minimum 10 cycles/minute.

D. Foam Compound: Two-part, liquid-silicone elastomer formulated to foam in place when mixed; flame spread/smoke developed rating 0/0 when tested in accordance with ASTM E84.

E. Plastic Pipe Device: Intumescent strip material, factory or site fabricated in flexible metal collar with adjustable, screw-tightened stainless steel clamp; UL classified for use with PVC, CPVC, CCPVC, CCABS, PVDF, PP, PB, and FRPP plastic pipe.

F. Fire-Safing Insulation: ASTM C612, Type I; high-melt mineral fibers and resinous binders formed into blankets, density not less than 4.0 lbs/cu ft, tested for 3-hour fire containment for required depths and dimensions.

G. Firestopping Pads: Intumescent, dielectric fire putty formed to 7 x 7 or 9.5 x 9.5 inch self-adhering pads, 2-hour fire rating listed by UL.

2.05 ACCESSORIES

A. Provide necessary accessory materials specified in UL Design to achieve complete firestop system at each penetration. Include collars, sleeves, attachment devices, intumescent materials, and other items required.

B. Primers, Sleeves, Forms, and Accessories: Type required for tested assembly design, and as recommended by firestopping manufacturer for specific substrate surfaces.

C. Dam Material: Mineral fiberboard, mineral fiber matting, sheet metal, alumina silicate fire board, or other permanent material required as part of the firestopping system, or removable if not specifically required as part of the firestopping system.

D. Retainers: Impale type clips to support mineral fiber safing blankets.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify openings are ready to receive the work of this Section.

3.02 PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other materials that could adversely affect bond of firestopping material.

B. Remove incompatible materials that could adversely affect bond.

C. Install backing or damming materials required to arrest liquid material leakage.

3.03 INSTALLATION - GENERAL

A. Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings.

B. Apply firestopping materials in sufficient thicknesses to achieve scheduled fire ratings, to uniform density and texture.

C. Install material at openings which contain penetrating sleeves, piping, ductwork, conduit and other items requiring firestopping.

D. Remove dam material after firestopping material has cured only if dam material is not required as part of the firestopping system; otherwise dam material to remain permanently in place.

E. Do not cover installed firestopping until inspected by authorities having jurisdiction.

F. Install labeling required by code.

3.04 INSTALLATION - FIRE SAFING INSULATION

A. Install safing insulation to completely fill spaces between floor slab edges and spandrel construction as detailed.

B. Install safing insulation to completely fill voids between floor and roof deck flutes and top of wall construction where wall ratings are indicated.

C. Install and support safing insulation permanently in position to comply with tested fire assembly and applicable building code requirements.

3.05 INSTALLATION - FIRESTOPPING PADS

A. Install firestopping pads on back side of electrical junction boxes in fire-rated walls where boxes are located in same stud space on opposite sides of same wall, and elsewhere required by jurisdictional authority and local fire department.

3.06 CLEANING

A. Clean adjacent surfaces of firestopping materials.

3.07 PROTECTION

A. Protect adjacent surfaces from damage by material installation.

END OF SECTION

SECTION 07 9200

JOINT SEALANTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Nonsag gunnable joint sealants.

B. Self-leveling gunnable and pourable joint sealants.

C. Joint backings and accessories.

1.02 DEFINITIONS

A. Nonsag Sealant: Permits application in joints on vertical surfaces without sagging or slumping.

B. Self-leveling Sealant: Pourable or self-leveling sealant that has sufficient flow to form a smooth, level surface when applied in a horizontal joint.

1.03 REFERENCE STANDARDS

A. ASTM C661 - Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer.

B. ASTM C834 - Standard Specification for Latex Sealants.

C. ASTM C920 - Standard Specification for Elastomeric Joint Sealants.

D. ASTM C1193 - Standard Guide for Use of Joint Sealants.

E. ASTM C1248 - Standard Test Method for Staining of Porous Substrate by Joint Sealants.

F. ASTM C1330 - Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants.

G. ASTM D2240 - Standard Test Method for Rubber Property--Durometer Hardness.

H. SWRI - Sealant, Waterproofing and Restoration Institute; Sealants: The Professionals' Guide.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate sealant work with other work requiring sealants, and with other Sections referencing this Section; do not obstruct indicated or required moisture weepage systems under any circumstances.
   2. Coordinate sealant surface preparation of exterior joint sealants scheduled for paint finish with Section 09 9113. Provide advice and recommendations on compatibility of specified preparation procedures with sealants used.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data for Sealants: Submit manufacturer's technical data sheets for each product to be used, that includes the following.
   1. Physical characteristics, including movement capability, VOC content, hardness, cure time, and color availability.
   2. List of backing materials approved for use with the specific product.
   3. Substrates that product is known to satisfactorily adhere to and with which it is compatible.
   4. Substrates the product should not be used on.
   5. Substrates for which use of primer is required.

C. Product Data for Accessory Products: Submit manufacturer's technical data sheet for each product to be used, including physical characteristics, installation instructions, and recommended tools.

D. Color Cards for Selection: Where sealant color is not specified, submit manufacturer's color cards showing standard colors available for selection.

1.06 QUALITY ASSURANCE

A. Conform to SWRI recommendations for materials and installation.

B. Installer Qualifications: Company specializing in performing the work of this Section with minimum three years documented experience.

C. System Compatibility: Assume responsibility for confirming that sealants are compatible with each other as a system, and also compatible with substrate surfaces with which they will be in contact, including but not limited to wall and sheathing surfaces, opening materials, other flashings and weather barrier materials.
   1. Assure that system components are compatible as specified prior to preparing and making specified submittals.
   2. Assume responsibility for removal of incompatible system components and installation of properly compatible components at no additional cost to Owner regardless of when incompatibility is discovered.

1.07 FIELD CONDITIONS

A. Maintain temperature and humidity recommended by the sealant manufacturer during and after installation.
   1. Install sealants only when temperature is in lower third of manufacturer's recommended installation temperature range wherever joint width is affected by ambient temperature variations.
   2. Install sealants only when ambient temperature conditions can be maintained at or above 40 degrees F during installation and 48 hours immediately following installation.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in original, unopened containers or bundles with labels indicating manufacturer, product name and designation, expiration period for use, pot life, curing time, and mixing instructions for multi-component materials.

1.09 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

B. Correct defective work within a five year period after Date of Substantial Completion.

C. Warranty: Include coverage of installed sealants and accessories which fail to achieve air tight and watertight seal, exhibit loss of adhesion, cohesion, abrasion resistance, weather resistance, extrusion resistance, migration resistance, stain resistance, general durability, or which appear to deteriorate in any other manner not clearly specified by submitted manufacturer's data as an inherent quality of the material for the exposure indicated.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturers:
   1. Adhesives Technology Corporation: www.atcepoxy.com.
   2. Bostik Inc.: www.bostik-us.com.
   3. Dayton Superior Corporation: www.daytonsuperior.com.
   4. Dow Corning Corporation: www.dowcorning.com.
   5. Hilti, Inc.: www.us.hilti.com.
   6. Master Builders Solutions: www.master-builders-solutions.com/en-us/#sle.
   7. Momentive Performance Materials, Inc. (formerly GE Silicones): www.momentive.com.
   8. Pecora Corporation: www.pecora.com.
   9. Sika Corporation: www.usa.sika.com/#sle.
   10. Tremco Global Sealants: www.tremcosealants.com.
   11. W.R. Meadows, Inc.: www.wrmeadows.com.
   12. Substitutions: See Section 01 6000 - Product Requirements.

2.02 JOINT SEALANT APPLICATIONS

A. Sealant Scope:
   1. Exterior Joints: Seal open joints, whether or not the joint is indicated on Drawings, unless specifically indicated not to be sealed. Exterior joints to be sealed include, but are not limited to, the following items.
      a. Wall expansion and control joints.
      b. Joints between door, window, and other frames and adjacent construction.
      c. Joints between different exposed materials.
      d. Openings below ledge angles in masonry.
      e. Other joints indicated below.
   2. Interior Joints: Do not seal interior joints unless specifically indicated to be sealed. Interior joints to be sealed include, but are not limited to, the following items.
      a. Joints between door, window, and other frames and adjacent construction.
      b. Other joints indicated below.
   3. Do not seal the following types of joints:
      a. Intentional weep holes in masonry, and weep systems in windows, storefronts, curtainwalls, and similar fenestration elements.
      b. Joints indicated to be treated with manufactured expansion joint cover or some other type of sealing device.
      c. Joints where sealant is specified to be provided by manufacturer of product to be sealed.
      d. Joints where installation of sealant is specified in another Section.
      e. Joints between suspended panel ceilings/grid and walls.

B. Exterior Joints: Use non-sag non-staining silicone sealant, unless otherwise indicated.

C. Interior Joints: Use non-sag polyurethane sealant, unless otherwise indicated.
   1. Wall and Ceiling Joints in Non-Wet Areas: Acrylic emulsion latex sealant.
   2. Wall and Ceiling Joints in Wet Areas: Non-sag polyurethane sealant for continuous liquid immersion.
   3. Joints between Fixtures in Wet Areas and Floors, Walls, and Ceilings: Mildew-resistant silicone sealant.

D. Definitions of Special Use Areas:
   1. Interior Wet Areas: Include restrooms and kitchens; fixtures in wet areas include plumbing fixtures, countertops, cabinets, and other similar items.

2.03 JOINT SEALANTS - GENERAL

A. General: Comply with volatile organic compound (VOC) content and emissions restrictions specified in Section 01 6116 - VOC Content and Emissions Restrictions.

B. Hardness: As recommended by manufacturer for applications shown.

C. Modulus of Elasticity: Provide lowest available modulus of elasticity for indicated requirements and consistent with exposure to weathering, indentation, abrasion and support of loading.

D. Compatibility: Provide sealants, joint fillers, and related materials that are compatible with one another and with substrates and other materials to which they will be exposed in the joint system.

E. Grade: For each application, provide grade of sealant complying with ASTM C920, and as recommended by manufacturer for indicated conditions, to achieve best possible performance. Types, grades, classes, and uses specified are for normal conditions.

F. Colors: As selected from manufacturer's full line, unless otherwise specified.

2.04 NONSAG JOINT SEALANTS

A. Non-Staining Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.
   1. Movement Capability: Plus and minus 50 percent, minimum.
   2. Non-Staining To Porous Stone: Non-staining to light-colored natural stone when tested in accordance with ASTM C1248.
   3. Dirt Pick-Up: Reduced dirt pick-up compared to other silicone sealants.

4. Hardness Range: 15 to 35, Shore A, when tested in accordance with ASTM C661 or ASTM D2240.
5. Cure Type: Single-component, neutral moisture curing.
6. Service Temperature Range: Minus 20 to 180 degrees F.

B. Mildew-Resistant Silicone Sealant: ASTM C920, Grade NS, Uses M and A; single component, mildew resistant; not expected to withstand continuous water immersion or traffic.
1. Color: White.

C. Polyurethane Sealant: ASTM C920, Grade NS, Uses M and A; single or multi-component; not expected to withstand continuous water immersion or traffic.
1. Movement Capability: Plus and minus 50 percent, minimum.

D. Polyurethane Sealant for Continuous Water Immersion: ASTM C920, Grade NS, Uses M and A; single or multicomponent; explicitly approved by manufacturer for continuous water immersion; suitable for traffic exposure when recessed below traffic surface.
1. Movement Capability: Plus and minus 35 percent, minimum.
2. Hardness Range: 20 to 35, Shore A, when tested in accordance with ASTM C661 or ASTM D2240.
3. Service Temperature Range: Minus 40 to 180 degrees F.

E. Acrylic Emulsion Latex: Water-based; ASTM C834, single component, non-staining, non-bleeding, non-sagging; not intended for exterior use.

2.05 ACCESSORIES

A. Backer Rod: Cylindrical cellular foam rod with surface that sealant will not adhere to, compatible with specific sealant used, and recommended by backing and sealant manufacturers for specific applications.
1. Applications Subject to Potential Moisture Intrusion (Exterior Applications): ASTM C1330; Type C - Closed Cell Polyethylene.
2. All Other Applications, and Joints Subject to Pedestrian or Vehicular Traffic: ASTM C1330; Type B - Bi-Cellular Polyethylene.
3. Closed Cell and Bi-Cellular Rod Size: 25 to 33 percent larger in diameter than joint width.

B. Backing Tape: Self-adhesive polyethylene tape with surface that sealant will not adhere to and recommended by tape and sealant manufacturers for specific application.

C. Masking Tape: Self-adhesive, nonabsorbent, non-staining, removable without adhesive residue, and compatible with surfaces adjacent to joints and sealants.

D. Joint Cleaner: Non-corrosive and non-staining type, type recommended by sealant manufacturer; compatible with joint forming materials.

E. Primers: Type recommended by sealant manufacturer to suit application; non-staining.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that joints are ready to receive work.

B. Verify that backing materials are compatible with sealants.

C. Verify that backer rods are of the correct size.

3.02 PREPARATION

A. Remove loose materials and foreign matter that could impair adhesion of sealant.

B. Clean joints, and prime as necessary, in accordance with manufacturer's instructions.

C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.

D. Mask elements and surfaces adjacent to joints from damage and disfigurement due to sealant work; be aware that sealant drips and smears may not be completely removable.

3.03 INSTALLATION

A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.

B. Perform installation in accordance with ASTM C1193.

C. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer, except where specific dimensions are indicated.
   1. Provide joints sized for width/depth ratios according to ASTM C1472.

D. Multiple backer rods are not permitted; use single backer rod properly sized to joint width.

E. Install bond breaker backing tape where backer rod cannot be used.

F. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.

G. Do not obstruct indicated or required moisture weepage systems under any circumstances.

H. Do not install sealant when ambient temperature is outside manufacturer's recommended temperature range, or will be outside that range during the entire curing period, unless manufacturer's approval is obtained and instructions are followed.

I. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.

3.04 POST-OCCUPANCY

A. Post-Occupancy Inspection: Perform visual inspection of entire length of project sealant joints at a time that joints have opened to their greatest width; i.e. at low temperature in thermal cycle. Report failures immediately and repair.

END OF SECTION

SECTION 08 1113

HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Thermally insulated hollow metal doors with frames.

1.02 DEFINITIONS

A. NAAMM/HMMA: National Association of Architectural Metal Manufacturers; Hollow Metal Manufacturers Association.

B. SDI: Steel Door Institute.

1.03 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design.

B. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors.

C. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100).

D. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.

E. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

F. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.

G. ASTM A1011/A1011M - Standard 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.

H. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

I. BHMA A156.115 - American National Standard for Hardware Preparation in Steel Doors and Steel Frames.

J. ICC A117.1 - Accessible and Usable Buildings and Facilities.

K. NAAMM HMMA 830 - Hardware Selection for Hollow Metal Doors and Frames.

L. NAAMM HMMA 831 - Hardware Locations for Hollow Metal Doors and Frames.

M. NAAMM HMMA 840 - Guide Specifications For Receipt, Storage and Installation of Hollow Metal Doors and Frames.

N. NAAMM HMMA 861 - Guide Specifications for Commercial Hollow Metal Doors and Frames.

O. SDI 117 - Manufacturing Tolerances for Standard Steel Doors and Frames.

P. UL 752 - Standard for Bullet-Resisting Equipment.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate with wall construction for anchor placement.
   2. Coordinate installation of hardware.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes.

C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and any indicated finish requirements.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Comply with NAAMM HMMA 840 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.

B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion and adverse effects on factory applied painted finish.

C. Inspect hollow metal products upon delivery for damage. Minor damage may be repaired provided refinishing is equal in all respects to new work and is acceptable to Architect; otherwise replace damaged items with new products as specified.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturers:
1. Any listed member of SDI or NAAMM/HMMA in good standing; www.steeldoor.org or www.naamm.org/hmma.
2. Substitutions: See Section 01 6000 - Product Requirements.

2.02 GENERAL DOOR AND FRAME REQUIREMENTS

A. Requirements for Hollow Metal Doors and Frames:
1. Steel Sheet: Comply with one or more of the following requirements; galvannealed steel complying with ASTM A653/A653M, cold-rolled steel complying with ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel complying with ASTM A1011/A1011M, commercial steel (CS) Type B, for each.
2. Accessibility: Comply with ICC A117.1 and ADA Standards.
3. Exterior Door Top Closures: Flush end closure channel, with top and door faces aligned.
4. Door Edge Profile: Manufacturers standard for application indicated.
5. Typical Door Face Sheets: Flush, unless otherwise indicated on Drawings.
6. Hardware Preparations, Selections and Locations: Comply with NAAMM HMMA 830 and NAAMM HMMA 831 or BHMA A156.115 and ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
    a. Prepare doors and frames for hardware in accordance with templates provided under Section 08 7100.

B. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with the specified requirements for each type; where two requirements conflict, comply with the most stringent.

2.03 HOLLOW METAL DOORS

A. Exterior Doors: Thermally insulated.
1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
    a. Level 3 - Extra Heavy-duty.
    b. Physical Performance Level A, 1,000,000 cycles; in accordance with ANSI/SDI A250.4.
    c. Model 1 - Full Flush.
    d. Door Face Metal Thickness: 16 gauge, 0.053 inch, minimum.

2. Door Core Material: Polyurethane, 1.8 lbs/cu ft minimum density.
    a. Foam Plastic Insulation: Manufacturer's standard board insulation with maximum flame spread index (FSI) of 75, and maximum smoke developed index (SDI) of 450 in accordance with ASTM E84, and completely enclosed within interior of door.
3. Door Thermal Resistance: R-Value of 8.7, minimum, for installed thickness of polyurethane.
4. Door Thickness: 1-3/4 inches, nominal.
5. Top Closures for Outswinging Doors: Flush with top of faces and edges.
6. Door Finish: Factory primed and field finished.

2.04 HOLLOW METAL FRAMES

A. Comply with standards and/or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.

B. Exterior Door Frames: Full profile/continuously welded type.
1. Galvanizing: Components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A653/A653M, with A60/ZF180 coating.
2. Frame Metal Thickness: 16 gauge, 0.053 inch, minimum.
3. Frame Finish: Factory primed and field finished.
4. Weatherstripping: Separate, see Section 08 7100.

2.05 FINISHES

A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.

2.06 ACCESSORIES

A. Silencers: Resilient rubber, fitted into drilled hole; provide three on strike side of single door, three on center mullion of pairs, and two on head of pairs without center mullions.

B. Temporary Frame Spreaders: Provide for factory- or shop-assembled frames.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

C. Verify that finished walls are in plane to ensure proper door alignment.

3.02 INSTALLATION

A. Install doors and frames in accordance with manufacturer's instructions, regulatory requirements, and related requirements of specified door and frame standards or custom guidelines indicated.

B. Install door hardware as specified in Section 08 7100.

3.03 TOLERANCES

A. Clearances Between Door and Frame: Comply with related requirements of specified frame standards or custom guidelines indicated in accordance with SDI 117 or NAAMM HMMA 861.

B. Maximum Diagonal Distortion (Warp): 1/8 inch measured with straight edge, corner to corner.

3.04 ADJUSTING

A. Adjust for smooth and balanced door movement.

3.05 SCHEDULE

A. Refer to Door and Frame Schedule on Drawings.

END OF SECTION

SECTION 08 1233

LIGHT GAUGE METAL FRAMES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Light gage metal door frame assemblies.

1.02 REFERENCE STANDARDS

A. ANSI/SDI A250.3 - Test Procedure and Acceptance Criteria for Factory Applied Finish Coatings for Steel Doors and Frames.

B. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100).

C. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.

D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

E. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.

F. ASTM A1011/A1011M - Standard 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.

G. BHMA A156.115 - American National Standard for Hardware Preparation in Steel Doors and Steel Frames.

H. NAAMM HMMA 830 - Hardware Selection for Hollow Metal Doors and Frames.

I. NAAMM HMMA 831 - Hardware Locations for Hollow Metal Doors and Frames.

J. NAAMM HMMA 840 - Guide Specifications For Receipt, Storage and Installation of Hollow Metal Doors and Frames.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the work with door opening construction, door frame and door hardware installation.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes; and one copy of referenced grade standard.

C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and identifying location of different finishes, if any.

D. Samples: Submit two samples of frame metal colors, 2 inch by 2 inch in size, showing factory finishes, colors, and surface textures, for selection.

E. Installer's Qualification Statement.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store in accordance with applicable requirements and in compliance with standards and/or custom guidelines as indicated.

B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturers - Light Gage Prefinished Frames:
   1. IDP - International Door Products Corp.: www.idpframes.com/#sle.
   2. Rediframe Products Division, Dunbarton Corporation: www.dunbarton.com.
   3. Timely Industries, Inc.: www.timelyframes.com/#sle.
   4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PERFORMANCE REQUIREMENTS

A. Refer to Door and Frame Schedule on Drawings for frame sizes, fire ratings, sound ratings, finishing, door hardware to be installed, and other variations, if any.

B. Door Frame Type: Provide hollow metal door frames with applied casings.

C. Steel Sheet: Comply with one or more of the following requirements; galvannealed steel complying with ASTM A653/A653M, cold-rolled steel complying with ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel complying with ASTM A1011/A1011M, commercial steel (CS) Type B, for each.
   1. Core Metal Thickness: Manufacturer's standard gage thickness for specified frame profile; 20 gage minimum, unless otherwise specified or scheduled.

D. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with the specified requirements for each type; for instance, an exterior frame that is also indicated as being sound-rated must comply with the requirements specified for exterior frames and for sound-rated frames; where two requirements conflict, comply with the most stringent.

E. Hardware Preparations, Selections and Locations: Comply with BHMA A156.115, NAAMM HMMA 830, NAAMM HMMA 831 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.

2.03 HOLLOW METAL DOOR FRAMES WITH APPLIED CASINGS

A. Frame Type: Knockdown, slip-on drywall frames; separate jambs and head with separate snap-on casings both sides; factory-applied finish on exposed surfaces.
   1. Frame Material: Cold-rolled steel complying with ASTM A1008/A1008M.
   2. Casing Material: Formed steel; same gage as door frame.
   3. Casing Profile: As indicated on Drawings.
   4. Finish: Factory-applied baked enamel finish, or electrostatically applied water-based paint.
      a. Color: As selected from manufacturer's full line.

2.04 FINISHES

A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.

B. Factory Finish: Complying with ANSI/SDI A250.3, manufacturer's standard coating.
   1. Color: To be selected by Architect from manufacturer's full range.

2.05 ACCESSORIES

A. Silencers: Resilient rubber or vinyl, fitted into drilled hole; provide three on strike side of single door, three on center mullion of pairs, and two on head of pairs without center mullions.

B. Temporary Frame Spreaders: Provide for factory- or shop-assembled frames.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

C. Verify that finished walls are in plane to ensure proper door alignment.

3.02 INSTALLATION

A. Install frames in accordance with manufacturer's instructions and related requirements of specified frame standards or custom guidelines indicated.

B. Install prefinished frames after painting and wall finishes are complete.

C. Coordinate frame anchor placement with wall construction.

D. Install door hardware as specified in Section 08 7100.

E. Touch up damaged factory finishes.

3.03 TOLERANCES

A. Maximum Diagonal Distortion: 1/16 inch measured with straight edges, crossed corner to corner.

3.04 SCHEDULE

A. Refer to Door and Frame Schedule on Drawings.

END OF SECTION

SECTION 08 1416

FLUSH WOOD DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Flush wood doors; flush and flush glazed configuration; fire-rated and non-rated.

1.02 REFERENCE STANDARDS

A. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards.

B. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, U.S. Version 3.1.

C. NFPA 80 - Standard for Fire Doors and Other Opening Protectives.

D. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies.

E. WDMA I.S. 1A - Interior Architectural Wood Flush Doors.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the work with door opening construction, door frame and door hardware installation.
   2. Coordinate installation of glazing.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Indicate door core materials and construction; veneer species, type and characteristics.

C. Shop Drawings: Show doors and frames, elevations, sizes, types, swings, undercuts, beveling, blocking for hardware, factory machining, factory finishing, cutouts for glazing and other details.

D. Samples: Submit accepted manufacturer’s stain color selector guide.
   1. After initial color selection, submit two samples 12 x 12 inch in size illustrating selected stain color, face veneers, and specified finishes.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing work of the type specified in this Section, with not less than three years of documented experience.

B. Obtain all doors of each type specified from a single manufacturer to assure uniformity of appearance and construction.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Package, deliver and store doors in accordance with specified quality standard.

B. Accept doors on site in manufacturer's packaging, and inspect for damage.

C. Protect doors with resilient packaging sealed with heat shrunk plastic; do not store in damp or wet areas or areas where sunlight might bleach veneer; seal top and bottom edges with tinted sealer if stored more than one week, and break seal on site to permit ventilation.

1.07 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

B. Interior Doors: Provide manufacturer's warranty for the life of the installation.

C. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturers:
   1. Algoma Hardwoods, Inc.: www.algomahardwoods.com.
   2. Haley Brothers: www.haleybros.com/#sle.
   3. Masonite Architectural: www.architectural.masonite.com/#sle.
   4. Oregon Door: www.oregondoor.com/sle.
   5. VT Industries, Inc.: www.vtindustries.com/#sle.
   6. Substitutions: See Section 01 6000 - Product Requirements.

2.02 DOORS

A. Doors: Refer to Drawings for locations and additional requirements.
   1. Quality Standard: Premium Grade, Heavy Duty performance, in accordance with AWI/AWMAC/WI (AWS), AWMAC/WI (NAAWS) or WDMA I.S. 1A.
   2. Wood Veneer Faced Doors: 5-ply unless otherwise indicated.

B. Interior Doors: 1-3/4 inches thick unless otherwise indicated; flush construction.
   1. Provide solid core doors at each location.
   2. Fire Rated Doors: Tested to ratings indicated on Drawings in accordance with UL 10C - Positive Pressure; Underwriters Laboratories Inc (UL) or Intertek/Warnock Hersey (WHI) labeled without any visible seals when door is closed.
   3. Provide following types at locations as scheduled on Drawings:
      a. Wood veneer facing with factory transparent finish.

2.03 DOOR AND PANEL CORES

A. General Requirement: Provide door cores fully bonded to stiles and rails.

B. Non-Rated Solid Core and 20 Minute Rated Doors: Type particleboard core (PC), plies and faces as indicated.
   1. Provide structural composite lumber core (SCLC) at doors with full lite glazing.

C. Fire-Rated Doors: Mineral core type, with fire resistant composite core (FD), plies and faces as indicated above; with core blocking as required to provide adequate anchorage of hardware without through-bolting.

2.04 DOOR FACINGS

A. Veneer Facing for Transparent Finish: Natural birch, veneer grade in accordance with quality standard indicated, plain sliced (flat cut), with slip match between leaves of veneer, balance match of spliced veneer leaves assembled on door or panel face.
   1. Vertical Edges: Same species as face veneer, solid wood edges, minimum 0.25 inch thick.
   2. "Pair Match" each pair of doors; "Set Match" pairs of doors within 10 feet of each other when doors are closed.

B. Facing Adhesive: Type I - waterproof.

2.05 DOOR CONSTRUCTION

A. Fabricate doors in accordance with door quality standard specified.

B. Cores constructed with stiles and rails:
   1. Provide solid blocks at lock edge and top of door for closer for hardware reinforcement.
      a. Provide solid blocking for other throughbolted hardware.
   2. Provide minimum 6 inch high solid wood top rail and minimum 16 inch high solid wood bottom rail, all doors; fire-resistant treated at fire-rated doors.

C. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.

D. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.

E. Provide edge clearances in accordance with the quality standard specified.

2.06 FACTORY FINISHING - WOOD VENEER DOORS

A. Finish work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 5 - Finishing for grade specified and as follows:
   1. Transparent:
      a. System - 11, Polyurethane, Catalyzed.
      b. Stain: As selected by Architect.
      c. Sheen: As selected by Architect.

B. Finish work in accordance with WDMA I.S. 1A for grade specified and as follows:
   1. Transparent:
      a. System - TR-6, Catalyzed Polyurethane.
      b. Stain: As selected by Architect.
      c. Sheen: As selected by Architect.

C. Factory finish doors in accordance with approved sample.

2.07 ACCESSORIES

A. Hollow Metal Door Frames: See Section 08 1113.

B. Glazing: See Section 08 8000.

C. Glazing Stops - Non-Rated Doors: Wood, of same species as door facing, butted corners; prepared for countersink style tamper proof screws.

D. Door Hardware: See Section 08 7100.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

C. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.

3.02 INSTALLATION

A. Install doors in accordance with manufacturer's instructions, regulatory requirements, and specified quality standard.
   1. Install fire-rated doors in accordance with NFPA 80 requirements.

B. Factory-Finished Doors: Do not field cut or trim; if fit or clearance is not correct, replace door.

C. Adjust width of non-rated doors by cutting equally on both jamb edges.
   1. Trim maximum of 3/4 inch off bottom edges.
   2. Trim fire-rated doors in strict compliance with fire rating limitations.

D. Use machine tools to cut or drill for hardware.

E. Install door louvers plumb and level.

3.03 TOLERANCES

A. Comply with specified quality standard for fit and clearance tolerances.

B. Comply with specified quality standard for telegraphing, warp, and squareness.

C. Maximum Undercut at Fire-Rated Doors: 3/4 inch clearance to non-combustible finish floor surface.

3.04 ADJUSTING

A. Adjust doors for smooth and balanced door movement.

B. Adjust closers for full closure.

C. Restore finish on all edges of shop finished doors before installation, if fitting or machining is required on site.

3.05 SCHEDULE

A. Refer to Door and Frame Schedule on the Drawings.

END OF SECTION

SECTION 08 3100

ACCESS DOORS AND PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wall and ceiling mounted access units.

1.02 REFERENCE STANDARDS

A. ITS (DIR) - Directory of Listed Products.

B. UL (FRD) - Fire Resistance Directory.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate installation with work of other trades, and obtain information on door sizes and exact locations from other trades.
   2. Coordinate placement of rough-in openings with Architect in tiled walls and gypsum board ceilings.
   3. Coordinate placement of access doors and panels with locations of toilet partitions and urinal screens so that doors or panels are not placed in conflict with partition or screen locations.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide sizes, types, finishes, hardware, scheduled locations, and details of adjoining work.

C. Manufacturer's Installation Instructions: Indicate installation requirements and rough-in dimensions.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturers:
   1. Activar Construction Products Group, Inc. - JL Industries: www.activarcpg.com/#sle.
   2. ACUDOR Products Inc.: www.acudor.com/#sle.
   3. Babcock-Davis: www.babcockdavis.com/sle.
   4. Best Access Doors: www.bestaccessdoors.com/#sle.
   5. Cendrex, Inc.: www.cendrex.com.
   6. Elmdor Stonemen: www.elmdorstoneman.com/#sle.
   7. FF Systems, Inc.: www.ffsystemsinc.com/#sle.
   8. Karp Associates, Inc.: www.karpinc.com.
   9. MIFAB, Inc.: www.mifab.com/#sle.
   10. Milcor by Commercial Products Group of Hart & Cooley, Inc.: www.milcorinc.com.
   11. Nystrom, Inc.: www.nystrom.com/sle.
   12. Studco Building Systems: www.studcosystems.com/#sle.
   13. Substitutions: See Section 01 6000 - Product Requirements.

2.02 ACCESS DOOR AND PANEL ASSEMBLIES

A. Wall-Mounted Units:
   1. Panel Material: Aluminum extrusions with gypsum board inlay.
   2. Size: 12 inch by 12 inch, unless otherwise indicated on Drawings.
   3. Door/Panel: Hinged, standard duty, with tool-operated spring or cam lock and no handle.
   4. Wall Mounting Criteria: Provide surface-mounted face frame and door surface flush with frame surface.
   5. Gypsum Board Mounting Criteria: Provide drywall bead frame with door surface flush with wall surface.

B. Walls in Wet Areas:
   1. Panel Material: Stainless steel, Type 304.
   2. Size: 12 inch by 12 inch, unless otherwise indicated on Drawings.
   3. Door/Panel: Hinged, standard duty, with tool-operated spring or cam lock and no handle.
   4. In All Wall Types: Surface mounted face frame and door surface flush with frame surface; gasketed door to frame all 4 sides.
   5. Gypsum Board Mounting Criteria: Provide drywall bead frame with door surface flush with wall surface.

C. Fire Rated Walls: See Drawings for wall fire ratings.
   1. Panel Material: Steel.
   2. Size: 12 inch by 12 inch, unless otherwise indicated on Drawings.
   3. Door/Panel: Insulated double-surface panel, with tool-operated spring or cam lock and no handle.

D. Ceilings, Unless Otherwise Indicated: Same type as for walls in corresponding functional locations.

2.03 WALL AND CEILING MOUNTED ACCESS UNITS

A. Wall and Ceiling Mounted Units: Factory fabricated door and frame, fully assembled units with corner joints welded, filled and ground flush; square and without rack or warp; coordinate requirements with type of installation assembly being used for each unit.
   1. Door Style: Single thickness with rolled or turned in edges.
   2. Frames: 16 gauge, 0.0598 inch, minimum thickness.
   3. Single Steel Sheet Door Panels: 1/16 inch, minimum thickness.
   4. Units in Fire-Rated Assemblies: Fire rating as required by applicable code for fire-rated assembly that access doors are being installed.
      a. Provide products listed by ITS (DIR) or UL (FRD) as suitable for purpose indicated.
   5. Steel Finish: Primed.
   6. Stainless Steel Finish: No. 4 brushed finish.
   7. Hardware:
      a. Hinge for Fire-Rated-Units: 175 degree steel hinges with non-removable pin.
      b. Hinges for Non-Fire-Rated Units: Concealed, constant force closure spring type.
      c. Latch/Lock: Tamperproof tool-operated cam latch.
      d. Number of Locks/Latches Required: As recommended by manufacturer for size of unit.
      e. Gasketing: Extruded neoprene, around perimeter of door panel.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that rough openings are correctly sized and located.

B. Begin installation only after substrates have been properly prepared, and if the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

C. Review access panel locations during wall framing rough-in to confirm location is coordinated with interior wall finishes.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to proceeding with this work.

B. Prepare surfaces using methods recommended by manufacturer for applicable substrates in accordance with project conditions.

3.03 INSTALLATION

A. Install units in accordance with manufacturer's instructions.

B. Install frames plumb and level in openings, and secure units rigidly in place.

C. Position units to provide convenient access to concealed equipment when necessary.

D. Adjust hardware and panels for proper operation.

E. Wet Locations: Seal frame to host wall all around; clear silicone sealant as specified in Section 07 9200.

END OF SECTION

SECTION 08 4313

ALUMINUM-FRAMED STOREFRONTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Aluminum-framed storefront framing system.

B. Aluminum doors and frames.
   1. Weatherstripping.

C. Design engineering of framing system and load-bearing connections to building structural frame system.

1.02 REFERENCE STANDARDS

A. AAMA CW-10 - Care and Handling of Architectural Aluminum From Shop to Site.

B. AAMA 609 & 610 - Cleaning and Maintenance Guide for Architecturally Finished Aluminum (Combined Document).

C. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum.

D. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections.

E. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

F. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

G. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate [Metric].

H. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

I. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes [Metric].

J. ASTM D4479/D4479M - Standard Specification for Asphalt Roof Coatings - Asbestos-Free.

K. ASTM E283/E283M - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.

L. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate attachment and seal of perimeter air and vapor barrier materials.
   2. Coordinate with installation of other components that comprise the exterior enclosure.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, door hardware, and internal drainage details.

C. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related work, expansion and contraction joint location and details, and field welding required.

D. Samples: Submit two samples 12 inches long illustrating finished aluminum surface.

E. Design Data: Provide framing member structural and physical characteristics, engineering calculations, and dimensional limitations.

1.05 QUALITY ASSURANCE

A. Designer Qualifications: Design structural support framing components under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed at Colorado.

B. Installer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience and approved by manufacturer.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Handle and store products of this Section in accordance with AAMA CW-10.

B. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.

1.07 FIELD CONDITIONS

A. Do not install sealants when ambient temperature is less than 40 degrees F. Maintain this minimum temperature during and 48 hours after installation.

1.08 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion.

C. Provide ten year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturers:
1. Arcadia, Inc.: www.arcadiainc.com/#sle.
2. Boyd Aluminum: www.boydaluminum.com/#sle.
3. EFCO Corporation: www.efcocorp.com.
4. Kawneer North America: www.kawneer.com/#sle.
5. Manko Window Systems, Inc.: www.mankowindows.com/#sle.
6. Oldcastle BuildingEnvelope: www.oldcastlebe.com/#sle.
7. Tubelite, Inc.: www.tubeliteinc.com/#sle.
8. Trulite Glass & Aluminum Solutions, LLC: www.trulite.com/#sle.
9. Substitutions: See Section 01 6000 - Product Requirements.

2.02 ALUMINUM-FRAMED STOREFRONT SYSTEM

A. Aluminum-Framed Storefront: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.
1. Glazing Rabbet: For 1 inch insulating glazing, unless otherwise indicated for interior applications.
2. Glazing Position: Centered (front to back).
3. Mullion Dimensions: 2 inches wide by 4-1/2 inches deep.
4. Finish: Class I color anodized.
5. Fabrication: Joints and corners flush, hairline, and weatherproof, accurately fitted and secured; prepared to receive anchors and hardware; fasteners and attachments concealed from view; reinforced as required for imposed loads.
    a. Fabricate individual system frame members, comp heads, sill pans, and other system components in single, continuous pieces; splices are not permitted unless specifically required by project installation conditions.
6. Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" in internal spaces.
7. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.

8. Expansion/Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F over a 12 hour period without causing detrimental effect to system components, anchorages, and other building elements.
9. Movement: Allow for movement between storefront and adjacent construction, without damage to components or deterioration of seals.
10. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.
11. Maintain continuous air barrier and/or vapor retarder seal throughout assembly, primarily in line with inside pane of glazing and inner sheet of infill panel, and heel bead of glazing compound.

2.03 PERFORMANCE REQUIREMENTS

A. Design Requirements: Design and size components to withstand the specified load requirements without damage or permanent set, when tested in accordance with ASTM E330/E330M, using loads 1.5 times the design wind loads and 10 second duration of maximum load.
1. Design Wind Loads: Comply with requirements of applicable code.
2. Member Deflection: Limit member deflection to L/175 of clear span, 3/4 inch total, or to flexure limit of glass in any direction, whichever is less, with full recovery of glazing materials.
3. Provide reinforced mullion sections as may be required to comply with specified design requirements, for manufacturer's specified system.

B. Water Penetration Resistance on Manufactured Assembly: No uncontrolled water on interior face, when tested in accordance with ASTM E331 at pressure differential of 10 psf.

C. Air Leakage: 0.06 cfm/sq ft maximum leakage of storefront wall area when tested in accordance with ASTM E283/E283M at 1.57 psf pressure difference.

D. Thermal Performance Requirements:
1. Condensation Resistance Factor of Framing: 60, minimum, measured in accordance with AAMA 1503.

2.04 COMPONENTS

A. Aluminum Framing Members: Tubular aluminum sections, thermally broken with interior section insulated from exterior, drainage holes and internal weep drainage system.
1. Framing members for interior applications need not be thermally broken.
2. Glazing Stops: Flush.

B. Glazing: See Section 08 8000.

C. Swing Doors: Glazed aluminum; nominal stile and rail dimensions as follows:
1. Thickness: 1-3/4 inches.
2. Top Rail: 3-1/2 inches wide.
3. Vertical Stiles: 3-1/2 inches wide.
4. Bottom Rail: 10 inches wide.
5. Glazing Stops: Square.
6. Finish: Same as storefront.
7. Design exterior doors for one inch insulating glass units and thermally broken.

D. Exterior Mullion Caps: Manufacturer's standard extrusions designed for installation on exterior mullions; sizes, shapes, and configrations as indicated on Drawings.

2.05 MATERIALS

A. Extruded Aluminum: ASTM B221 (ASTM B221M).

B. Sheet Aluminum: ASTM B209 (ASTM B209M); minimum thicknesses as follows:

C. Fasteners: Stainless steel.

D. Sill Pan Flashing Sealant: Elastomeric, silicone or polyurethane, compatible with flashing material.

E. Glazing Gaskets: As recommended by storefront manufacturer; type to suit application to achieve weather, moisture, and air infiltration requirements.
   1. Size gaskets as required by manufacturer of glazing channel frame to provide proper pressure and bite on glazing units.
   2. Coordinate with glazing requirements specified in Section 08 8000 - Glazing.

F. Glazing Accessories: See Section 08 8000.

2.06 ACCESSORIES

A. Reinforcement: Where fasteners screw-anchor into aluminum less than 1/8 inch thick, reinforce the interior with aluminum or non-magnetic stainless steel to receive screw threads, or provide standard non-corrosive, pressed-in splined grommet nuts.

B. Brackets: High-strength aluminum brackets and reinforcements where possible; otherwise provide non-magnetic stainless steel or galvanized steel complying with ASTM A123/A123M.

C. Sill Pans: Manufacturer's standard extruded profile, thermally broken, designed to direct moisture to the exterior at sill conditions; including splice sleeves and continuously sealed end dams.
   1. Provide with sill pan clips for installation without the use of penetrating fasteners.

D. Comp-Heads: Manufacturer's standard extruded profile, thermally broken, designed to accommodate minimum one inch deflection of building elements at head conditions.

E. Water Deflectors: Manufacturer's standard internal system accessory specifically designed to route internal water drainage away from top surfaces of insulated glass units.

F. Expansion Anchors: Stainless steel, drilled-in type expansion bolts for required attachment to concrete or masonry.

G. Protective Backing Paint: Asphaltic mastic, ASTM D4479/D4479M, Type I.

H. Internal System Sealants and Gaskets: As recommended by manufacturer for use within the framing system for fabrication, assembly, and installation. Use products which will remain permanently elastic, non-shrinking, and waterproof.

2.07 FINISHES

A. Class I Color Anodized Finish: AAMA 611 AA-M12C22A44 Electrolytically deposited colored anodic coating not less than 0.7 mils thick.

B. Touch-Up Materials: As recommended by coating manufacturer for field application.

2.08 HARDWARE

A. For each door, include weatherstripping and sill sweep strip.

B. Door Hardware: As specified in Section 08 7100, except as specified in this Section.

C. Weatherstripping: Wool pile, continuous and replaceable; provide on all doors.

D. Sill Sweep Strips: Resilient seal type, retracting, of neoprene; provide on all doors.

E. Reinforce components internally for door hardware and door operators.

F. Finishing: Apply factory finish to all surfaces that will be exposed in completed assemblies, including exposed fasteners.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify dimensions, tolerances, and method of attachment with other work.

B. Verify that storefront wall openings and adjoining water-resistive and/or air barrier seal materials are ready to receive work of this Section.

3.02 INSTALLATION

A. Install wall system in accordance with manufacturer's instructions.

B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.

C. Provide alignment attachments and shims to permanently fasten system to building structure.

D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.

E. Provide thermal isolation where components penetrate or disrupt building insulation.

F. Where fasteners penetrate sill flashings, make watertight by seating and sealing fastener heads to sill flashing.

G. Install sill pans with end dams; do not obstruct weep paths with sealants. Locate sill pan joints, if required, minimum 12 inches from centerline of vertical mullions. Seal to adjacent work to form water tight dam.

H. Install comp-head units where detailed; do not secure comp-heads to primary storefront head frames.

I. Install internal system sealants as installation progresses. Seal sill pan splices, end dams, water deflectors, and other components to ensure that proper water weepage paths are established and maintained within the system.

J. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

3.03 TOLERANCES

A. Maximum Variation from Plumb: 0.06 inch per 3 feet non-cumulative or 0.06 inch per 10 feet, whichever is less.

B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch.

C. Location: Limit variation from plane or dimensioned location to 1/8 inch in 12 feet, non-cumulative, and 1/2 inch in overall length of member.

3.04 ADJUSTING

A. Adjust operating hardware for smooth operation.

3.05 CLEANING

A. Remove protective material from pre-finished aluminum surfaces.

B. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths, and take care to remove dirt from corners and to wipe surfaces clean.

C. Upon completion of installation, thoroughly clean aluminum surfaces in accordance with AAMA 609 & 610.

3.06 PROTECTION

A. Protect installed products from damage until Date of Substantial Completion.

END OF SECTION

SECTION 08 4329

SLIDING DOOR ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Glazed aluminum sliding wall panel systems.

B. Support and operating hardware.

1.02 REFERENCE STANDARDS

A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide information on dimensions, frame and sill construction, glazing, and hardware.

C. Shop Drawings: Indicate opening dimensions, elevations of different types, and framed opening tolerances.

D. Samples: Submit two samples, 12 by 12 inch in size illustrating typical frame corner construction, accessories, and finishes.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in installation of products of type specified, with not less than three years of documented experience.

B. Basis of Design: Drawing details are based on door/wall systems by specified basis of design manufacturer. Door/wall systems by other acceptable manufacturers are permitted, subject to compliance with all specified performance characteristics, and provided that deviations in dimension, profile, and finish are minor, and do not detract from the indicated design intent.
   1. Comply with requirements specified in Section 01 4000 and Section 01 6000.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to project site and store in manufacturer's protective cartons until openings are ready for installation.

B. Protect finished surfaces with wrapping paper or strippable coating during installation. Do not use adhesive papers or sprayed coatings that bond to substrate when exposed to sunlight or weather.

1.06 FIELD CONDITIONS

A. Do not install sealants when ambient temperature is less than 40 degrees F.

B. Maintain this minimum temperature during and 24 hours after installation of sealants.

1.07 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion.

C. Provide five year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design Manufacturer:
   1. The Sliding Door Company; Flexible Track System Bypassing Room Divider: www.slidingdoorco.com.
   2. Substitutions: See Section 01 6000 - Product Requirements.

2.02 SLIDING AND FOLDING GLAZED DOORS AND WALLS

A. Glazed Aluminum Sliding Wall Panel Systems: Extruded aluminum sliding and fixed wall panel frames, factory fabricated; complete with sill, flashings, and support and anchorage devices.
   1. Stacking Configuration: As shown on Drawings.
   2. Support System: Floor mounted.
   3. Standard Sill: Flush type, with sealant, shims and fasteners at necessary locations.
      a. Finish: As selected by Architect from manufacturer's standard line.
   4. Aluminum Frames: Factory finished; manufacturer's standard corner construction.
   5. Glass Stops: Same material and color as frame.
   6. Aluminum Frame Finish: PVDF coating in accordance with AAMA 2605.
      a. Sheen: Standard gloss.
      b. Color: As selected from manufacturer's full range of colors.

B. Sliding Wall Panel Hardware: Manufacturer's standard hardware including carriages with sealed ball bearing rollers, and top or bottom tracks.
   1. Door Hardware: Back to back pull handle.
   2. Locking Mechanisms: Minimum two-point deadbolt locking of each panel; manufacturer's standard type.
   3. Additional Wall Panel Hardware: Include a key locking mechanism with a cutout in outside escutcheon to accommodate cylinder; see Section 08 7100.
   4. Exposed Hardware Finish: As selected from manufacturer's standard line.

2.03 FACTORY ASSEMBLY

A. Factory assemble sliding operable panel frames as single unit, including head, jambs, and bottom sections; provide concealed fasteners.
   1. Sizes: Allow for tolerances of rough framed openings, clearances, and shims at perimeter of assemblies.
   2. Joints and Corners: Flush, hairline, accurately fitted and secured; prepared to receive anchors; fasteners and attachments concealed from view; reinforced as required for imposed loads.
   3. Glazing: Field installed.

2.04 ACCESSORIES

A. Anchors: Hot-dipped galvanized or stainless steel in accordance with project and manufacturer's installation requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that openings are ready to receive work and opening dimensions and clearances are as indicated on Drawings.

3.02 PREPARATION

A. Prepare opening to permit correct installation of door unit in coordination with air and vapor seal.

3.03 INSTALLATION

A. Install assemblies in accordance with manufacturer's instructions.

B. Attach frame and shims to perimeter opening to accommodate construction tolerances and other irregularities.

C. Use anchorage devices to securely fasten assembly to adjacent construction without distortion or imposed stresses.

3.04 TOLERANCES

A. Maintain dimensional tolerances and alignment with adjacent work.

B. Maximum Variation from Plumb: 1/16 inch.

C. Maximum Variation from Level: 1/16 inch.

D. Longitudinal or Diagonal Warp: Plus or minus 1/8 inch from 10 feet straight edge.

3.05 ADJUSTING

A. Adjust hardware for smooth operation.

3.06 CLEANING

A. Remove protective material from factory finished surfaces.

B. Remove labels and visible markings.

C. Wash surfaces by method recommended and acceptable to sealant and window manufacturer; rinse and wipe surfaces clean.

D. Remove excess sealant by moderate use of mineral spirits or other solvent acceptable to sealant manufacturer.

3.07 PROTECTION

A. Protect installed products from damage until Date of Substantial Completion.

END OF SECTION

SECTION 08 6223

TUBULAR SKYLIGHTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Tubular skylights, consisting of skylight dome, reflective tube, and diffuser assembly.

1.02 REFERENCE STANDARDS

A. AAMA/WDMA/CSA 101/I.S.2/A440 - North American Fenestration Standard/Specification for windows, doors, and skylights.

B. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

C. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate [Metric].

D. ASTM D635 - Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position.

E. ASTM D1929 - Standard Test Method for Determining Ignition Temperature of Plastics.

F. ASTM D2843 - Standard Test Method for Density of Smoke from the Burning or Decomposition of Plastics.

G. ASTM E2112 - Standard Practice for Installation of Exterior Windows, Doors and Skylights.

H. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

I. ASTM E108 - Standard Test Methods for Fire Tests of Roof Coverings.

J. ASTM E283/E283M - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.

K. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.

L. UL (DIR) - Online Certifications Directory.

M. UL 790 - Standard for Standard Test Methods for Fire Tests of Roof Coverings.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.

C. Shop Drawings: Indicate configurations, dimensions, locations, fastening methods, and installation details.

D. Grade Substantiation: Prior to submitting shop drawings or starting fabrication, submit one of the following showing compliance with specified grade:
   1. Evidence of AAMA Certification.
   2. Evidence of WDMA Certification.
   3. Evidence of CSA Certification.
   4. Test report(s) by independent testing agency itemizing compliance and acceptable to authorities having jurisdiction.

E. Test Reports: Prior to submitting shop drawings or starting fabrication, submit test report(s) by independent testing agency showing compliance with performance requirements in excess of those prescribed by specified grade.

1.04 QUALITY ASSURANCE

A. Basis of Design: Specifications are based on skylight types by specified basis of design manufacturer and product(s). Skylight types manufactured by other acceptable manufacturers are permitted, subject to compliance with specified requirements; and provided that deviations in design, weight, performance, and profile are minor, and do not detract substantially from the indicated design intent.
   1. Comply with requirements specified in Section 01 4000 and Section 01 6000.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.06 FIELD CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.07 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Skylights: Manufacturer's standard warranty for 10 years.

C. Electrical Parts: Manufacturer's standard warranty for three years, unless otherwise indicated.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design Manufacturer:
   1. Solatube International, Inc.: www.solatube.com.
      a. Model: 330DS-C.
   2. Substitutions: See Section 01 6000 - Product Requirements.

B. Other Acceptable Manufacturers:
   1. DayLite, Natural Lighting Technologies: www.dayliteco.com.
   2. Kingspan Light + Air; Formerly Bristolite Daylighting Systems, Inc.: www.bristolite.com/sle.
   3. Tubular Skylight Inc.: www.tubular-skylight.com.
   4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 TUBULAR SKYLIGHTS

A. Tubular Skylights: Transparent roof-mounted skylight dome and curb, reflective tube, and ceiling level diffuser assembly, transferring sunlight to interior spaces.
   1. Fabrication and Assembly of Components: By single manufacturer.
   2. Non-Metal Parts: Flammability less than the following.
      a. Roof-Top Components: Class B when tested in accordance with ASTM E108 or UL 790.
      b. Self-Ignition Temperature: Greater than 650 degrees F, when tested in accordance with ASTM D1929.
      c. Smoke Developed Index: Maximum of 450, when tested in accordance with ASTM E84; or maximum rating of 75, when tested in accordance with ASTM D2843.
      d. Combustibility - Light Transmitting Parts: Burning extent of 1 inch or less (ICC Class CC-1), when tested in accordance with ASTM D635 in the thickness intended for use.
   3. Thermal Movement: Fabricate to allow for thermal movement resulting from temperature differential from minus 30 to 180 degrees F without damage to components, fasteners, or substrates.

B. Roof Assemblies: Transparent, UV and impact resistant dome with flashing base supporting dome and top of tube.
   1. Glazing: Polycarbonate plastic, 1/8 inch minimum thickness.
   2. Low-Angled Sun Reflector: Concentric, light refracting etched lines, minimum 2 inches high, to improve light input when sun is low on horizon.
   3. Base: One piece, seamless, leak-proof flashing functioning as base support for dome and top of tube; specified manufacturer's recommended base flashing units for use on flat commercial roof applications to meet required curb height requirements.
   4. Base Height: 12 inches.
   5. Dome Ring: Attached to top of base section; 0.090 inch nominal thickness injection molded high impact ABS; to prevent thermal bridging between base flashing and tubing and channel condensed moisture out of tubing; weather seal of medium density pile weather stripping.

C. Reflective Tube: ASTM B209 (ASTM B209M) aluminum sheet, thickness between 0.015 inch and 0.020 inch.
   1. Extension Tubes: Basis of design manufacturer's Spectralight Infinity Extension Tubes and Flashing Turret Extensions.
   2. Interior Finish: Exposed interior surfaces of high reflectance specular finish; specular reflectance of 92, total reflectance 95 percent.
   3. Tube Diameter: 21 inches.
   4. Tube Configuration and Length: As indicated on the Drawings.

D. Diffuser Assemblies: Supporting light transmitting surface at bottom termination of tube, with compression seal to minimize condensation and bug or dirt infiltration.
   1. Diffuser: Basis of design manufacturer's OptiView Diffuser.
   2. Diffuser Trim: Edge and attachment trim for diffuser lens; injection molded high impact ABS.
   3. Diffuser Shape at Solid Ceilings: Round, same diameter as tube.
   4. Diffuser Shape in Lay-In Ceiling Grid: Square, 24 by 24 inches, to fit grid; metal transition box.
   5. Lens: Flush frosted lens.
   6. Lens Material: Polycarbonate plastic.
   7. Lens Thickness: 0.038 inch, minimum.
   8. Visible Light Transmission (VLT): 90 percent, minimum.
   9. Seal: Closed cell EPDM foam rubber.

2.03 PERFORMANCE REQUIREMENTS

A. Grade: AAMA/WDMA/CSA 101/I.S.2/A440 requirements for specific tubular skylight:
   1. Product Type: Tubular Daylighting Device, Closed Ceiling (TDDCC).
   2. Performance Grade (PG): Equivalent to or greater than specified design pressure.

B. Design Pressure (DP): In accordance with applicable codes.

C. No permanent deflection in excess of 0.2 percent of span.

D. Air Leakage: 0.30 cfm/sq ft maximum leakage for tubular skylight unit when tested at 1.57 psf pressure difference in accordance with ASTM E283/E283M.

E. Water Resistance: No uncontrolled water leakage at 6.27 psf pressure differential with water rate of 5 gallons/h/sf, when tested in accordance with ASTM E331; design to ensure that water will not accumulate inside assembly.

2.04 ACCESSORIES

A. Fasteners: Same material as metals being fastened, non-magnetic steel, non-corrosive metal of type recommended by manufacturer, or injection molded nylon.

B. Sealant: Elastomeric, silicone or polyurethane; compatible with materials being sealed.

C. Lighting Fixtures: Bracket mounted inside skylight tube just above diffuser; UL (DIR) listed.
   1. Type: Compact fluorescent fixture, for 26 W lamps, 1 lamp per tube.
   2. Electrical Requirements: 110 V, 15 amp GFCI circuit.
   3. Contractor to furnish lamps.
   4. Options: Manufacturer's standard 0-10V daylight dimmer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

A. Install in accordance with manufacturer's written instructions.
   1. Comply with ASTM E2112 for installation of weather barrier materials in conjunction with installation of skylights.

B. Set roof assembly flashing in continuous bead of sealant.

C. Seal joints exposed to weather in accordance with sealant manufacturer's written instructions.

D. Conduct field test for water tightness; conduct water test in presence of Architect. Correct defective work and re-test until satisfactory.

3.04 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

SECTION 08 71 00

DOOR HARDWARE

PART 1 - GENERAL

1.1 SUMMARY:

A. Section Includes: Finish Hardware for door openings, except as otherwise specified herein.

1. Door hardware for steel (hollow metal) doors.
2. Door hardware for aluminum doors.
3. Door hardware for wood doors.
4. Door hardware for other doors indicated.
5. Keyed cylinders as indicated.

B. Related Sections:

1. Division 6: Rough Carpentry.
2. Division 8: Aluminum Doors and Frames
3. Division 8: Hollow Metal Doors and Frames.
4. Division 8: Wood Doors.
5. Division 26 Electrical
6. Division 28: Electronic Security

C. References: Comply with applicable requirements of the following standards. Where these standards conflict with other specific requirements, the most restrictive shall govern.

1. Builders Hardware Manufacturing Association (BHMA)
2. NFPA 101 Life Safety Code
3. NFPA 80 -Fire Doors and Windows
4. ANSI-A156.xx- Various Performance Standards for Finish Hardware
5. UL10C – Positive Pressure Fire Test of Door Assemblies
6. ANSI-A117.1 – Accessible and Usable Buildings and Facilities
7. DHI /ANSI A115.IG – Installation Guide for Doors and Hardware
8. ICC – International Building Code

D. Intent of Hardware Groups

1. Should items of hardware not definitely specified be required for completion of the Work, furnish such items of type and quality comparable to adjacent hardware and appropriate for service required.
2. Where items of hardware aren't definitely or correctly specified, are required for completion of the Work, a written statement of such omission, error, or other discrepancy to be submitted to Architect, prior to date specified for receipt of bids for clarification by addendum; or, furnish such items in the type and quality established by this specification, and appropriate to the service intended.

E. Allowances

1. Refer to Division 1 for allowance amount and procedures.

F. Alternates

1. Refer to Division 1 for Alternates and procedures.

1.2 SUBSTITUTIONS:

A. Comply with Division 1.

1.3 SUBMITTALS:

A. Comply with Division 1.

B. Special Submittal Requirements: Combine submittals of this Section with Sections listed below to ensure the "design intent" of the system/assembly is understood and can be reviewed together.

C. Product Data: Manufacturer's specifications and technical data including the following:

1. Detailed specification of construction and fabrication.
2. Manufacturer's installation instructions.
3. Wiring diagrams for each electric product specified. Coordinate voltage with electrical before submitting.
4. Submit 6 copies of catalog cuts with hardware schedule.
5. Provide 9001-Quality Management and 14001-Environmental Management for products listed in Materials Section 2.2

D. Shop Drawings - Hardware Schedule: Submit 6 complete reproducible copy of detailed hardware schedule in a vertical format.

1. List groups and suffixes in proper sequence.
2. Completely describe door and list architectural door number.
3. Manufacturer, product name, and catalog number.
4. Function, type, and style.
5. Size and finish of each item.
6. Mounting heights.
7. Explanation of abbreviations and symbols used within schedule.
8. Detailed wiring diagrams, specially developed for each opening, indicating all electric hardware, security equipment and access control equipment, and door and frame rough-ins required for specific opening.

E. Templates: Submit templates and "reviewed Hardware Schedule" to door and frame supplier and others as applicable to enable proper and accurate sizing and locations of cutouts and reinforcing.

1. Templates, wiring diagrams and "reviewed Hardware Schedule" of electrical terms to electrical for coordination and verification of voltages and locations.

F. Samples: (If requested by the Architect)

1. 1 sample of Lever and Rose/Escutcheon design, (pair).
2. 3 samples of metal finishes

G. Contract Closeout Submittals: Comply with Division 1 including specific requirements indicated.

1. Operating and maintenance manuals: Submit 3 sets containing the following.

a. Complete information in care, maintenance, and adjustment, and data on repair and replacement parts, and information on preservation of finishes.
b. Catalog pages for each product.
c. Name, address, and phone number of local representative for each manufacturer.
d. Parts list for each product.

2. Copy of final hardware schedule, edited to reflect, "As installed".

3. Copy of final keying schedule
4. As installed “Wiring Diagrams” for each piece of hardware connected to power, both low voltage and 110 volts.
5. One set of special tools required for maintenance and adjustment of hardware, including changing of cylinders.

1.4 QUALITY ASSURANCE

A. Comply with Division 1.

1. Statement of qualification for distributor and installers.
2. Statement of compliance with regulatory requirements and single source responsibility.
3. Distributor's Qualifications: Firm with 3 years experience in the distribution of commercial hardware.

    a. Distributor to employ full time Architectural Hardware Consultants (AHC) for the purpose of scheduling and coordinating hardware and establishing keying schedule.
    b. Hardware Schedule shall be prepared and signed by an AHC.

4. Installer's Qualifications: Firm with 3 years experienced in installation of similar hardware to that required for this Project, including specific requirements indicated.
5. Regulatory Label Requirements: Provide testing agency label or stamp on hardware for labeled openings.

    a. Provide UL listed hardware for labeled and 20 minute openings in conformance with requirements for class of opening scheduled.
    b. Underwriters Laboratories requirements have precedence over this specification where conflict exists.

6. Single Source Responsibility: Except where specified in hardware schedule, furnish products of only one manufacturer for each type of hardware.

B. Review Project for extent of finish hardware required to complete the Work. Where there is a conflict between these Specifications and the existing hardware, notify the Architect in writing and furnish hardware in compliance with the Specification unless otherwise directed in writing by the Architect.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packing and Shipping: Comply with Division 1.

1. Deliver products in original unopened packaging with legible manufacturer's identification.
2. Package hardware to prevent damage during transit and storage.
3. Mark hardware to correspond with "reviewed hardware schedule".
4. Deliver hardware to door and frame manufacturer upon request.

B. Storage and Protection: Comply with manufacturer's recommendations.

1.6 PROJECT CONDITIONS:

A. Coordinate hardware with other work. Furnish hardware items of proper design for use on doors and frames of the thickness, profile, swing, security and similar requirements indicated, as necessary for the proper installation and function, regardless of omissions or conflicts in the information on the Contract Documents.

B. Review Shop Drawings for doors and entrances to confirm that adequate provisions will be made for the proper installation of hardware.

1.7 WARRANTY:

A. Refer to Conditions of the Contract

B. Manufacturer's Warranty:

1. Closers: Ten years
2. Exit Devices: Five Years
3. Locksets & Cylinders: Three years
4. All other Hardware: Two years.

1.8 OWNER'S INSTRUCTION:

A. Instruct Owner's personnel in operation and maintenance of hardware units.

1.9 MAINTENANCE:

A. Extra Service Materials: Deliver to Owner extra materials from same production run as products installed. Package products with protective covering and identify with descriptive labels. Comply with Division 1 Closeout Submittals Section.

1. Special Tools: Provide special wrenches and tools applicable to each different or special hardware component.
2. Maintenance Tools: Provide maintenance tools and accessories supplied by hardware component manufacturer.
3. Delivery, Storage and Protection: Comply with Owner's requirements for delivery, storage and protection of extra service materials.

B. Maintenance Service: Submit for Owner's consideration maintenance service agreement for electronic products installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

A. The following manufacturers are approved subject to compliance with requirements of the Contract Documents. Approval of manufacturers other than those listed shall be in accordance with Division 1.

Item:	Manufacturer:	Approved:
Hinges	Stanley	Bommer, McKinney, Ives
Continuous Hinges	Stanley	Select, ABH, Pemko
Locksets	Best	
Cylinders	Best	
Exit Devices	Precision	Von Duprin,
Closers	LCN 4040XP	Dorma 8900, Norton 7500
Push/Pull Plates	Trimco	Burns, Rockwood, Ives
Push/Pull Bars	Trimco	Burns, Rockwood, Ives
Protection Plates	Trimco	Burns, Rockwood, Ives
Overhead Stops	Dorma	Rixson, Glynn Johnson, ABH
Door Stops	Trimco	Burns, Rockwood, Ives
Flush Bolts	Trimco	ABH, Burns, Ives
Coordinator & Brackets	Trimco	ABH, Burns, Ives
Threshold & Gasketing	National Guard	Reese, K.N. Crowder, Zero

2.2 MATERIALS:

A. Hinges:

1. Template screw hole locations
2. Minimum of 2 permanently lubricated non-detachable bearings
3. Equip with easily seated, non-rising pins
4. Sufficient size to allow 180-degree swing of door
5. Furnish hinges with five knuckles and flush [concealed] bearings
6. Provide hinge type as listed in schedule.
7. Furnish 3 hinges per leaf to 7 foot 6 inch height. Add one for each additional 30 inches in height or fraction thereof.
8. Tested and approved by BHMA for all applicable ANSI Standards for type, size, function and finish
9. UL10C listed for Fire rated doors.

B. Geared Continuous Hinges:

1. Tested and approved by BHMA for ANSI A156.26-1996 Grade 1
2. Anti-spinning through fastener
3. UL10C listed for 3 hour Fire rating
4. Non-handed
5. Lifetime warranty
6. Provide Fire Pins for 3-hour fire ratings
7. Sufficient size to permit door to swing 180 degrees

2.3 MATERIALS:

A. Hinges: Shall be Five Knuckle Ball bearing hinges

1. Template screw hole locations
2. Bearings are to be fully hardened.
3. Bearing shell is to be consistent shape with barrel.
4. Minimum of 2 permanently lubricated non-detachable bearings on standard weight hinge and 4 permanently lubricated bearing on heavy weight hinges.
5. Equip with easily seated, non-rising pins.
6. Non Removable Pin screws shall be slotted stainless steel screws.
7. Hinges shall be full polished, front, back and barrel.
8. Hinge pin is to be fully plated.
9. Bearing assembly is to be installed after plating.
10. Sufficient size to allow 180-degree swing of door
11. Furnish five knuckles with flush ball bearings
12. Provide hinge type as listed in schedule.
13. Furnish 3 hinges per leaf to 7 foot 6 inch height. Add one for each additional 30 inches in height or fraction thereof.
14. Tested and approved by BHMA for all applicable ANSI Standards for type, size, function and finish
15. UL10C listed for Fire rated doors.

B. Geared Continuous Hinges:

1. Tested and approved by BHMA for ANSI A156.26-1996 Grade 1
2. Anti-spinning through fastener
3. UL10C listed for 3 hour Fire rating
4. Non-handed
5. Lifetime warranty
6. Provide Fire Pins for 3-hour fire ratings
7. Sufficient size to permit door to swing 180 degrees

C. Electrified Functions for Hinges: Comply with the following:
   1. Power Transfer: Concealed PTFE-jacketed wires, secured at each leaf and continuous through hinge knuckle. Provide wire quantity and sizes required for electric hardware be served.

D. Mortise Type Locks and Latches:

   1. Tested and approved by BHMA for ANSI A156.13, Series 1000, Operational Grade 1, Extra-Heavy Duty, Security Grade 2 and be UL10C.
   2. Furnish UL or recognized independent laboratory certified mechanical operational testing to 4 million cycles minimum.
   3. Provide 9001-Quality Management and 14001-Environmental Management.
   4. Fit ANSI A115.1 door preparation
   5. Functions and design as indicated in the hardware groups
   6. Solid, one-piece, 3/4-inch (19mm) throw, anti-friction latchbolt made of self-lubricating stainless steel
   7. Deadbolt functions shall have 1 inch (25mm) throw bolt made of hardened stainless steel
   8. Latchbolt and Deadbolt are to extend into the case a minimum of 3/8 inch (9.5mm) when fully extended
   9. Auxiliary deadlatch to be made of one piece stainless steel, permanently lubricated
   10. Provide sufficient curved strike lip to protect door trim
   11. Lever handles must be of forged or cast brass, bronze or stainless steel construction and conform to ANSI A117.1. Levers that contain a hollow cavity are not acceptable
   12. Lock shall have self-aligning, thru-bolted trim
   13. Levers to operate a roller bearing spindle hub mechanism
   14. Mortise cylinders of lock shall have a concealed internal setscrew for securing the cylinder to the lockset. The internal setscrew will be accessible only by removing the core, with the control key, from the cylinder body.
   15. Spindle to be designed to prevent forced entry from attacking of lever
   16. Provide locksets with 7-pin removable and interchangeable core cylinders
   17. Each lever to have independent spring mechanism controlling it
   18. Core face must be the same finish as the lockset.

E. Cylindrical Type Locks and Latchsets:

   1. Tested and approved by BHMA for ANSI A156.2, Series 4000, Operational Grade 1, Extra-Heavy Duty, and be UL10C listed.
   2. Provide 9001-Quality Management and 14001-Environmental Management.
   3. Fit modified ANSI A115.2 door preparation.
   4. Locksets and cores to be of the same manufacturer to maintain complete lockset warranty
   5. Locksets to have anti-rotational studs that are thru-bolted
   6. Keyed lever shall not have exposed “keeper” hole
   7. Each lever to have independent spring mechanism controlling it
   8. 2-3/4 inch (70 mm) backset
   9. 9/16 inch (14 mm) throw latchbolt
   10. Provide sufficient curved strike lip to protect door trim
   11. Outside lever sleeve to be seamless, of one-piece construction made of a hardened steel alloy
   12. Keyed lever to be removable only after core is removed, by authorized control key
   13. Provide locksets with 7-pin removable and interchangeable core cylinders
   14. Hub, side plate, shrouded rose, locking pin to be a one-piece casting with a shrouded locking lug.
   15. Locksets outside locked lever must withstand minimum 1400 inch pounds of torque. In excess of that, a replaceable part will shear. Key from outside and inside lever will still operate lockset.
   16. Core face must be the same finish as the lockset.
   17. Functions and design as indicated in the hardware groups.

F. Cylindrical Type Locks and Latchsets:

1. Provide locksets tested and approved by BHMA/ANSI A156.2, Series 4000, Operational Grade 1, Extra-Heavy Duty.
2. Provide locksets listed by Underwriters Laboratories for use on fire rated single or double swinging doors.
3. Provide locksets that meet the design and operation of the cylindrical lock to meet the accessible requirements of ANSI A117.1 and ADA–Americans with Disabilities Act.
4. Provide locksets made in a manufacturing facility to compliant with ISO 9001-Quality Management and ISO 14001-Environmental Management.
5. Provide locksets that meet or exceed 50 Million cycle test verified by third party testing agency.
6. Provide locksets with the following mechanical features
    a. Locksets outside locked lever must withstand minimum 1400 inch-pounds of torque. In excess of that, a replaceable part will shear. Key from outside and/or inside lever will still operate lockset.
    b. Locksets shall fit modified ANSI A115.2 door preparation.
    c. 2-3/4 inch (70 mm) backset, standard.
    d. Door thickness – Available for 1 3/4” to 2 1/4” doors.
    e. 9/16 inch (14 mm) throw latchbolt.
    f. Latch to have single piece tail-piece construction.
    g. Chassis – Critical latch and chassis components to be brass or corrosion-treated steel.
    h. Lock shall allow the lever handle to move 45 degrees from parallel to the horizontal plane without engaging the latchbolt assembly.
    i. Hub, side plate, shrouded rose, locking pin to be a one-piece casting with a shrouded locking lug.
    j. Locksets to have anti-rotational studs that are thru-bolted.
    k. Provide sufficient curved strike lip to protect door trim at single doors. At pairs of doors, provide 7/8” Lip to Center Strike.
    l. Each lever to have independent spring mechanism.
    m. Lever springs to be contained in the main lock hub.
    n. Outside lever sleeve to be seamless, of one-piece construction made of a hardened steel alloy.
    o. Keyed lever to be removable only after core is removed, by authorized control key.
7. Locksets to have the capability of supporting manufacturers’ conventional core as well as large and small interchangeable cores.
8. Provide core face with the same finish as the lockset.
9. Provide functions and design as indicated in the hardware groups.
10. Acceptable manufacturers and/or products:
    a. dormakaba USA Inc. - Best 9K Series
    b. ASSA ABLOY Group - Sargent 11 Line
    c. Allegion – Schlage ND Series

G. Exit Devices:

1. Exit devices to meet or exceed BHMA for ANSI 156.3, Grade 1.
2. Exit devices to be tested and certified by UL or by a recognized independent laboratory for mechanical operational testing to 10 million cycles minimum with inspection confirming Grade 1 Loaded Forces have been maintained.
3. Exit devices chassis to be investment cast steel, zinc dichromate.
4. Exit devices to have stainless steel deadlocking ¾” through latch bolt.
5. Exit devices to be equipped with sound dampening on touchbar.
6. Non-fire rated exit devices to have cylinder dogging.
7. Non-fire rated exit devices to have ¼” minimum turn hex key dogging.
8. Touchpad to be “T” style constructed of architectural metal with matching metal end caps.
9. Touchbar assembly on wide style exit devices to have a ¼” clearance to allow for vision frames.
10. All exposed exit device components to be of architectural metals and “true” architectural finishes.
11. Provide strikes as required by application.
12. Fire exit hardware to conform to UL10C and UBC 7-2. UL tested for Accident Hazard.

13. The strike is to be black powder coated finish.
14. Exit devices to have field reversible handing.
15. Provide heavy duty vandal resistant lever trim with heavy duty investment cast stainless steel components and extra strength shock absorbing overload springs. Lever shall not require resetting. Lever design to match locksets and latchsets.
16. Provide 9001-Quality Management and 14001-Environmental Management.
17. Vertical Latch Assemblies to have gravity operation, no springs.
18. Exit Device Intruder Function Visual Indicator is to be used in conjunction with the ANSI “10” Function, which allows the outside lever trim to be locked from the inside while the door remains closed. Rim cylinder on the exterior/trim side retracts the latch from the outside.
    a. Indicator to be actuated by a rim cylinder equipped with a keyed core or thumb-turn.
    b. Directional indicator feature shall have a large status indicator window with directional pointer embossed into the active case cover to indicate key turn direction to lock and unlock outside lever trim. Labels or stickers are not acceptable.
    c. The status indicator window shall be integrated into the housing of the exit device and is to contain bright reflective material that may be seen in low light conditions.
    d. Indicator window to be protected by impact resistant lens cover.
    e. The action to lock down/unlock shall require a quarter turn (90°) of key or thumb turn.
        1) Locked status shall be indicated by a red indicator that will appear under the lens cover with an image of a locked padlock.
        2) Unlocked status shall be indicated by a green indicator that will appear under the lens of the cover with an image of an unlocked padlock.

H. Cylinders:

1. Provide the necessary cylinder housings, collars, rings & springs as recommended by the manufacturer for proper installation.
2. Provide the proper cylinder cams or tail piece as required to operate all locksets and other keyed hardware items listed in the hardware sets.
3. Coordinate and provide as required for related sections.

I. Door Closers shall:

1. Tested and approved by BHMA for ANSI 156.4, Grade 1
2. UL10C certified
3. Provide 9001-Quality Management and 14001-Environmental Management.
4. Closer shall have extra-duty arms and knuckles
5. Conform to ANSI 117.1
6. Maximum 2 7/16 inch case projection with non-ferrous cover
7. Separate adjusting valves for closing and latching speed, and backcheck
8. Provide adapter plates, shim spacers and blade stop spacers as required by frame and door conditions
9. Full rack and pinion type closer with 1½“ minimum bore
10. Mount closers on non-public side of door, unless otherwise noted in specification
11. Closers shall be non-handed, non-sized and multi-sized.

J. Door Stops: Provide a dome floor or wall stop for every opening as listed in the hardware sets.

1. Wall stop and floor stop shall be wrought bronze, brass or stainless steel.
2. Provide fastener suitable for wall construction.
3. Coordinate reinforcement of walls where wall stop is specified.
4. Provide dome stops where wall stops are not practical. Provide spacers or carpet riser for floor conditions encountered

K. Over Head Stops: Provide a Surface mounted or concealed overhead when a floor or wall stop cannot be used or when listed in the hardware set.

1. Concealed overhead stops shall be heavy duty bronze or stainless steel.
2. Surface overhead stops shall be heavy duty bronze or stainless steel.

L. Push Plates: Provide with four beveled edges ANSI J301, .050 thickness, size as indicated in hardware set. Furnish oval-head countersunk screws to match finish.

M. Pulls with plates: Provide with four beveled edges ANSI J301, .050 thickness Plate s with ANSI J401 Pull as listed in hardware set. Provide proper fasteners for door construction.

N. Push Pull Bars: Provide ANSI J504, .1" Dia. Pull and push bar model and series as listed in hardware set. Provide proper fasteners for door construction.

O. Kickplates: Provide with four beveled edges ANSI J102, 10 inches high by width less 2 inches on single doors and 1 inch on pairs of doors. Furnish oval-head countersunk screws to match finish.

P. Mop plates: Provide with four beveled edges ANSI J103, 4 inches high by width less 1 inch on single doors and 1 inch on pairs of doors. Furnish oval-head countersunk screws to match finish.

Q. Armor Plates: Provide ANSI J101 with four beveled edges, 40 inches high by width less 1 inch on single or pairs of doors. Furnish oval-head countersunk screws to match finish.

1. Provide cutouts for hardware as listed in the hardware sets.
2. Provide Warnock Hersey labeled plates for 3 hour metal fire doors where allowed by local authority.

R. Door Bolts: Flush bolts for wood or metal doors.

1. Provide a set of Automatic bolts, Certified ANSI/BHMA 156.3 Type 25 for hollow metal label doors.
2. Provide a set of Automatic bolts, Certified ANSI/BHMA 156.3 Type 27 at wood label doors.
3. Manual flush bolts, Certified ANSI/BHMA 156.16 at openings where allowed local authority.
4. Provide Dust Proof Strike, Certified ANSI/BHMA 156.16 at doors with flush bolts without thresholds.

S. Coordinator and Brackets: Provide a surface mounted coordinator when automatic bolts are used in the hardware set.

1. Coordinator, Certified ANSI/BHMA A1156.3 Type 21A for full width of the opening.
2. Provide mounting brackets for soffit applied hardware.
3. Provide hardware preparation (cutouts) for latches as necessary.

T. Power Supply: Provide power supply RPSMLR2 series for Motorized Latch Retraction exit devices. Provide the appropriate control circuit card necessary to operate the number of MLR exit devices used at each opening.
1. UL Listed for class II output
2. Include circuit breakers for protection of motherboard
3. 120 Volt AC input at 1 Amp
4. Control module shall include Fire alarm terminal contacts.

U. Power Supply: UL Listed, Field Selectable 12VDC or 24VDC output. The power supply will specifically designed to support electric locks and access controls. The power supply uses 115 VAC at 800mA input. The power shall be able to be expanded to four station controls. The filtered and regulated output power is field selectable for 12 or 24 VDC.

1. Fire Alarm/Life Safety emergency release included in power supply.
2. Available options for multiple door options four or more control stations, Adjustable Time delay relay, Battery charging, Battery Back up.

V. Door Position Switch: Provide door position switch for door status monitoring as indicated in hardware sets.

1. At all fired rated doors the door and frames, position switch preparation will be provided by the door and frame manufacturer or by an authorized label service agent.

W. Quick Connect plug-in connectors: Stanley quick connect plug-in must be used with a combination of the following components to work as a complete plug and play system.
   1. Best locks series 45HW, 45HM, 8KW, 9KW, 9KM
   2. To include Quick connectors to Best lock products Suffix “C” Example (45HW-7DEL14H DS **C)**
   3. Precision Exit Devices 2000 Series, DE, DS, TS, TDS, LDS, ELR
   4. To include Quick connectors to Precision Electric Exit device products Prefix “C” Example (**C** ELR 2108 x V4908A TS**)**
   5. Precision 12 Conductor Electric Power Transfer EPT-12C
   6. Stanley 12 Hinges Conductor Hinge CECB179-12C

X. Quick Connect Wire Harnesses: The Quick Connect wire harness shall have of one four wire connector and one eight wire connector. The four wire connector has two 18AWG and two 24AWG wires. The eight wire connector has eight 24AWG wires Stanley quick connect wire harnesses are available in various length’s, 3” (76mm), 6” (152mm), 12” (304mm), 26” (660mm) 32” (812mm) 38” (965mm), 44” (1117mm), 50” (1270mm) and 192” (4876mm).
   1. Wire Harness that is terminated at both ends is specified as WH-size (Example WH-3).
   2. Wire Harness that is terminated at one end with exposed pin head at the other is specified as WH-size P (Example WH-3P).
   3. Wire Harness 6” (152mm) terminated at one end with bray leads on the other is specified as WH-6E.

   Notes The Wire harnesses with suffix “E” has brae wire ends, is used to connect the quick connect harness to a hardwired connection.
   Wire harnesses of different lengths may be combined to form a desired length
   The maximum size hole needed to pass through the quick connect plug is 1” (25MM).

Y. Seals: All seals shall be finished to match adjacent frame color. Seals shall be furnished as listed in schedule. Material shall be UL listed for labeled openings.

Z. Weatherstripping: Provide at head and jambs only those units where resilient or flexible seal strip is easily replaceable. Where bar-type weatherstrip is used with parallel arm mounted closers install weatherstrip first.

   1. Weatherstrip shall be resilient seal of (Neoprene, Polyurethane, Vinyl, Pile, Nylon Brush, Silicone)
   2. UL10C Positive Pressure rated seal set when required.

AA. Door Bottoms/Sweeps: Surface mounted or concealed door bottom where listed in the hardware sets.

   1. Door seal shall be resilient seal of (Neoprene, Polyurethane, Nylon Brush, Silicone)
   2. UL10C Positive Pressure rated seal set when required.

BB. Thresholds: Thresholds shall be aluminum beveled type with maximum height of ½” for conformance with ADA requirements. Furnish as specified and per details. Provide fasteners and screws suitable for floor conditions.

CC. Provide one wall mounted Telkee, Lund or MMF series key cabinet complete with hooks, index and tags to accommodate 50% expansion. Coordinate mounting location with architect.

DD. Keystone Web Key Management Software: Provide one, Keystone Web product “KSWN” key management software. Shall include

1. Configurable Password Policy for logins.
2. User friendly interface - Tile Icons and Customizable dashboard.
3. Easy Data Entry & Import to import/append data continuously.
4. Active Directory synchronization to reduce manual entry.
5. Configurable Email notifications for all keys and other items currently due back on a designated day, notifications when keys and items are issued, and notifications when keys and other items are returned.
6. Global Search functionality capable of listing all cores and their location, building and doors.
7. Cross-references people to cores and keys, doors, and buildings they access.
8. Customizable Reports.
9. Self-serve Password retrieval functionality.
10. Program shall be standalone or network capable, LAN or WAN compatible.
11. Flexibility: The software shall be capable of allowing an authorized user secure access to the software from anywhere, provided user can access their organization's secure network.
12. Encrypted database and SQL server express backend.
13. Software program is to be compatible with Windows 7 Professional 32/64 bit (Standalone PC). Windows 2008/2012 Server 32/64 bit.
14. Browser Requirements: Internet Explorer 10 or greater Microsoft Edge browser latest Firefox or Chrome Internet browsers.
15. Minimum Microsoft software Prerequisites: SQL Server 2014 Express or Greater. NET Framework 4.5 or greater.

EE. Silencers: Furnish silencers on all interior frames, 3 for single doors, 2 for pairs. Omit where any type of seals occur.

2.4 FINISH:

A. Designations used in Schedule of Finish Hardware - 3.05, and elsewhere to indicate hardware finishes are those listed in ANSI/BHMA A156.18 including coordination with traditional U.S. finishes shown by certain manufacturers for their products

B. Powder coat door closers to match other hardware, unless otherwise noted.

C. Aluminum items shall be finished to match predominant adjacent material. Seals to coordinate with frame color.

2.5 KEYS AND KEYING:

A. Provide keyed brass construction cores and keys during the construction period. Construction control and operating keys and core shall not be part of the Owner's permanent keying system or furnished in the same keyway (or key section) as the Owner's permanent keying system. Permanent cores and keys (prepared according to the accepted keying schedule) will be furnished to the Owner.

B. Cylinders, removable and interchangeable core system: Best CORMAX™ Patented 7-pin.

C. Permanent keys and cores: Stamped with the applicable key mark for identification. These visual key control marks or codes will not include the actual key cuts. Permanent keys will also be stamped "Do Not Duplicate."

D. Transmit Grand Masterkeys, Masterkeys and other Security keys to Owner by Registered Mail, return receipt requested.

E. Furnish keys in the following quantities:

1. 1 each Grand Masterkeys

2. 4 each Masterkeys
3. 2 each Change keys each keyed core
4. 15 each Construction masterkeys
5. 1 each Control keys

F. The Owner, or the Owner's agent, will install permanent cores and return the construction cores to the Hardware Supplier. Construction cores and keys remain the property of the Hardware Supplier.

G. Keying Schedule: Arrange for a keying meeting, and programming meeting with Architect Owner and hardware supplier, and other involved parties to ensure locksets and locking hardware, are functionally correct and keying and programming complies with project requirements. Furnish 3 typed copies of keying and programming schedule to Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of conditions: Examine doors, frames, related items and conditions under which Work is to be performed and identify conditions detrimental to proper and or timely completion.

1. Do not proceed until unsatisfactory conditions have been corrected.

3.2 HARDWARE LOCATIONS:

A. Mount hardware units at heights indicated in the following publications except as specifically indicated or required to comply with the governing regulations.

1. Recommended Locations for Builder’s Hardware for Standard Steel Doors and Frames, by the Door and Hardware Institute (DHI).

2. Recommended locations for Architectural Hardware for flush wood doors (DHI).

3. WDMA Industry Standard I.S.-1A-04, Industry Standard for Architectural wood flush doors.

3.3 INSTALLATION:

A. Install each hardware item per manufacturer's instructions and recommendations. Do not install surface mounted items until finishes have been completed on the substrate. Set units level, plumb and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.

B. Conform to local governing agency security ordinance.

C. Install Conforming to ICC/ANSI A117.1 Accessible and Usable Building and Facilities.

1. Adjust door closer sweep periods so that from the open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches from the latch, measured to the landing side of the door.

D. Installed hardware using the manufacturers fasteners provided. Drill and tap all screw holes located in metallic materials. Do not use “Riv-Nuts” or similar products.

3.4 FIELD QUALITY CONTROL AND FINAL ADJUSTMENT

A. Contractor/Installers, Field Services: After installation is complete, contractor shall inspect the completed door openings on site to verify installation of hardware is complete and properly adjusted, in accordance with both the Contract Documents and final shop drawings.

1. Check and adjust closers to ensure proper operation.

2. Check latchset, lockset, and exit devices are properly installed and adjusted to ensure proper operation.

   a. Verify levers are free from binding.
   b. Ensure latchbolts and dead bolts are engaged into strike and hardware is functioning.

3. Report findings, in writing, to architect indicating that all hardware is installed and functioning properly. Include recommendations outlining corrective actions for improperly functioning hardware if required.

3.5 SCHEDULE OF FINISH HARDWARE:

Manufacturer List

Code	Name
AC	Accurate Lock & Hardware
BE	Best Access Systems
BY	By Others
DM	Dorma Door Controls
LC	LCN Closers
NA	National Guard
PR	Precision
PX	ePlex/Powerplex
ST	Stanley
TR	Trimco
TRIM	Trimco

Option List

Code	Description
C	Quick Connect Wiring System
L	BTB Concealed Mtd.
N	Thru-Bolt w/ Flow-Thru
CE	CONC/WIRE-USE WITH 10,18,54,56,58,66 SUF
FL	Fire Exit Hardware
LD	Less Dogging
LS	Latch Status Monitor (45HW,47HW)
S3	ANSI Strike Package
TS	TOUCHBAR MONITORING SWITCH
CSK	COUNTER SINKING OF KICK and MOP PLATES
LBR	LESS BOTTOM ROD
MLR	MOTORIZED LATCH RETRACTION
NRP	NON REMOVEABLE PIN STD/HEAVY WT HINGE
RQE	Request to Exit
SIA	ABRASIVE COATING-6" WIDTH-AL OR SS
TDS	TOUCHBAR MONITORING DOUBLE SWITCH
VIB	Double Visual Indictor Option
CE-58	CONCEALED WIRES (8)
S3-7/8	ANSI Strike Package - 7/8" Flat Lip

4040-18TJ	Drop Plate
B4E	BEVELED 4 EDGES - KICK PLATES
1/4-20 SSMS/EA	STAINLESS MACHINE SCREWS/EXPANSION ANC.
1/4-20-2" COMBO	1/4-20 X COMBO MS/ANCHOR (SS)

Finish List

Code	Description
AL	Aluminum
AL	Aluminum (BHMA 689)
26D	Satin Chrome
626	Satin Chromium Plated
630	Satin Stainless Steel
GREY	Grey
US26D	Chromium Plated, Dull
US32D	Stainless Steel, Dull

Hardware Sets

SET #1 - NOT USED

SET #2 – NOT USED

SET #3

1	Electric Continuous Hinge	661HD CE-58	AL	ST
1	Exit Device	C MLR TS 2403	630	PR
1	Rim Cylinder	12E-72 PATD	626	BE
1	Door Pull	AP423 LENGTH AS SELECTED BY ARCHITECT X N MTG	630	TR
1	Closer Top Jamb Mount	4040XP REGARM 4040-18TJ	AL	LC
1	Overhead Stop	910 SERIES	626	DM
1	Gasket	SUPPLIED BY ALUM DOOR MFG/SUPPLIER		BY
1	Door Sweep	200 SA		NA
1	Threshold	8513 1/4-20 SSMS/EA SIA (VERIFY FLOOR CONDITION)		NA
1	Wire Harness	WH-6E		ST
1	Wire Harness	WH-12		ST
1	Wire Harness	WH-192		ST
1	Door Position Switch	MC4		DM
1	Card Reader	SUPPLIED BY SECURITY VENDOR		BY
1	Power Supply	RPSMLR2		PR

SET #4

1	Electric Continuous Hinge	661HD CE-58	AL	ST
1	Continuous Hinge	661HD	AL	ST
1	Dust Proof Strike	3911	630	TR
1	Semi Auto Bolts	3810 X 3820	626	TR
1	Electro-mech Lock	9KW3-7DEU16D PATD C RQE	626	BE
1	Coordinator	3094B2	Silver	TR
2	Mounting Bracket	3095/3096	Silver	TR
2	Closer	4040XP SCUSH	AL	LC

2	Kick Plate	K0050 10" X 2" LDW B4E CSK	630	TR
1	Drip Cap	16 A - 4" ODW		NA
1	Weatherstrip	700 SA (HEAD)		NA
2	Weatherstrip	700 ES (JAMBS)		NA
2	Door Sweep	200 SA		NA
1	Threshold	8513 1/4-20 SSMS/EA SIA (VERIFY FLOOR CONDITION)		NA
1	Astragal	139 SS X 5050 B	US32D	NA
1	Wire Harness	WH-6E		ST
1	Wire Harness	WH-32		ST
1	Wire Harness	WH-192		ST
2	Door Position Switch	MC4		DM
1	Card Reader	SUPPLIED BY SECURITY VENDOR		BY
1	Power Supply	RPSMLR2		PR

SET #5

2	Continuous Hinge	661HD	AL	ST
1	Dust Proof Strike	3911	630	TR
1	Semi Auto Bolts	3810 X 3820	626	TR
1	Lockset - Storeroom	9K3-7D16D PATD S3-7/8	626	BE
1	Coordinator	3094B2	Silver	TR
2	Mounting Bracket	3095/3096	Silver	TR
2	Closer	4040XP SCUSH	AL	LC
2	Kick Plate	K0050 10" X 2" LDW B4E CSK	630	TR
1	Drip Cap	16 A - 4" ODW		NA
1	Weatherstrip	700 SA (HEAD)		NA
2	Weatherstrip	700 ES (JAMBS)		NA
2	Door Sweep	200 SA		NA
1	Threshold	8513 1/4-20 SSMS/EA SIA (VERIFY FLOOR CONDITION)		NA
1	Astragal	139 SS X 5050 B	US32D	NA

SET #6

1	Electric Continuous Hinge	661HD CE-58	AL	ST
1	Exit Device	C MLR TS 2403 X 2903B	630	PR
1	Rim Cylinder	12E-72 PATD	626	BE
1	Closer Top Jamb Mount	4040XP REGARM 4040-18TJ	AL	LC
1	Overhead Stop	910 SERIES	626	DM
1	Gasket	SUPPLIED BY ALUM DOOR MFG/SUPPLIER		BY
1	Door Sweep	200 SA		NA
1	Threshold	8513 1/4-20 SSMS/EA SIA (VERIFY FLOOR CONDITION)		NA
1	Wire Harness	WH-6E		ST
1	Wire Harness	WH-12		ST
1	Wire Harness	WH-192		ST
1	Door Position Switch	MC4		DM
1	Card Reader	SUPPLIED BY SECURITY VENDOR		BY
1	Power Supply	RPSMLR2		PR

SET #7

1	Continuous Hinge	661HD	AL	ST
1	Lockset - Storeroom	9K3-7D16D PATD S3	626	BE
1	Closer	4040XP SCUSH | 4040XP REGARM @ 131C	AL	LC
1	Overhead Stop	910 SERIES @ 131C	626	DM
1	Kick Plate	K0050 10" X 2" LDW B4E CSK	630	TR
1	Drip Cap	16 A - 4" ODW		NA
1	Weatherstrip	700 SA (HEAD)		NA

2	Weatherstrip	700 ES (JAMBS) CONDITION)		NA
1	Door Sweep	200 SA		NA
1	Threshold	8513 1/4-20 SSMS/EA SIA (VERIFY FLOOR CONDITION)		NA

SET #8

1	All Door Hardware	SUPPLIED BY SLIDING DOOR PANEL SYSTEM MFG/SUPPLIER		BY

SET #9

3	Hinges	FBB179 4 1/2 X 4 1/2 NRP	US26D	ST
1	Lockset - Storeroom	9K3-7D16D PATD S3	626	BE
1	Closer	4040XP RWPA	AL	LC
1	Kick Plate	K0050 10" X 2" LDW B4E CSK	630	TR
1	Gasketing	5050 B (HEAD & JAMBS)		NA
1	Door Sweep	C607 A		NA

SET #10

2	Hinges	FBB168 4 1/2 X 4 1/2 NRP	US26D	ST
1	Electric Hinge	CE FBB168 4 1/2 X 4 1/2	US26D	ST
1	Exit Device	C TS E2103 X 4908B	630	PR
1	Rim Cylinder	12E-72 PATD	626	BE
1	Closer	4040XP EDA	AL	LC
1	Wall Bumper	1270CVSV	626	TR
1	Smoke Seal	5075 B (HEAD & JAMBS)		NA
1	Wire Harness	WH-6E		ST
1	Wire Harness	WH-12		ST
1	Wire Harness	WH-192		ST
1	Door Position Switch	MC4		DM
1	Card Reader	SUPPLIED BY SECURITY VENDOR		BY
1	Power Supply	RPSMLR2		PR

SET #11

6	Hinges	FBB179 4 1/2 X 4 1/2	US26D	ST
1	Dust Proof Strike	3911	630	TR
2	Manual Flushbolt	3917-12	626	TR
1	Passage Set	9K3-0N16D S3	626	BE
2	Overhead Stop	700 Series	626	DM
2	Silencer	1229A	GREY	TR

SET #12

2	Hinges	FBB179 4 1/2 X 4 1/2 NRP	US26D	ST
1	Electric Hinge	CE FBB179 4 1/2 X 4 1/2	US26D	ST
1	Electro-mech Lock	9KW3-7DEU16D PATD C RQE	626	BE
1	Closer	4040XP REGARM | 4040XP EDA @ 103C, 127	AL	LC
1	Wall Bumper	1270CVSV	626	TR
1	Smoke Seal	5075 B (HEAD & JAMBS)		NA
1	Wire Harness	WH-6E		ST
1	Wire Harness	WH-32		ST
1	Wire Harness	WH-192		ST
1	Door Position Switch	MC4		DM
1	Card Reader	SUPPLIED BY SECURITY VENDOR		BY
1	Power Supply	RPSMLR2		PR

SET #13

3	Hinges	FBB179 4 1/2 X 4 1/2	US26D	ST

1	Lockset - Entrance/Office	9K3-7EA16D PATD S3	626	BE
1	Wall Bumper	1270CVSV	626	TR
1	Smoke Seal	5075 B (HEAD & JAMBS)		NA

SET #14

3	Hinges	FBB179 4 1/2 X 4 1/2	US26D	ST
1	Lockset - Storeroom	9K3-7D16D PATD S3	626	BE
1	Closer	4040XP REGARM	AL	LC
1	Kick Plate	K0050 10" X 2" LDW B4E CSK	630	TR
1	Wall Bumper	1270CVSV	626	TR
1	Gasketing	5050 B (HEAD & JAMBS)		NA
1	Door Sweep	C607 A		NA

SET #15

3	Hinges	FBB179 4 1/2 X 4 1/2	US26D	ST
1	Passage Set	9K3-0N16D S3	626	BE
1	Wall Bumper	1270CVSV	626	TR
1	Smoke Seal	5075 B (HEAD & JAMBS)		NA

SET #16

3	Hinges	FBB179 4 1/2 X 4 1/2	US26D	ST
1	Privacy Set w/Indicator	45H-0L16H VIB	626	BE
1	Closer	4040XP RWPA	AL	LC
1	Kick Plate	K0050 10" X 2" LDW B4E CSK	630	TR
1	Mop Plate	KM050 6" X 1" LDW B4E CSK	630	TR
1	Wall Bumper	1270CVSV	626	TR
1	Smoke Seal	5075 B (HEAD & JAMBS)		NA

SET #17

2	Hinges	FBB179 4 1/2 X 4 1/2 NRP	US26D	ST
1	Electric Hinge	CE FBB179 4 1/2 X 4 1/2	US26D	ST
1	Electro-mech Lock	9KW3-7DEU16D PATD C RQE	626	BE
1	Closer	4040XP EDA | 4040XP SCUSH @ 111B	AL	LC
1	Wall Bumper	1270CVSV | OMIT @ 111B	626	TR
1	Smoke Seal	5075 B (HEAD & JAMBS)		NA
1	Wire Harness	WH-6E		ST
1	Wire Harness	WH-32		ST
1	Wire Harness	WH-192		ST
1	Door Position Switch	MC4		DM
1	Card Reader	SUPPLIED BY SECURITY VENDOR		BY
1	Power Supply	RPSMLR2		PR

SET #18

3	Hinges	FBB179 4 1/2 X 4 1/2 NRP	US26D	ST
1	Lockset - Storeroom	9K3-7D16D PATD S3	626	BE
1	Closer	4040XP REGARM | 4040XP SCUSH @ 113	AL	LC
1	Wall Bumper	1270CVSV | OMIT @ 113	626	TR
1	Smoke Seal	5075 B (HEAD & JAMBS)		NA

SET #19

2	Hinges	FBB179 4 1/2 X 4 1/2 NRP	US26D	ST
1	Electric Hinge	CE FBB179 4 1/2 X 4 1/2	US26D	ST
1	Electro-mech Lock	9KW3-7DEU16D PATD C RQE	626	BE
1	Closer	4040XP SCUSH | 4040XP EDA @ 112	AL	LC
1	Smoke Seal	5075 B (HEAD & JAMBS)		NA
1	Wire Harness	WH-6E		ST
1	Wire Harness	WH-32		ST

1	Wire Harness	WH-192		ST
1	Door Position Switch	MC4		DM
1	Card Reader	SUPPLIED BY SECURITY VENDOR		BY
1	Power Supply	RPSMLR2		PR

SET #20

3	Hinges	FBB179 4 1/2 X 4 1/2 NRP	US26D	ST
1	Lockset - Storeroom	9K3-7D16D PATD S3	626	BE
1	Closer	4040XP REGARM | 4040XP EDA @ 244	AL	LC
1	Kick Plate	K0050 10" X 2" LDW B4E CSK	630	TR
1	Wall Bumper	1270CVSV	626	TR
1	Gasketing	5050 B (HEAD & JAMBS)		NA
1	Door Sweep	C607 A		NA

SET #21

4	Hinges	FBB179 4 1/2 X 4 1/2 NRP	US26D	ST
1	Lockset - Storeroom	9K3-7D16D PATD S3	626	BE
1	Closer	4040XP EDA	AL	LC
1	Kick Plate	K0050 10" X 2" LDW B4E CSK	630	TR
1	Wall Bumper	1270CVSV	626	TR
1	Gasketing	5050 B (HEAD & JAMBS)		NA
1	Door Sweep	C607 A		NA

SET #22

3	Hinges	FBB179 4 1/2 X 4 1/2	US26D	ST
1	Lockset - Entrance/Office	9K3-7EA16D PATD S3	626	BE
1	Wall Bumper	1270CVSV	626	TR
1	Smoke Seal	5075 B (HEAD & JAMBS)		NA

SET #23

3	Hinges	FBB191 4 1/2 X 4 1/2	US32D	ST
1	Electronic Pushbutton Lock	P2031BLL41	626	PX
1	Cormax Core	ICX-7	626	BE
1	Closer	4040XP REGARM	AL	LC
1	Kick Plate	K0050 10" X 2" LDW B4E CSK	630	TR
1	Mop Plate	KM050 6" X 1" LDW B4E CSK	630	TR
1	Wall Bumper	1270CVSV	626	TR
1	Gasketing	5050 B (HEAD & JAMBS)		NA

SET #24

3	Hinges	FBB168 4 1/2 X 4 1/2	US26D	ST
1	Exit Device	2114 X 4914B	630	PR
1	Closer	4040XP EDA	AL	LC
1	Wall Bumper	1270CVSV	626	TR
1	Smoke Seal	5075 B (HEAD & JAMBS)		NA

SET #25

3	Hinges	FBB168 4 1/2 X 4 1/2	US26D	ST
1	Exit Device	2114 X 4914B	630	PR
1	Closer	4040XP SCUSH	AL	LC
1	Smoke Seal	5075 B (HEAD & JAMBS)		NA

SET #26

2	Hinges	FBB179 4 1/2 X 4 1/2	US26D	ST
1	Electric Hinge	CE FBB179 4 1/2 X 4 1/2	US26D	ST
1	Electro-mech Lock	45HW-7TDEU16H PATD C VIB	626	BE
1	Closer	4040XP REGARM	AL	LC
1	Wall Bumper	1270CVSV	626	TR

1	Smoke Seal	5075 B (HEAD & JAMBS)		NA
1	Wire Harness	WH-6E		ST
1	Wire Harness	WH-32		ST
1	Wire Harness	WH-192		ST
1	Door Position Switch	MC4		DM
1	Card Reader	SUPPLIED BY SECURITY VENDOR		BY
1	Power Supply	RPSMLR2		PR

SET #27

3	Hinges	FBB179 4 1/2 X 4 1/2 NRP	US26D	ST
1	Lockset - Storeroom	9K3-7D16D PATD S3	626	BE
1	Closer	4040XP EDA	AL	LC
1	Kick Plate	K0050 10" X 2" LDW B4E CSK	630	TR
1	Gasketing	5050 B (HEAD & JAMBS)		NA
1	Door Sweep	C607 A		NA

SET #28

3	Hinges	FBB191 4 1/2 X 4 1/2	US32D	ST
1	Lockset - Storeroom	9K3-7D16D PATD S3	626	BE
1	Closer	4040XP REGARM	AL	LC
1	Kick Plate	K0050 10" X 2" LDW B4E CSK	630	TR
1	Mop Plate	KM050 6" X 1" LDW B4E CSK	630	TR
1	Wall Bumper	1270CVSV	626	TR
1	Gasketing	5050 B (HEAD & JAMBS)		NA

SET #29

6	Hinges	FBB179 4 1/2 X 4 1/2 NRP	US26D	ST
1	Dust Proof Strike	3911	630	TR
1	Semi Auto Bolts	3810 X 3820	626	TR
1	Lockset - Storeroom	9K3-7D16D PATD S3-7/8	626	BE
1	Coordinator	3094B2	Silver	TR
2	Mounting Bracket	3095/3096	Silver	TR
1	Closer	4040XP SCUSH	AL	LC
1	Closer	4040XP EDA	AL	LC
2	Kick Plate	K0050 10" X 2" LDW B4E CSK	630	TR
1	Wall Bumper	1270CVSV	626	TR
2	Door Sweep	C607 A		NA
1	Gasketing	5050 B (HEAD & JAMBS)		NA
1	Astragal	158 SA		NA

SET #30

1	Electric Hinge	CE FBB168 4 1/2 X 4 1/2	US26D	ST
2	Hinges	FBB168 4 1/2 X 4 1/2 NRP	US26D	ST
1	Electro-mech Lock	45HW-7DEU16H PATD C LS RQE	626	BE
1	Closer	4040XP REGARM	AL	LC
1	Wall Bumper	1270CVSV	626	TR
1	Smoke Seal	5075 B (HEAD & JAMBS)		NA
1	Wire Harness	WH-6E		ST
1	Wire Harness	WH-32		ST
1	Wire Harness	WH-192		ST
1	Door Position Switch	MC4		DM
1	Card Reader	SUPPLIED BY SECURITY VENDOR		BY
1	Power Supply	RPSMLR2		PR
1	Release Button Console	CC403DTM		DM

SET #31 – NOT USED

SET #32

3	Hinges	FBB168 4 1/2 X 4 1/2 NRP	US26D	ST
1	Power Transfer	EPT-12C		PR
1	Exit Device	C E2103 X 4908B ALW x WH495	630	PR
1	Rim Cylinder	12E-72 PATD	626	BE
1	Mortise Cylinder	1E-74 C4 PATD	626	BE
1	Closer	4040XP EDA	AL	LC
1	Wall Bumper	1270CVSV	626	TR
1	Smoke Seal	5075 B (HEAD & JAMBS)		NA
1	Wire Harness	WH-6E		ST
1	Wire Harness	WH-12		ST
1	Wire Harness	WH-192		ST
1	Door Position Switch	MC4		DM
2	Card Reader	SUPPLIED BY SECURITY VENDOR		BY
1	Power Supply	RPSMLR2		PR

SET #33

3	Hinges	FBB179 4 1/2 X 4 1/2	US26D	ST
1	Push Plate	1001-9	630	TR
1	Pull Plate	1018-3B	630	TR
1	Closer	4040XP REGARM	AL	LC
1	Kick Plate	K0050 10" X 2" LDW B4E CSK	630	TR
1	Mop Plate	KM050 6" X 1" LDW B4E CSK	630	TR
1	Wall Bumper	1270CVSV	626	TR
1	Smoke Seal	5075 B (HEAD & JAMBS)		NA

SET #34

1	All Door Hardware	REUSE EXISTING		BY

SET #35

2	Hinges	FBB168 4 1/2 X 4 1/2 NRP	US26D	ST
1	Electric Hinge	CE FBB168 4 1/2 X 4 1/2	US26D	ST
1	Exit Device	C TS E2103 X 4908B	630	PR
1	Rim Cylinder	12E-72 PATD	626	BE
1	Closer	4040XP SCUSH	AL	LC
1	Smoke Seal	5075 B (HEAD & JAMBS)		NA
1	Wire Harness	WH-6E		ST
1	Wire Harness	WH-12		ST
1	Wire Harness	WH-192		ST
1	Door Position Switch	MC4		DM
1	Card Reader	SUPPLIED BY SECURITY VENDOR		BY
1	Power Supply	RPSMLR2		PR

SET #36

3	Hinges	FBB179 4 1/2 X 4 1/2	US26D	ST
1	Passage Set	9K3-0N16D S3	626	BE
1	Wall Bumper	1270CVSV	626	TR
1	Gasket	SUPPLIED BY ALUM FRAME MFG/SUPPLIER		BY

SET #37

3	Hinges	FBB179 4 1/2 X 4 1/2	US26D	ST
1	Passage Set	9K3-0N16D S3	626	BE
1	Closer	4040XP REGARM | OMIT @ 249	AL	LC
1	Overhead Stop	910 SERIES @ DOOR 249	626	DM
1	Wall Bumper	1270CVSV | OMIT @ 249	626	TR
1	Smoke Seal	5075 B (HEAD & JAMBS)		NA

SET #38

6	Hinges	FBB179 4 1/2 X 4 1/2	US26D	ST
1	Dust Proof Strike	3911	630	TR
2	Manual Flushbolt	3917-12	626	TR
1	Passage Set	9K3-0N16D S3	626	BE
1	Overhead Stop	700 Series	626	DM
1	Wall Bumper	1270CVSV	626	TR
2	Silencer	1229A	GREY	TR

SET #39 – NOT USED

SET #40 – NOT USED

SET #41 – NOT USED

SET #42 – NOT USED

SET #43 – NOT USED

SET #44 – NOT USED

SET #45

1	Electric Hinge	CE FBB168 4 1/2 X 4 1/2	US26D	ST
5	Hinges	FBB168 4 1/2 X 4 1/2 NRP	US26D	ST
1	Exit Device	FL 2701 LBR	630	PR
1	Exit Device	C FL TS E2703 X 4908B LBR	630	PR
1	Rim Cylinder	12E-72 PATD	626	BE
2	Closer	4040XP EDA	AL	LC
2	Wall Bumper	1270CVSV	626	TR
1	Astragal Smoke Seal	5070 B 84"		NA
1	Smoke Seal	5075 B (HEAD & JAMBS)		NA
1	Wire Harness	WH-12		ST
1	Wire Harness	WH-192		ST
1	Wire Harness	WH-6E		ST
1	Door Position Switch	MC4		DM
1	Card Reader	SUPPLIED BY SECURITY VENDOR		BY
1	Power Supply	RPSMLR2		PR

SET #46

4	Hinges	FBB168 4 1/2 X 4 1/2	US26D	ST
1	Push Plate	1001-9	630	TR
1	Pull Plate	1018-3B	630	TR
1	Closer	4040XP EDA	AL	LC
1	Kick Plate	K0050 10" X 2" LDW B4E CSK	630	TR
1	Wall Bumper	1270CVSV	626	TR
1	Smoke Seal	5075 B (HEAD & JAMBS)		NA

SET #47

2	Hinges	FBB179 4 1/2 X 4 1/2 NRP	US26D	ST
1	Electric Hinge	CE FBB179 4 1/2 X 4 1/2	US26D	ST
1	Electro-mech Lock	9KW3-7DEU16D PATD C RQE	626	BE
1	Closer	4040XP EDA	AL	LC
1	Kick Plate	K0050 10" X 2" LDW B4E CSK	630	TR
1	Wall Bumper	1270CVSV	626	TR
1	Smoke Seal	5075 B (HEAD & JAMBS)		NA
1	Wire Harness	WH-6E		ST
1	Wire Harness	WH-32		ST

1	Wire Harness	WH-192		ST
1	Door Position Switch	MC4		DM
1	Card Reader	SUPPLIED BY SECURITY VENDOR		BY
1	Power Supply	RPSMLR2		PR

SET #48

3	Hinges	FBB168 4 1/2 X 4 1/2 NRP	US26D	ST
1	Power Transfer	EPT-12C		PR
1	Exit Device	C E2103 X 4908B ALW x WH495	630	PR
1	Rim Cylinder	12E-72 PATD	626	BE
1	Mortise Cylinder	1E-74 C4 PATD	626	BE
1	Closer	4040XP EDA	AL	LC
1	Wall Bumper	1270CVSV	626	TR
1	Smoke Seal	5075 B (HEAD & JAMBS)		NA
1	Wire Harness	WH-6E		ST
1	Wire Harness	WH-12		ST
1	Wire Harness	WH-192		ST
1	Door Position Switch	MC4		DM
1	PIR Request to Exit Switch	915	CAS	RC
1	Card Reader	SUPPLIED BY SECURITY VENDOR		BY
1	Power Supply	RPSMLR2		PR

END SECTION

SECTION 08 8000

GLAZING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Insulating glass units.

B. Monolithic glass.

C. Glazing compounds.

1.02 REFERENCE STANDARDS

A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials.

B. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test.

C. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers.

D. ASTM C920 - Standard Specification for Elastomeric Joint Sealants.

E. ASTM C1036 - Standard Specification for Flat Glass.

F. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass.

G. ASTM C1172 - Standard Specification for Laminated Architectural Flat Glass.

H. ASTM C1193 - Standard Guide for Use of Joint Sealants.

I. ASTM C1376 - Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass.

J. ASTM E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings.

K. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation.

L. GANA (GM) - GANA Glazing Manual.

M. GANA (SM) - GANA Sealant Manual.

N. NFRC 100 - Procedure for Determining Fenestration Product U-factors.

O. NFRC 200 - Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence.

P. NFRC 300 - Test Method for Determining the Solar Optical Properties of Glazing Materials and Systems.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data on Insulating Glass Unit Types: Provide structural, physical and environmental characteristics, size limitations, special handling and installation requirements.

C. Product Data on Glazing Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements, and identify available colors.

D. Samples: Submit two samples 12 by 12 inch in size, showing coloration and design of each type of glass specified.

E. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.04 QUALITY ASSURANCE

A. Perform Work in accordance with GANA Glazing Manual and GANA Sealant Manual for glazing installation methods.

B. Installer Qualifications: Company specializing in performing the work of this Section with minimum three years documented experience.

C. Provide each type of glass, primary sealant, and gasket from a single manufacturer with not less than five years documented experience in the production of required materials.

D. Basis of Design: Specifications for certain glass products are based on specific glass types by the specified basis of design manufacturer. Glass types manufactured by other acceptable manufacturers are permitted, subject to compliance with all performance requirements; and provided that deviations in performance and coloration are minor, and do not detract substantially from the indicated design intent.
   1. Comply with requirements specified in Section 01 4000 and Section 01 6000.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Comply with manufacturer's instructions for shipping, handling, storing, and protection of glass and glazing materials. Exercise exceptional care to prevent edge damage to glass, and damage to coatings.

B. Where insulating glass units will be exposed to substantial altitude changes during shipping, comply with manufacturer's recommendations for venting and sealing.

1.06 FIELD CONDITIONS

A. Do not install glazing when ambient temperature is less than 40 degrees F.

B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

C. Install sealants only when ambient temperature conditions can be maintained at or above 40 degrees F during installation and 48 hours immediately following installation.

1.07 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

B. Insulating Glass Units: Provide a five (5) year manufacturer warranty to include coverage for seal failure, interpane dusting or misting, including providing products to replace failed units.

C. Laminated Glass: Provide a five (5) year manufacturer warranty to include coverage for delamination, including providing products to replace failed units.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS - EXTERIOR GLAZING ASSEMBLIES

A. Provide type and thickness of exterior glazing assemblies to support assembly dead loads, and to withstand live loads caused by positive and negative wind pressure acting normal to plane of glass.
   1. Design Pressure: Calculated in accordance with applicable codes.
   2. Comply with ASTM E1300 for design load resistance of glass type, thickness, dimensions, and maximum lateral deflection of supported glass.
   3. Provide glass edge support system sufficiently stiff to limit the lateral deflection of supported glass edges to less than 1/175 of their lengths under specified design load.
   4. Design glazing units to reliably perform and remain reliably engaged on all edges under all service and thermal stresses, including those associated with partial shading.
   5. Limit center of glass deflection to the lesser of 3/4 inch or L/100 (where L is short side dimension of glass unit), or flexure limit of glass, whichever is less, with full recovery of glazing materials.
   6. Assure and confirm compatibility of all materials in contact with each other.
   7. Glass thicknesses listed are minimum.

B. Thermal and Optical Performance: Provide exterior glazing products with performance properties as indicated. Performance properties are in accordance with manufacturer's published data as determined with the following procedures and/or test methods:
   1. Center of Glass U-Value: Comply with NFRC 100 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
   2. Center of Glass Solar Heat Gain Coefficient (SHGC): Comply with NFRC 200 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
   3. Solar Optical Properties: Comply with NFRC 300 test method.

2.02 GLASS MATERIALS

A. Float Glass: Provide float glass based glazing unless otherwise indicated.
   1. Annealed Type: ASTM C1036, Type I - Transparent Flat, Class 1 - Clear, Quality - Q3.
   2. Kind HS - Heat-Strengthened Type: Complies with ASTM C1048.
   3. Kind FT - Fully Tempered Type: Complies with ASTM C1048.
   4. Fully Tempered Safety Glass: Complies with ANSI Z97.1 or 16 CFR 1201 criteria for safety glazing used in hazardous locations.
   5. Impact Resistant Safety Glass: Complies with ANSI Z97.1 - Class B, or 16 CFR 1201 - Category I criteria.
   6. Thicknesses: As indicated; provide greater thickness as required for exterior glazing wind load design.

B. Laminated Glass: Float glass laminated in accordance with ASTM C1172.
   1. Laminated Safety Glass: Complies with ANSI Z97.1 - Class B or 16 CFR 1201 - Category I impact test requirements.
   2. Polyvinyl Butyral (PVB) Interlayer: 0.060 inch thick, minimum.
   3. Acceptable Manufacturers:
      a. 3M Window Film: www.solutions.3m.com/#sle.
      b. Flexvue Films: www.flexvuefilms.com/#sle.
      c. Kuraray America, Inc.: www.kuraray.us.com/#sle.
      d. Madico, Inc.: www.madico.com.
      e. Substitutions: See Section 01 6000 - Product Requirements.

2.03 INSULATING GLASS UNIT APPLICATIONS

A. Acceptable Insulating Glass Unit Manufacturers:
   1. Fabricator certified by glass manufacturer for type of glass, coating, and treatment involved and capable of providing specified warranty.
   2. Substitutions: See Section 01 6000 - Product Requirements.

B. General - Combined Requirements: If a particular glass unit is indicated to comply with more than one type of requirement, such as color, safety characteristics, or other requirements, comply with all specified requirements for each type as scheduled on Drawings.

C. Insulating Glass Units: Types as indicated on Drawings.
   1. Basis of Design: As specified in this Section below.
   2. Durability: Certified by an independent testing agency to comply with ASTM E2190.
   3. Coated Glass: Comply with requirements of ASTM C1376 for pyrolytic (hard-coat) or magnetic sputter vapor deposition (soft-coat) type coatings on flat glass; coated vision glass, Kind CV; coated overhead glass, Kind CO; or coated spandrel glass, Kind CS.
   4. Warm-Edge Spacers: Polypropylene warm-edge technology design.
      a. Spacer Width: As required for specified insulating glass units.
      b. Spacer Height: Manufacturer's standard.
      c. Acceptable Products:
         1) Quanex IG Systems, Inc.; Super Spacer TriSeal: www.quanex.com/#sle.
         2) Technoform Glass Insulation; TGI-Spacer: www.glassinsulation.us/#sle.
         3) Substitutions: See Section 01 6000 - Product Requirements.
   5. Spacer Color: Black.
   6. Edge Seal:
      a. Dual-Sealed System: Provide polyisobutylene sealant as primary seal applied between spacer and glass panes, and silicone sealant as secondary seal applied around perimeter.
      b. Color: Black.

7. Purge interpane space with dry air, hermetically sealed.
8. Breather Tubes: Provide tubes from air space for insulating glass units without inert type gas that have a change of altitude greater than 2500 feet between point of fabrication and point of installation to permit pressure equalization of air space.
    a. Breather Tubes: Seal breather tubes upon installation in accordance with insulating glass fabricator's requirements.
9. Space between lites filled with air.
10. Total Thickness: 1 inch.
11. Glazing Method: Dry glazing method, gasket glazing.

D. Insulating Glass Units: Safety glazing.
1. Applications:
    a. Glazed lites in exterior doors.
    b. Glazed sidelights and panels next to doors.
    c. Locations required by applicable federal, state, and local codes and regulations.
    d. Other locations specified or indicated on Drawings.
2. Glass Type: Same as other vision glazing except use fully tempered float glass for both outboard and inboard lites.

2.04 BASIS OF DESIGN - INSULATING GLASS UNITS

A. Basis of Design - Insulating Glass Units: Vision glazing, with low-e coating.
1. Applications: Exterior insulating glass glazing unless otherwise indicated.
2. Thermal Transmittance (U-Value): As specified on Drawings, maximum.
3. Solar Heat Gain Coefficient (SHGC): As specified on Drawings, maximum.
4. Coated Glass: Comply with requirements of ASTM C1376 for pyrolytic (hard-coat) or magnetic sputter vapor deposition (soft-coat) type coatings on flat glass; coated vision glass, Kind CV; coated overhead glass, Kind CO; or coated spandrel glass, Kind CS.
5. Basis of Design - Vitro Architectural Glass (formerly PPG Glass): www.vitroglazings.com/#sle.
6. Outboard Lite: Heat-strengthened float glass, 1/4 inch thick, minimum.
    a. Low-E Coating: Vitro Architectural Glass (formerly PPG Glass) Solarban 60 on #2 surface.
    b. Glass: Clear.
7. Inboard Lite: Heat-strengthened float glass, 1/4 inch thick.
    a. Coating: No coating on inboard lite.
    b. Glass: Clear.
8. Substitutions: See Section 01 6000 - Product Requirements.

2.05 MONOLITHIC GLAZING UNITS

A. Monolithic Interior Vision Glazing:
1. Applications: Interior glazing unless otherwise indicated.
2. Glass Type: Fully tempered float glass.
3. Tint: Clear.
4. Thickness: 1/4 inch, nominal.
5. Glazing Method: Dry glazing method, gasket glazing.

B. Transparent One-Way Mirror: Mirror quality float glass with pyrolytic (hard coat) type coating located on high light level surface of glass; ASTM C1376.
1. Applications: Locations as indicated on the Drawings.
2. Thickness: 1/4 inch.
3. Glass Tint: Grey.
4. Glass Type: Fully tempered.
5. Lighting Ratio: Maintain at least 8:1 lighting level ratio between coated side (bright-observed side) and uncoated side (dim-observer side).
6. Glazing Method: Gasket glazing.
7. Acceptable Manufacturer:
    a. Pilkington North America Inc.; Pilkington Mirropane Transparent Mirror: www.pilkington.com/na/#sle.
    b. Substitutions: See Section 01 6000 - Product Requirements.

2.06 GLAZING COMPOUNDS

A. General Requirements:
   1. Provide black exposed glazing accessory materials, unless specifically indicated otherwise.
   2. Provide materials of hardness as recommended by manufacturer for required application and condition of installation in each case. Provide only compounds which are known to be fully compatible with surfaces contacted, including glass products, seals, and glazing channel surfaces.

B. Silicone Sealant: Single component; neutral curing; capable of water immersion without loss of properties; non-bleeding, non-staining; ASTM C920, Type S, Grade NS, Class 25, Uses M, A, and G; with cured Shore A hardness range of 15 to 25; black color.

2.07 ACCESSORIES

A. Setting Blocks: Silicone, with 80 to 90 Shore A durometer hardness; ASTM C864 Option II. Length of 0.1 inch for each square foot of glazing or minimum 4 inch by width of glazing rabbet space minus 1/16 inch by height to suit glazing method and pane weight and area.

B. Spacer Shims: Neoprene, 50 to 60 Shore A durometer hardness; ASTM C864 Option II. Minimum 3 inch long by one half the height of the glazing stop by thickness to suit application, self adhesive on one face.

C. Glazing Gaskets: Resilient silicone extruded shape to suit glazing channel retaining slot; ASTM C864 Option II; color black.
   1. Size gaskets as required by manufacturer of glazing channel frame to provide proper pressure and bite on glazing units.

D. Glass Mounting System Components: Extruded aluminum, satin anodized finish, unless otherwise specified.
   1. Acceptable Manufacturer:
      a. C.R. Laurence Co., Inc.: www.crlaurence.com.
         1) Face Plate Clamps: Catalog #EH13, brushed nickel.
         2) Corner Posts Extrusions: Catalog #6421000.
         3) Center Post Extrusions: Catalog #6432000.
         4) Post Mounting Base: Catalog #6406002, mill finish.
      b. Substitutions: Refer to Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.01 VERIFICATION OF CONDITIONS

A. Verify that openings for glazing are correctly sized and within tolerances, including those for size, squareness, and offsets at corners.

B. Verify that the minimum required face and edge clearances are being provided.

C. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and support framing is ready to receive glazing system.

D. Proceed with glazing system installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Clean contact surfaces with appropriate solvent and wipe dry within maximum of 24 hours before glazing. Remove coatings that are not tightly bonded to substrates.

B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.

C. Prime surfaces scheduled to receive sealant where required for proper sealant adhesion.

D. Sealed Insulating Glass Units: Seal breather tubes immediately prior to glass unit installation with bead of silicone sealant according to sealed insulating glass unit manufacturers requirements; do not crimp, bend, or otherwise damage breather tubes.

3.03 INSTALLATION - GENERAL

A. Install glazing in compliance with written instructions of glass, gaskets, and other glazing material manufacturers, unless more stringent requirements are indicated, including those in glazing referenced standards.

B. Install glazing sealants in accordance with ASTM C1193, GANA (SM), and manufacturer's instructions.

C. Do not exceed edge pressures around perimeter of glass lites as stipulated by glass manufacturer.

D. Set glass lites of system with uniform pattern, draw, bow, and similar characteristics.

E. Set glass lites in proper orientation so that coatings face exterior or interior as indicated.

F. Prevent glass from contact with any contaminating substances that may be the result of construction operations such as, and not limited to the following; weld splatter, fire-safing, plastering, mortar droppings, etc.

3.04 INSTALLATION - DRY GLAZING METHOD (GASKET GLAZING)

A. Application - Exterior and/or Interior Glazed: Set glazing infills from either the exterior or the interior of the building.

B. Place setting blocks at 1/4 points with edge block no more than 6 inch from corners; do not block weep paths.

C. Rest glazing on setting blocks and push against fixed stop with sufficient pressure on gasket to attain full contact.

D. Install removable stops without displacing glazing gasket; exert pressure for full continuous contact.

3.05 CLEANING

A. Remove excess glazing materials from finish surfaces immediately after application using solvents or cleaners recommended by manufacturers.

B. Remove nonpermanent labels immediately after glazing installation is complete.

C. Clean glass and adjacent surfaces after sealants are fully cured.

D. Clean glass on both exposed surfaces not more than 4 days prior to Date of Substantial Completion in accordance with glass manufacturer's written recommendations.

3.06 PROTECTION

A. Remove and replace glass that is damaged during construction period prior to Date of Substantial Completion.

END OF SECTION

SECTION 08 8733

DECORATIVE GLAZING FILMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Glazing film applied to existing and new glazing assemblies.

B. Glazing assemblies to receive film are indicated on Drawings.

1.02 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Record of product certification for safety requirements.
   2. Preparation instructions and recommendations.
   3. Storage and handling requirements and recommendations.
   4. Installation methods.

C. Samples: For each film product to be used, minimum size 4 inches by 6 inches, representing actual product, color, and patterns.

D. Specimen Warranty.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: Certified by glazing film manufacturer.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of authorities having jurisdiction.

1.06 FIELD CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.07 WARRANTY

A. Provide 10 year manufacturer's replacement warranty to cover film against peeling, cracking, discoloration, and deterioration.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturers:
   1. Manufacturers and products as specified on Drawings.
   2. Substitutions: See Section 01 6000 - Product Requirements.

2.02 MATERIALS

A. Glazing Film: Transparent polyester or vinyl film for permanent bonding to glass.
   1. Applications: Locations as indicated on Drawings.
   2. Series Types: As specified on Drawings.
   3. Colors: As specified on Drawings.

4. Adhesive Type: Pressure sensitive acrylic, or as otherwise recommended by film manufacturer for indicated applications.
5. Surface Burning Characteristics: Flame spread index of 25, maximum, and smoke developed index of 450, maximum, when tested in accordance with 1 (Class A).

B. Accessory Materials: As recommended or required by film manufacturer.

C. Glass Cleaner: As recommended by glazing film manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Field-Applied Film: Verify that existing conditions are adequate for proper application and performance of film.

B. Examine glass and frames. Verify that existing conditions are adequate for proper application and performance of film.

C. Verify glass is not cracked, chipped, broken, or damaged.

D. Verify that frames are securely anchored and free of defects.

E. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Clean glass of dust, dirt, paint, oil, grease, mildew, mold, and other contaminants that would inhibit adhesion.

B. Immediately prior to applying film, thoroughly wash glass with neutral cleaning solution.

C. Protect adjacent surfaces.

D. Do not begin installation until substrates have been properly prepared.

3.03 INSTALLATION

A. Do not apply glazing film when surface temperature is less that 40 degrees F or if precipitation is imminent.

B. Install in accordance with manufacturer's instructions, without air bubbles, wrinkles, streaks, bands, thin spots, pinholes, or gaps, as required to achieve specified performance.

C. Accurately cut film with straight edges to required sizes allowing 1/16 inch to 1/8 inch gap at perimeter of glazed panel unless otherwise required by anchorage method.

D. Seams: Seam film only as required to accommodate material sizes; form seams vertically without overlaps and gaps; do not install with horizontal seams.

E. Clean glass and anchoring accessories following installation. Remove excess sealants and other glazing materials from adjacent finished surfaces.

F. Remove labels and protective covers.

3.04 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

SECTION 09 2116

GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Performance criteria for gypsum board assemblies.
   1. Fire-rated assemblies.

B. Metal stud wall framing.

C. Suspended metal ceiling framing.

D. Acoustic insulation and accessories.
   1. Mullion seal accessories.

E. Gypsum wallboard.

F. Joint treatment and accessories.

1.02 REFERENCE STANDARDS

A. AISI S100 - North American Specification for the Design of Cold-Formed Steel Structural Members.

B. ASTM A641/A641M - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.

C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

D. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members.

E. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.

F. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.

G. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board.

H. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.

I. ASTM C1047 - Standard Specification for Accessories For Gypsum Wallboard and Gypsum Veneer Base.

J. ASTM C1178/C1178M - Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel.

K. ASTM C1396/C1396M - Standard Specification for Gypsum Board.

L. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.

M. ASTM E488/E488M - Standard Test Methods for Strength of Anchors in Concrete Elements.

N. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.

O. ASTM E413 - Classification for Rating Sound Insulation.

P. GA-216 - Application and Finishing of Gypsum Panel Products.

Q. GA-600 - Fire Resistance Design Manual.

R. ICC (IBC) - International Building Code.

S. UL (FRD) - Fire Resistance Directory.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate with mechanical and electrical work. Do not attach or support metal framing to ducts, pipes, conduit, or similar items.
   2. Coordinate installation of ceiling suspension system with installation of overhead structural systems to ensure that inserts and other structural anchorage provisions have been installed to receive ceiling anchors in a manner that will develop their full strength and at spacing required to support ceiling.
   3. Coordinate gypsum board work with requirements of Section 07 8400 to maintain integrity of fire-rated and smoke-rated partitions required to comply with specified regulatory requirements.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on metal framing, gypsum board, accessories, and joint finishing system.
   1. Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing gypsum board installation and finishing, with minimum three years of documented experience.

B. Stud Framing: Products that do not comply with ASTM C645 or ASTM C754 are not permitted.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store and protect products in accordance with referenced standards.

B. Handle gypsum boards to prevent damage to ends, edges, and surfaces.

1.07 FIELD CONDITIONS

A. Maintain ambient temperatures at not less than 40 degrees F for non-adhesive attachment of gypsum board, and not less than 50 degrees F for adhesive attachment.

B. Maintain ambient temperatures at not less than 50 degrees F for a period 48 hours before gypsum board finishing, during installation, and after installation of board materials.

PART 2 PRODUCTS

2.01 GYPSUM BOARD ASSEMBLIES

A. Provide completed assemblies complying with ASTM C840 and GA-216 as applicable.

B. Fire Rated Assemblies: Provide completed assemblies as specified on Drawings.
   1. ICC (IBC) Item Numbers: Comply with applicable requirements of ICC (IBC) for the particular assembly.
   2. Gypsum Association File Numbers: Comply with requirements of GA-600 for the particular assembly.
   3. UL Assembly Numbers: Provide construction equivalent to that listed for the particular assembly in the current UL (FRD).
   4. Where any specified rated assembly requires the use of proprietary gypsum board system products, installation methods or procedures, comply with specified rated assembly requirements including requirements associated with assembly options which may be selected by Contractor.

2.02 METAL FRAMING MATERIALS

A. Acceptable Manufacturers:
   1. ClarkDietrich: www.clarkdietrich.com/#sle.
   2. Jaimes Industries: www.jaimesind.com/#sle.
   3. CEMCO; California Expanded Metal Company: www.cemcosteel.com.
   4. Marino: www.marinoware.com.
   5. R-stud, LLC: www.rstud.com/#sle.
   6. Phillips Manufacturing Co: www.phillipsmfg.com/#sle.

7. SCAFCO Corporation: www.scafco.com/#sle.
8. Steel Construction Systems: www.steelconsystems.com/#sle.
9. Supreme Steel Framing System Association; : www.ssfsa.com//#sle.
10. Substitutions: See Section 01 6000 - Product Requirements.

B. Metal Framing - General: Provide framing materials complying with specified standards and tested assemblies; galvanized sheet steel, 25 gage unless specified, noted, scheduled, or detailed otherwise.
1. Use minimum 20 gage studs at door jambs, tile backing support, and other locations indicated on Drawings.

C. Studs: "C" shaped with ribbed webs, and flanges with rolled edge stiffeners.
1. Runners: U shaped, sized to match studs.
2. Other Stud System Accessories: Manufacturer's standard clips, shoes, ties, reinforcements, fasteners, and other accessories as required for a complete stud framing system.
a. Stud Fasteners: Comply with ASTM C1513; size and length to suit connecting requirements.
3. Furring Members: Hat-shaped sections, minimum depth of 7/8 inch.

D. Partition Head to Structure Connections: Provide mechanical anchorage devices that accommodate deflection using slotted holes, screws, and anti-friction bushings, preventing rotation of studs while maintaining structural performance of partition.
1. Structural Performance: Maintain lateral load resistance and vertical movement capacity required by applicable code, when evaluated in accordance with AISI S100.
2. Material: ASTM A653/A653M steel sheet, SS Grade 50/340, with G60/Z180 hot-dipped galvanized coating.
3. Provide top track preassembled with connection devices spaced to fit stud spacing indicated on Drawings; minimum track length of 12 feet.

E. Non-Structural Framing Accessories:
1. Framing Connectors: ASTM A653/A653M G90 galvanized steel clips; secures cold rolled channel to wall studs for lateral bracing.

2.03 CEILING SUSPENSION SYSTEM COMPONENTS

A. Gypsum Board Interior Ceiling Suspension System:
1. Ceiling Hangers: Type and size as specified in ASTM C754 for conditions and spacing required.
2. Ceiling Hanger Wire: ASTM A641/A641M, Class 1 coating; soft temper, pre-stretched, yield stress load at least three times design load, but not less than 12 gage.
3. Ceiling Hanger Angles: Not less than 7/8 x 7/8 inch x 16 gage galvanized steel formed angles; ASTM A653/A653M, G90 coating, with minimum 5/16 diameter bolted connections.
4. Ceiling Hanger Anchors: Size for three times imposed loads, as determined by ASTM E488/E488M; corrosive resistant materials with loops or holes for attachment of hanger wires.

2.04 BOARD MATERIALS

A. Acceptable Manufacturers - Gypsum-Based Board:
1. American Gypsum Company: www.americangypsum.com/#sle.
2. CertainTeed Corporation: www.certainteed.com/#sle.
3. Continental Building Products: www.continental-bp.com/#sle.
4. Georgia-Pacific Gypsum: www.gpgypsum.com/#sle.
5. National Gypsum Company: www.nationalgypsum.com/#sle.
6. PABCO Gypsum: www.pabcogypsum.com/#sle.
7. USG Corporation: www.usg.com/#sle.
8. Substitutions: See Section 01 6000 - Product Requirements.

B. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
1. Applications: Use for vertical surfaces and ceilings, unless otherwise indicated.
2. Thickness: As indicated on Drawings.

C. Backing Board For Wet Areas:
   1. Applications: Surfaces behind tile in wet areas including toilet rooms.
   2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
   3. Glass-Mat-Faced Backing Board: Coated glass mat water-resistant gypsum backing panel as defined in ASTM C1178/C1178M.
      a. Applications: All other tiling applications, except shower and tub surrounds, unless specifically indicated otherwise on Drawings.
      b. Standard Type Thickness: 5/8 inch.
      c. Acceptable Products:
         1) CertainTeed Corporation; Diamondback Tile Backer: www.certainteed.com/#sle.
         2) Georgia-Pacific Gypsum; DensShield Tile Backer: www.gpgypsum.com/#sle.
         3) National Gypsum Company; Gold Bond eXP Tile Backer: www.nationalgypsum.com/#sle.
         4) Substitutions: See Section 01 6000 - Product Requirements.

D. Water-Resistant Gypsum Board: Water-resistant gypsum backing board as defined in ASTM C1396/C1396M; sizes to minimum joints in place; ends square cut.
   1. Applications: Ceilings and vertical surfaces in "wet" areas but not behind thinset tile.
   2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
   3. Thickness: As indicated on Drawings.
   4. Acceptable Products:
      a. American Gypsum Company; M-Bloc: www.americangypsum.com/#sle.
      b. Georgia-Pacific Gypsum; ToughRock Mold-Guard Gypsum Board: www.gpgypsum.com/#sle.
      c. National Gypsum Company; Gold Bond XP Gypsum Board: www.nationalgypsum.com/#sle.
      d. Substitutions: See Section 01 6000 - Product Requirements.

E. Shaftwall and Coreboard: Type X; 1 inch thick by 24 inches wide, beveled long edges, ends square cut.
   1. Paper-Faced Type: Gypsum shaftliner board or gypsum coreboard as defined ASTM C1396/C1396M; water-resistant faces.

2.05 ACOUSTICAL ACCESSORIES

A. Resilient Furring Channels: ASTM C645 galvanized steel sheet, 25 gage thickness; 1/2 inch depth, for attachment to substrate through one leg only.

B. Acoustic Insulation - General: Use type of acoustical insulation to comply with indicated assembly requirements.

C. Acoustic Insulation: ASTM C665; preformed glass fiber, friction fit type, unfaced.
   1. Thickness: Full thickness of indicated wall framing.

D. Acoustic Sealant: Acrylic emulsion latex or water-based elastomeric sealant; do not use solvent-based non-curing butyl sealant.

E. Resilient Partition Sound Isolation Seals: Resilient solid neoprene rubber sheet, designed to isolate wall assemblies from window frames to reduce flanking structure-borne noise; installed continuously between wall assembly and window frames.
   1. Strip Width: 1-1/2 inch.
   2. Thickness: 1/8 inch.
   3. Acceptable Product:
      a. STC Sound Control; Mullion Seal: www.stcsoundcontrol.com.
      b. Substitutions: See Section 01 6000 - Product Requirements.

2.06 INSTALLATION AND FINISHING ACCESSORIES

A. Finishing Accessories: ASTM C1047, galvanized steel sheet ASTM C1047 G90, rolled zinc, or rigid plastic, unless noted otherwise.
   1. Types: As detailed or required for finished appearance.
   2. Special Shapes: In addition to conventional corner bead and control joints, provide L-bead at exposed panel edges.

B. Special Beads, Joint Accessories, and Other Trim: ASTM C1047, rigid plastic, galvanized steel, or rolled zinc, unless noted otherwise.
   1. Control Joints: One-piece, v-grooved control joint with integral perforated flanges; removable tape to protect v-groove during finishing.
      a. Applications: Locations specifically noted on Drawings; also located at internal corners, wall locations at re-entrant soffit corners, and ceiling locations at re-entrant soffit corners whether or not specifically noted on Drawings.

C. Joint Materials: ASTM C475/C475M, and as recommended by gypsum board manufacturer for project conditions.
   1. Interior Gypsum Board Tape: 2 inch wide, creased paper tape for joints and corners, except as otherwise indicated or specified for proprietary finishing systems.
   2. Joint Compound for Wet Locations: Chemical quick-setting type for first 2 coats, and vinyl type top coat specially formulated for finishing topping.

D. Screws for Fastening of Gypsum Panel Products to Cold-Formed Steel Studs Less than 0.033 inches in Thickness: ASTM C1002; self-piercing tapping screws, corrosion-resistant.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that project conditions are appropriate for work of this Section before commencing work of this Section.

3.02 SHAFT WALL INSTALLATION

A. Shaft Wall Framing: Install in accordance with GA-600 requirements.
   1. Fasten runners to structure with short leg to finished side, using appropriate power-driven fasteners at not more than 24 inches on center.

B. Shaft Wall Coreboard: Cut panels to accurate dimensions and install sequentially between special friction studs.

C. Seal perimeter of shaftwall work where it abuts other work following requirements of Section 07 8400 - Firestopping for firestopping and fire-resistive joint sealant as applicable. Use exposed acoustic sealant at joints exposed to view on finished side.

3.03 FRAMING INSTALLATION

A. Metal Framing: Install in accordance with ASTM C754 and manufacturer's instructions.

B. Suspended Ceilings and Soffits:
   1. Level ceiling and soffit system to a tolerance of 1/600.
   2. Laterally brace entire suspension system.
   3. Space ceiling framing and furring members 16 inches on center, except as otherwise specified.
   4. Space ceiling framing and furring members at water-resistant gypsum board locations not to exceed 12 inches on center.

C. Stud Framing: Space studs as permitted by standard or as specified below.
   1. Space studs 16 inches on center, except as otherwise indicated or required by specified tested assemblies, and secure to floor and ceiling runners with screws.
   2. Provide supplemental framing matching primary wall framing to support cut edges of gypsum boards not supported by primary vertical wall framing members.
   3. Extend partition framing to structure in all locations, unless otherwise indicated on Drawings.
   4. Partitions Terminating at Structure: Attach top runner to structure, maintain clearance between top of studs and structure, and connect studs to track using specified mechanical devices in accordance with manufacturer's instructions; verify free movement of top of stud connections; do not leave studs unattached to track.
      a. At partitions supported by on-grade slabs, provide top slip joint to accommodate 1-1/2 inch vertical movement. Provide deflection tracks or firestop tracks at slip joints where specified, or detailed on Drawings.

5. Isolate stud system from transfer of structural loading to system, both horizontally and vertically. Provide slip or cushioned type joints to attain lateral support free from axial loading. Install each steel framing and furring member so that fastening surfaces do not vary more than 1/8 inch from plane of faces of adjacent framing.

D. Framing Openings: Reinforce openings as required for weight of doors or operable panels, using not less than double studs at jambs.
   1. Access Doors: Coordinate placement of openings for access doors and hatches with Architect before framing opening. Avoid placing openings at highly visible locations on wall and ceilings. Refer to Section 08 3100.

E. Standard Wall Furring: Install at concrete and masonry walls scheduled to receive gypsum board, not more than 4 inches from floor and ceiling lines and abutting walls. Secure in place on alternate channel flanges at maximum 24 inches on center.

F. Blocking: Install wood blocking for support of the following items; see Section 06 1000 for additional requirements:
   1. Framed openings.
   2. Wall-mounted cabinets.
   3. Plumbing fixtures.
   4. Toilet partitions.
   5. Toilet accessories.
   6. Wall-mounted door hardware.
   7. Similar items indicated on Drawings.

3.04 ACOUSTIC ACCESSORIES INSTALLATION

A. Acoustical Furring: Install resilient channels to framing at maximum 24 inches on center. Locate gypsum board joints only over resilient channel members.
   1. Install with open leg facing up.
   2. Do not screw through gypsum board and resilient channel to wall stud; use screws that are only long enough to engage gypsum board and resilient channel.

B. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.

C. Sound Isolation Seals: Apply to vertical window frames continuously in accordance with manufacturer's instructions, and as detailed on Drawings.

D. Acoustic Sealant: Install as follows:
   1. Place one bead continuously on substrate before installation of perimeter framing members.
   2. Place continuous bead at perimeter of each layer of gypsum board.
   3. Seal around all penetrations by conduit, pipe, ducts, and rough-in boxes, except where firestopping is provided.

3.05 BOARD INSTALLATION

A. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.
   1. Space fasteners in accordance with ASTM C840 and manufacturer's recommendations.
   2. Install interior wall and partition boards in accordance with requirements of referenced installation standards, except where fire or sound rating requires a particular direction; comply with the method stated in the tested assembly data.
   3. Locate exposed end-butt joints as far from center of walls and ceilings as possible, and stagger not less than 24 inches in alternate courses of board.

B. Single-Layer Non-Rated Applications: Install gypsum board in most economical direction, with ends and edges occurring over firm bearing.

C. Fire-Resistance-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.
   1. Limit annular space between gypsum wall board edges and electrical device boxes to maximum 1/8 inch, or as limited by applicable Code.

D. Exposed Gypsum Board in Interior Wet Areas: Seal joints, cut edges, and holes with water-resistant sealant.

E. Installation on Metal Framing: Use screws for attachment of gypsum board.

3.06 INSTALLATION OF TRIM AND ACCESSORIES

A. Control Joints: Place control joints consistent with lines of building spaces as indicated on Drawings; if not specifically indicated, provide control joints as follows:
   1. Not more than 30 feet apart on walls and ceilings over 50 feet long.

B. Corner Beads: Install at external corners, using longest practical lengths.

C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.

D. Decorative and Special Trim: Install at locations shown on Drawings and in accordance with manufacturer's instructions.

3.07 JOINT TREATMENT

A. Paper Faced Gypsum Board: Use paper joint tape, embed with drying type joint compound and finish with drying type joint compound.

B. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
   1. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated or specified.
   2. Level 2: In utility areas, behind cabinetry, and on backing board to receive tile finish.
   3. Level 1: Wall areas above finished ceilings, whether or not accessible in the completed construction.

C. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
   1. Feather coats of joint compound so that camber is maximum 1/32 inch.
   2. Taping, filling, and sanding are not required at surfaces behind adhesive applied ceramic tile and fixed cabinetry.
   3. Taping, filling, and sanding are not required at base layer of double-layer applications.

3.08 TOLERANCES

A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet in any direction.

END OF SECTION

SECTION 09 3000

TILING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Tile for floor applications.

B. Tile for wall applications.

C. Non-ceramic trim.

1.02 REFERENCE STANDARDS

A. ANSI A108/A118/A136 - American National Standard Specifications for the Installation of Ceramic Tile (Compendium).

B. ASTM C499 - Standard Test Method for Facial Dimensions and Thickness of Flat, Rectangular Ceramic Wall and Floor Tile.

C. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.

D. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.

E. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.

F. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation.

1.03 DEFINITIONS

A. Module Size: Actual tile size, with minor facial dimension as measured by ASTM C499, plus joint width indicated.

B. Facial Dimension: Actual tile size, with minor facial dimension as measured by ASTM C499.

C. Large Format Tile: Any tile unit that maintains an edge of 15 inches or greater in any dimension.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate location of tiling movement joints on concrete floor substrates with locations of concrete floor expansion and control joints; align substrate joints and tiling system joints where required by specified reference standards.

B. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this Section; require attendance by all affected installers.
   1. Convene under general provisions of Section 01 7000.
   2. Review installation procedures and coordination requirements.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's data sheets on tile, mortar, grout, and accessories. Include instructions for using grouts and adhesives.

C. Shop Drawings: Indicate tile layout, patterns, color arrangement, perimeter conditions, junctions with dissimilar materials, control and expansion joints, and setting details.

D. Samples: Submit manufacturer’s color boards consisting of actual tiles showing full range of colors, textures, and patterns available for each type and composition of tile specified.
   1. Include samples of specified accessories requiring color selection.
   2. Submit manufacturer’s color samples of available grout consisting of actual sections of grout showing full range of colors available for each type of grout specified.

E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

F. Maintenance Data: Include recommended cleaning methods, cleaning materials, and stain removal methods.

1.06 QUALITY ASSURANCE

A. Installer Qualifications:
   1. Company specializing in performing tile installation, with minimum of five years of documented experience.

B. Provide materials obtained from only one manufacturer for each type and color of tile, and for each type of mortar, grout, adhesive, and sealant.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

1.08 FIELD CONDITIONS

A. Comply with referenced standards and manufacturer's recommendations for protection and maintenance of environmental conditions during and after installation.

B. Do not install solvent-based products in an unventilated environment.

C. Maintain ambient and substrate temperature above 50 degrees F and below 100 degrees F during installation and curing of setting and grout materials.
   1. Maintain higher temperatures for proprietary mortars and grouts when recommended by manufacturer.

D. Vent temporary heaters to the exterior to prevent damage to tile work due to carbon dioxide accumulation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturers:
   1. Manufacturers and products specified on Drawings.
   2. Substitutions: See Section 01 6000 - Product Requirements.
      a. Acceptability of substituted items may be determined solely on the basis of design, appearance or finish.

2.02 TRIM AND ACCESSORIES

A. Metal Trim: Extruded aluminum, style, configuration, and dimensions to suit application, for setting using tile mortar or adhesive.
   1. Applications:
      a. Open edges of floor tile.
      b. Wall corners, outside where tile meets.
      c. Transition between floor finishes of different heights.
      d. Floor to wall joints, where specified floor and wall tile do not have manufactured coved units.
      e. Borders and other trim as indicated on Drawings.
   2. Acceptable Manufacturers:
      a. Futura Industries Corp./Futura Transitions: www.futuratransitions.com.
      b. Schluter-Systems: www.schluter.com/#sle.
      c. Genesis APS International: www.genesis-aps.com/#sle.
      d. Substitutions: See Section 01 6000 - Product Requirements.

2.03 SETTING MATERIALS

A. Setting Materials - General:
   1. Use only the types of mortar bed materials to set the types of tile for which the mortar is labeled.

B. Latex-Portland Cement Mortar Bond Coat: ANSI A118.4.
   1. Applications: For floor applications in new construction; high-bond Portland cement mortar.
      a. Acceptable Products:
         1) Custom Building Products; MegaLite Crack Prevention Mortar, ProLite Tile & Stone Mortar, or Complete Contact Fortified Mortar.
         2) LATICRETE International, Inc.; 255 MultiMax or Sure Set.
         3) Mapei Corporation; Ultralite or Ultracontact.
         4) Substitutions: See Section 01 6000 - Product Requirements.
   2. Applications: For wall applications; non-sagging, latex Portland cement mortar.
      a. Acceptable Products:
         1) Custom Building Products; MegaLite or FlexBond Crack Prevention Mortar.
         2) LATICRETE International, Inc.; LATICRETE 254 Platinum.
         3) Mapei Corporation; Ultraflex 3.
         4) Substitutions: See Section 01 6000 - Product Requirements.

2.04 GROUTS

A. Standard Grout: ANSI A118.6 standard cement grout.
   1. Applications: Use this type of grout where indicated and where no other type of grout is indicated.
   2. Use sanded grout for joints 1/8 inch wide and larger; use unsanded grout for joints less than 1/8 inch wide.
   3. Color(s): As selected by Architect from manufacturer's full line.
   4. Acceptable Products:
      a. Custom Building Products; Polyblend Non-Sanded Grout/Sanded Grout: www.custombuildingproducts.com.
      b. LATICRETE International, Inc.; LATICRETE 1500 Sanded Grout/1600 Unsanded Grout: www.laticrete.com.
      c. Mapei Corporation; Keracolor S/U: www.mapei.com
      d. Substitutions: See Section 01 6000 - Product Requirements.

B. Epoxy Grout: ANSI A118.3 chemical resistant and water-cleanable epoxy grout.
   1. Applications: Where indicated or specified.
   2. Color(s): As selected by Architect from manufacturer's full line.
   3. Acceptable Products:
      a. Custom Building Products; CEG-IG 100% Solids Industrial Grade Epoxy Grout: www.custombuildingproducts.com/#sle.
      b. LATICRETE International, Inc.; LATICRETE SPECTRALOCK PRO Premium Grout: www.laticrete.com.
      c. Mapei Corporation; Kerapoxy, Kerapoxy IEG, or Opticolor: www.mapei.com.
      d. Substitutions: See Section 01 6000 - Product Requirements.

2.05 MAINTENANCE MATERIALS

A. Grout Sealer: Liquid-applied, moisture and stain protection for existing or new Portland cement grout.
   1. Composition: Water-based colorless silicone.

2.06 ACCESSORY MATERIALS

A. Concrete Floor Slab Crack Isolation Membrane: Material complying with ANSI A118.12; not intended as waterproofing.
   1. Crack Resistance: No failure at 1/8 inch gap, minimum.
   2. Fluid or Trowel Applied Type:
      a. Thickness: 20 mils, maximum.

3. Acceptable Products:
    a. LATICRETE International, Inc; LATICRETE Blue 92 Anti-Fracture Membrane: www.laticrete.com/#sle.
    b. Merkrete, by Parex USA, Inc; Merkrete Fracture Guard: www.merkrete.com/#sle.
    c. Substitutions: See Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that subfloor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive tile.

B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive tile.

C. Verify that subfloor surfaces are dust free and free of substances that could impair bonding of setting materials to subfloor surfaces.

D. Cementitious Subfloor Surfaces: Verify that substrates are ready for tiling installation by testing for moisture and alkalinity (pH).
    1. Test as Follows:
        a. Alkalinity (pH): ASTM F710.
        b. Internal Relative Humidity: ASTM F2170.
        c. Moisture Vapor Emission: ASTM F1869.
    2. Obtain instructions if test results are not within limits recommended by tiling material manufacturer and setting material manufacturer.

E. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

A. Protect surrounding work from damage.

B. Vacuum clean surfaces and damp clean.

C. Repair substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.

3.03 INSTALLATION - GENERAL

A. Install tile and grout in accordance with applicable requirements of ANSI A108.1a through ANSI A108.19, manufacturer's instructions, and TCNA (HB) recommendations.

B. Blending: For tile exhibiting color or pattern variations within the ranges of accepted submittals, verify that tile has been blended in the packages so that tile units taken from one package show same range in colors or patterns as those taken from other packages. If not blended in the packages, blend tile in the field before installation.

C. Floor System Coverage: Where specified for individual setting methods, install floor tile units with 100 percent mortar coverage by complying with applicable special requirements for back buttering of tile units in referenced ANSI A108 specifications.

D. Install crack isolation membrane to comply with ANSI A118.10 and membrane manufacturer's written instructions for full floor coverage.

E. Movement Joints: Comply with TCNA (HB) Method EJ171F requirements for locations, spacing, and installation of applicable movement joints, whether or not specifically indicated or detailed on Drawings, and as follows:
    1. Spacing - Interior: Maximum 24 feet on center in each direction.
    2. Spacing - Above-Ground Concrete Slabs: Maximum 10 feet on center in each direction.
    3. Joint Width: Match adjacent grouted joint widths, unless TCNA EJ171 requires a specific joint width based on joint location or joint service conditions.

4. Apply sealant joint to junction of tile and dissimilar materials and junction of dissimilar planes, including but not limited to floor to wall joints, corners, and metal trim and non-ceramic accessory items.
5. Keep movement joints free of setting adhesive and grout.
6. Form internal angles and corners square, not grouted, with sealant joint.
7. Form external angles and corners square, not grouted, with sealant joint.
8. Apply specified sealant to joints.

F. Lay tile to pattern indicated. Do not interrupt tile pattern through openings.

G. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly.
1. Where floor and wall tile are of same dimensional module, align floor and wall joints.

H. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make grout joints without voids, cracks, excess mortar or excess grout, or too little grout.

I. Install non-ceramic trim in accordance with manufacturer's instructions.

J. Sound tile after setting. Remove and replace hollow sounding units.

K. Keep control and expansion joints free of mortar, grout, and adhesive.

L. Prior to grouting, allow installation to completely cure; minimum of 48 hours.

M. Grout tile joints, except where movement joints are indicated or specified.

N. At changes in plane and tile-to-tile control joints, use tile sealant instead of grout, with either bond breaker tape or backer rod as appropriate to prevent three-sided bonding.

O. Allow completed tiling assemblies to cure full 72 hours before allowing heavy foot or equipment traffic on final installations.

P. Seal joints between tile work and other work with sealant specified in Section 07 9200.

Q. Remove tiling installations that do not conform to specified requirements and tolerances, particularly lippage tolerances, and re-install in compliance with specified requirements.

3.04 INSTALLATION - FLOORS - THIN-SET METHODS

A. Over interior concrete substrates, install in accordance with TCNA (HB) Method F113, latex-Portland cement bond coat.
1. Grout Type: Standard grout with grout sealer.
2. Provide 100 percent coverage of setting mortar over tile back surfaces.
3. Use crack isolation membrane under all tile meeting or exceeding definition of large format tile units in nominal face dimension, and also where specified.

3.05 INSTALLATION - WALL TILE

A. Over coated glass mat backer board on studs, install in accordance with TCNA (HB) Method W245.
1. Grout Type: Standard grout with grout sealer.

3.06 TOLERANCES

A. Comply with applicable requirements of ANSI A108.2, unless otherwise specified in this Section.

B. Flatness - Finished Tiling Surfaces:
1. Ceramic Tile: 1/4 inch in 10 feet.
2. Pressed Tile and Porcelain Tile: 1/4 inch in 10 feet.
3. Stone Tile: 1/8 inch in 10 feet.

C. Lippage - Adjacent Tile Units:
1. Wall Tile Installations - Severe Lighting: 1/32 inch; joint width 1/16 inch to less than 1/4 inch; all tile sizes.
2. Glazed Tile and Mosaic Tile: 1/32 inch; joint width 1/16 inch to 1/8 inch; 1 x 1 inch to 6 x 6 inch tile size.
3. Stone Tile: 1/16 inch; joint width 1/4 inch or greater; 6 x 6 inch to 8 x 8 inch tile size.

4. Pressed Floor Tile and Porcelain Tile: 1/32 inch; joint width 1/16 inch to less than 1/4 inch; all tile sizes.
5. Pressed Floor Tile and Porcelain Tile: 1/16 inch; joint width greater than 1/4 inch; all tile sizes.

3.07 CLEANING

A. Clean tile and grout surfaces.

B. Unglazed tile may be cleaned with sulfamic acid solutions only when permitted by the tile and grout manufacturer's printed instructions, but not sooner than 14 days after completion of installation. Protect metal surfaces, iron, and vitreous fixtures from effects of acid cleaning. Flush surfaces with clean water before and after acid cleaning.

C. Leave finished installation clean and free of cracked, chipped, broken, un-bonded, or otherwise defective tile work.

3.08 PROTECTION

A. Do not permit traffic over finished floor surface for minimum 7 days after installation.

END OF SECTION

SECTION 09 5100

ACOUSTICAL CEILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Suspended metal grid ceiling system.

B. Acoustical units.

C. Supplementary acoustical insulation above ceiling.

1.02 REFERENCE STANDARDS

A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

B. ASTM C635/C635M - Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.

C. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels.

D. ASTM E1264 - Standard Classification for Acoustical Ceiling Products.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate the location of hangers with other work.

B. Sequencing: Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.
   1. Do not install acoustical units until after interior wet work is dry.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on suspension system components and acoustical units.

C. Samples: Submit two samples minimum 6 by 6 inch in size illustrating material and finish of acoustical units.

D. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Extra Acoustical Units: 80 sq ft of each type and size.

1.05 QUALITY ASSURANCE

A. System Installer Qualifications: Company specializing in the installation of products specified in this Section with minimum three years documented experience.

1.06 FIELD CONDITIONS

A. Maintain uniform temperature of minimum 60 degrees F, and maximum humidity of 20 to 40 percent prior to, during, and after acoustical unit installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturers - Acoustic Panels:
   1. Manufacturers and ceiling panel products specified on Drawings.
   2. Substitutions: See Section 01 6000 - Product Requirements.
      a. Acceptability of substituted items may be determined solely on the basis of design, appearance or finish.

B. Acceptable Manufacturers - Suspension Systems:
   1. Same as for acoustical units.
   2. Substitutions: See Section 01 6000 - Product Requirements.

2.02 ACOUSTICAL CEILINGS

A. Acoustical Units - General: ASTM E1264, Class A.

2.03 SUSPENSION SYSTEMS

A. Metal Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with perimeter moldings, hold down clips, stabilizer bars, clips, and splices as required.
   1. Steel Grid: ASTM A653/A653M, G30 coating, unless otherwise indicated.
   2. Finish: Manufacturer's standard, unless otherwise specified for grid type and location.

B. Exposed Suspension System, Type 1: Hot-dipped galvanized steel grid and cap.
   1. Structural Classification: Intermediate-duty, when tested in accordance with ASTM C635/C635M.
   2. Profile: Tee; 15/16 inch face width.
   3. Finish: Baked enamel.
      a. High-Humidity Finish: Manufacturer's standard finish classified for severe environmental performance.
   4. Color: White.

C. Exposed Suspension System, Type 2: Hot-dipped galvanized steel grid and cap.
   1. Structural Classification: Intermediate-duty, when tested in accordance with ASTM C635/C635M.
   2. Profile: Tee; 9/16 inch face width.
   3. Finish: Baked enamel.
      a. High-Humidity Finish: Manufacturer's standard finish classified for severe environmental performance.
   4. Color: White.

2.04 ACCESSORIES

A. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.

B. Hanger Wire: Minimum 12 gauge, 0.08 inch galvanized steel wire.

C. Hold-Down Clips: Manufacturer's standard clips to suit application.

D. Perimeter Trim Profiles: Same material and finish as grid.
   1. Size: As required for installation conditions.
   2. Angle Molding: L-shaped, for mounting at same elevation as face of grid.

E. Metal Edge Trim for "Cloud" Suspension Systems: Extruded aluminum; provide attachment clips, splice plates, and preformed corner pieces for complete trim system.
   1. Trim Height: AS indicated on Drawings.
   2. Finish: Baked enamel.
   3. Color: As indicated on Drawings.
   4. Acceptable Products:
      a. Armstrong World Industries, Inc.; Axiom Classic Trim: www.armstrong.com.
      b. USG Corporation; Compasso Suspension Trim: www.usg.com/ceilings/#sle.
      c. Substitutions: See Section 01 6000 - Product Requirements.

F. Touch-up Paint: Type and color to match acoustical and grid units.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that layout of hangers will not interfere with other work.

3.02 PREPARATION

A. Install after major above-ceiling work is complete.

3.03 INSTALLATION - SUSPENSION SYSTEM

A. Install suspension system in accordance with ASTM C636/C636M and manufacturer's instructions and as supplemented in this section.

B. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.

C. Locate system on room axis according to reflected plan.

D. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
   1. Use longest practical lengths.
   2. Overlap and rivet corners.

E. Suspension System, Non-Seismic: Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.

F. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.

G. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.

H. Support fixture loads using supplementary hangers located within 6 inches of each corner, or support components independently.
   1. Support all fixtures weighing less than 56 lb by at least two supplementary No. 12 gage hangers if required by applicable building code; hangers may be slack.

I. Do not eccentrically load system or induce rotation of runners.

3.04 INSTALLATION - ACOUSTICAL UNITS

A. Install acoustical units in accordance with manufacturer's instructions.

B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.

C. Lay directional patterned units with pattern parallel to shortest room axis, unless otherwise indicated or directed.

D. Fit border trim neatly against abutting surfaces.

E. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.

F. Cutting Acoustical Units:
   1. Cut to fit irregular grid and perimeter edge trim.
   2. Make field cut edges of same profile as factory edges; finish cut edges to match factory finished edges if cut edge is exposed to view.

G. Install hold-down clips on panels within 20 ft of an exterior door.

3.05 TOLERANCES

A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.

B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

END OF SECTION

SECTION 09 5426

SUSPENDED WOOD CEILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wood grilles.

B. Metal suspension system.

1.02 REFERENCE STANDARDS

A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

B. ASTM C635/C635M - Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.

C. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels.

D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

E. CISCA (WC) - Wood Ceilings Technical Guidelines.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
1. Coordinate the installation of ceiling system with size, location and installation of fire sprinkler system.
2. Coordinate the location of hangers with other work.

B. Sequencing:
1. Sequence work to ensure ceilings are not installed until building is enclosed, dust generating activities have terminated, and overhead work is completed.
2. Do not install ceiling until after interior wet work is dry.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate grid layout and related dimensioning, attachment of wood ceiling components to grid, accessory attachments, junctions with other ceiling finishes, and mechanical and electrical items installed in the ceiling.

C. Product Data: Provide data on wood ceiling components and suspension system components.

D. Samples: Submit two full size samples illustrating material and finish of wood ceiling components.

E. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the work of this Section.
1. Minimum three years documented experience.

B. Basis of Design: Specifications are based on linear wood ceiling systems by specified basis of design manufacturer. Systems manufactured by other acceptable manufacturers are permitted, subject to compliance with specified requirements; and provided that deviations in design, finish, weight, and profile are minor, and do not detract substantially from the indicated design intent.
1. Comply with requirements specified in Section 01 4000 and Section 01 6000.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver wood ceiling components to project site in original, unopened packages.

B. Store in fully enclosed space, flat, level and off the floor.

1.07 FIELD CONDITIONS

A. Do not install suspended wood ceiling system until wet construction work is complete and permanent heat and air conditioning is installed and operating.

B. Maintain room temperature between 60 degrees F and 75 degrees F and relative humidity between 35 to 55 percent before, during, and after installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design Manufacturer:
1. Armstrong World Industries, Inc.: www.armstrong.com/woodworks.
a. System As specified on Drawings.
2. Substitutions: See Section 01 6000 - Product Requirements.

B. Other Acceptable Manufacturers:
1. 9Wood: www.9wood.com/#sle.
2. Rulon International: www.rulonco.com/#sle.
3. USG Corporation: www.usg.com/ceilings/#sle.
4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 SUSPENDED WOOD CEILING SYSTEM

A. Performance Requirements:
1. Design for maximum deflection of 1/360 of span.
2. Surface Burning Characteristics: Flame spread index of 25, smoke developed index of 450, when tested in accordance with ASTM E84.

B. Wood-Based Materials:
1. Solid Wood: Clear, dry, sound, plain sawn, selected for compatible species, grain and color, no defects.

C. Metal Suspension System:
1. General: Comply with ASTM C635/C635M; die cut and interlocking components, with perimeter moldings, hold down clips, stabilizer bars, clips, and splices as required.
a. Materials:
1) Steel Grid: ASTM A653/A653M, G30 coating, unless otherwise indicated.
b. Finish/Color: Baked enamel, black.
2. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement.

D. Accessories: Manufacturer's standard accessories for installation method indicated, seismic requirements and above-ceiling accessibility.

2.03 FABRICATION

A. Shop fabricate wood ceiling components to the greatest extent possible.

B. Fabricate components to allow access to ceiling plenum as required.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Do not install ceiling until after interior wet work is dry.

3.02 PREPARATION

A. Layout wood ceiling components in pattern according to reflected ceiling plan and as shown on shop drawings.

B. Acclimate wood ceiling materials by removing from packaging in installation area a minimum of 48 hours prior to installation.

3.03 INSTALLATION

A. General: Install suspended wood ceiling system in accordance with CISCA (WC).

B. Suspension System:
   1. Install suspension system in accordance with ASTM C636/C636M and manufacturer's instructions and as supplemented in this section.
   2. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.
   3. Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.
   4. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.
   5. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.
   6. Support fixture loads using supplementary hangers located within 6 inches of each corner, or support components independently.
   7. Do not eccentrically load system or induce rotation of runners.

C. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.

D. Wood Ceiling:
   1. Install wood ceilings in accordance with manufacturer's instructions.
   2. Fit wood components in place, free from damaged edges or other defects detrimental to appearance and function.
   3. Install components in uniform plane, and free from twist, warp, and dents.
   4. Cut to fit irregular grid and perimeter edge trim.
   5. Make field cut edges of same profile as factory edges, seal and finish according to manufacturer.
   6. Install clips, stabilizer bars, and other attachments as indicated to secure wood ceiling components tight to the grid system.
   7. Install acoustical backer above wood ceiling components; fit tight between grid members.

3.04 TOLERANCES

A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.

3.05 CLEANING

A. Clean and touch up minor finish damage. Remove and replace components that cannot be successfully cleaned and repaired.

END OF SECTION

SECTION 09 6500

RESILIENT FLOORING AND BASE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Resilient flooring.

B. Resilient wall base.

C. Flooring system accessories.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Sequencing:
   1. Install resilient flooring and accessories after other finishing operations, including painting have been completed.
   2. Do not install resilient flooring over concrete slabs until slabs have been fully cured, and are sufficiently dry to achieve proper bond with adhesive as determined by resilient flooring manufacturer's recommended bond and moisture test.

1.03 REFERENCE STANDARDS

A. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.

B. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.

C. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.

C. Verification Samples: Submit two samples, minimum 12 x 12 inch in size illustrating color and pattern for each resilient flooring product specified.

D. Certification: Prior to installation of flooring, submit written certification by flooring manufacturer and adhesive manufacturer that condition of subfloor is acceptable.

E. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in installing specified flooring with minimum three years documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Upon receipt, immediately remove any shrink-wrap and check materials for damage and the correct style, color, quantity and run numbers.

B. Deliver and store materials in manufacturer's original unopened containers, with brand names and production lot numbers clearly marked.

C. Store all materials off of the floor in an acclimatized, weather-tight space until ready for installation. Maintain storage space within lower and upper temperature and humidity limits required by flooring manufacturer

D. Store materials for not less than 48 hours prior to installation in area of installation at a minimum temperature of 65 degrees F to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F and not exceeding 85 degrees F, unless otherwise restricted by flooring manufacturer. Maintain temperature and relative humidity at the same levels during installation, and after installation.
   1. Protect roll materials from damage by storing on end.
   2. Do not double stack pallets.

1.07 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Resilient Flooring: Provide manufacturer's warranty, as follows:
   1. Materials: Minimum 2 years from date of purchase.
   2. Installation: Minimum 2 years from date of installation; warrant entire installation against loss of adhesion to substrates.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturers:
   1. Manufacturers and products specified on Drawings.
   2. Substitutions: See Section 01 6000 - Product Requirements.
      a. Acceptability of substituted items may be determined solely on the basis of design, appearance or finish.

2.02 RESILIENT BASE

A. Resilient Base: ASTM F1861, Type TS rubber, vulcanized thermoset; Style B, Cove.
   1. Height: 4 inch.
   2. Thickness: 0.125 inch.
   3. Length: Roll.
   4. Color: To be selected by Architect from manufacturer's full range.
   5. Accessories: Premolded external corners and internal corners.

2.03 ACCESSORIES

A. Subfloor Filler: White premix latex; type recommended by adhesive material manufacturer.

B. Adhesives: Waterproof; types recommended by flooring manufacturer.
   1. Comply with volatile organic compound (VOC) content and emissions restrictions specified in Section 01 6116 - VOC Content and Emissions Restrictions.

C. Metal Edge Trim: Extruded aluminum, style, configuration, and dimensions to suit application, for setting using adhesive.
   1. Applications:
      a. Open edges of flooring.
      b. Transition between floor finishes of different heights.
      c. Thresholds at door openings.
      d. Borders and other trim as indicated on Drawings.
   2. Acceptable Manufacturers:
      a. Futura Industries Corp./Futura Transitions: www.futuratransitions.com.
      b. Schluter-Systems: www.schluter.com/#sle.
      c. Genesis APS International: www.genesis-aps.com/#sle.
      d. Substitutions: See Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of flooring to substrate.

B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive resilient base.

C. Cementitious Subfloor Surfaces: Verify that substrates are ready for resilient flooring installation by testing for moisture and alkalinity (pH).
   1. Test as Follows:
      a. Alkalinity (pH): ASTM F710.
      b. Internal Relative Humidity: ASTM F2170.
      c. Moisture Vapor Emission: ASTM F1869.
   2. Obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.

D. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

A. Prepare floor substrates as recommended by flooring and adhesive manufacturers.

B. Remove subfloor ridges and bumps. Fill minor low spots, cracks, joints, holes, and other defects with subfloor filler to achieve smooth, flat, hard surface.

C. Prohibit traffic until filler is fully cured.

D. Clean substrate.

3.03 INSTALLATION - GENERAL

A. Starting installation constitutes acceptance of subfloor conditions.

B. Install in accordance with manufacturer's written instructions.

C. Adhesive-Applied Installation:
   1. Spread only enough adhesive to permit installation of materials before initial set.
   2. Fit joints and butt seams tightly.
   3. Set flooring in place, press with heavy roller to attain full adhesion.

D. Where type of floor finish, pattern, or color are different on opposite sides of door, terminate flooring under centerline of door.

E. Install edge strips at unprotected or exposed edges, where flooring terminates, and where indicated.
   1. Metal Strips: Attach to substrate before installation of flooring using stainless steel screws.

F. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.

3.04 INSTALLATION - TILE AND PLANK FLOORING

A. Mix tile from container to ensure shade variations are consistent when tile is placed, unless otherwise indicated in manufacturer's installation instructions.

B. Lay flooring with joints and seams parallel to building lines to produce symmetrical pattern.

C. Install square tile to indicated pattern. Allow minimum 1/2 full size tile width at room or area perimeter.

D. Install plank tile with a random offset of at least 6 inches from adjacent rows.

3.05 INSTALLATION - RESILIENT BASE

A. Fit joints tightly and make vertical. Install in longest lengths possible; maintain minimum dimension of 18 inches between joints.

B. Miter internal corners. At external and internal corners, use premolded units.
   1. At exposed ends, use premolded units.

C. Install base on solid backing. Bond tightly to wall and floor surfaces.

D. Scribe and fit to door frames and other interruptions.

3.06 CLEANING

A. Remove excess adhesive from floor, base, and wall surfaces without damage.

B. Clean in accordance with manufacturer's written instructions.

3.07 PROTECTION

A. Prohibit traffic on resilient flooring for 48 hours after installation.

END OF SECTION

SECTION 09 6566

RESILIENT ATHLETIC FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Rubber sheet flooring, adhesively installed.

1.02 REFERENCE STANDARDS

A. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.

B. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's printed data sheets for products specified.

C. Verification Samples: Actual flooring material specified, not less than 12 inch square, mounted on solid backing.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer certified in writing by the flooring manufacturer to be qualified for installation of specified flooring system.

B. Basis of Design: Specifications for flooring products are based on systems by the specified basis of design manufacturer. Flooring types manufactured by other acceptable manufacturers are permitted, subject to compliance with all performance requirements; and provided that deviations in composition and coloration are minor, and do not detract substantially from the indicated design intent.
   1. Comply with requirements specified in Section 01 4000 and Section 01 6000.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to project site in unopened containers clearly labeled with manufacturer's name and identification of contents.

B. Store materials in dry and clean location until needed for installation. During installation, handle in a manner that will prevent marring and soiling of finished surfaces.

1.06 FIELD CONDITIONS

A. Install resilient flooring and accessories after other finishing operations, including painting have been completed.

B. Maintain temperature in spaces to receive adhesively installed resilient flooring within range of 70 to 95 degrees F for not less than 48 hours before the beginning of installation and for not less than 48 hours after installation has been completed. Subsequently, do not allow temperature in installed spaces to drop below 50 degrees F or to go above 100 degrees F.

1.07 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Resilient Flooring: Provide manufacturer's warranty, as follows:
   1. Materials: Minimum 2 years from date of purchase.
   2. Installation: Minimum 2 years from date of installation; warrant entire installation against loss of adhesion to substrates.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design Manufacturers:
   1. As specified on Drawings for each flooring product.
   2. Substitutions: See Section 01 6000 - Product Requirements.
      a. Acceptability of substituted items may be determined solely on the basis of design, appearance or finish.

2.02 ACCESSORIES

A. Leveling Compound: Latex-modified cement formulation as recommended by flooring manufacturer for substrate conditions.

B. Primers and Adhesives: Waterproof; types specifically required and supplied by flooring manufacturer for use under indicated project conditions, and to provide specified warranty regardless of moisture content of substrates at time of installation.
   1. Comply with volatile organic compound (VOC) content and emissions restrictions specified in Section 01 6116 - VOC Content and Emissions Restrictions.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates for conditions detrimental to installation of athletic flooring. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of athletic flooring to substrate.

C. Cementitious Subfloor Surfaces: Verify that substrates are ready for resilient flooring installation by testing for moisture and alkalinity (pH).
   1. Test as Follows:
      a. Alkalinity (pH): ASTM F710.
      b. Internal Relative Humidity: ASTM F2170.
      c. Moisture Vapor Emission: ASTM F1869.
   2. Obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.

3.02 PREPARATION

A. Prepare floor substrates as recommended by flooring and adhesive manufacturers.

B. Concrete: Use leveling compound as necessary to achieve substrate flatness of plus or minus 1/8 inch within 10 ft radius.

C. Remove coatings that are incompatible with flooring adhesives, using methods recommended by flooring manufacturer.

D. Broom clean areas to receive athletic flooring immediately before beginning installation.

3.03 INSTALLATION

A. Starting installation constitutes acceptance of subfloor conditions.

B. Install in accordance with manufacturer's written instructions.

C. Resilient Sheet Flooring:
   1. Unroll flooring and allow to relax before beginning installation.
   2. Mix adhesive thoroughly and apply to substrate with notched trowel. Roll flooring into fresh adhesive, butting factory edges and compression fitting.
   3. Roll entire flooring surface with steel roller to assure adhesion to substrate and eliminate air bubbles.

4. Immediately remove any adhesive from flooring surface, using chemical recommended by flooring manufacturer.
5. Weld seams using techniques and equipment recommended by manufacturer.
6. Lay out game lines using tape and taping machine approved by flooring manufacturer. Apply game line paint with roller, and allow to dry before removing tape.
7. Apply transparent top coat over flooring if recommended by manufacturer, to achieve a uniform finished appearance.

3.04 CLEANING

A. Clean flooring using methods recommended by manufacturer.

3.05 PROTECTION

A. Protect finished athletic flooring from construction traffic to ensure that it is without damage upon Date of Substantial Completion.

END OF SECTION

SECTION 09 6813

TILE CARPETING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Carpet tile, fully adhered.

1.02 REFERENCE STANDARDS

A. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.

B. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.

C. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.

D. CRI 104 - Standard for Installation of Commercial Carpet.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.

C. Samples: Submit two carpet tiles illustrating color and pattern design for each carpet color selected.

D. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

E. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Extra Carpet Tiles: Quantity equal to 5 percent of total installed of each color and pattern installed.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in installing carpet tile with minimum three years documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver carpeting materials in original mill protective wrapping, with mill register numbers and tags attached.

B. Store inside, in well ventilated area, protected from weather, moisture, and soiling.

1.06 FIELD CONDITIONS

A. Stage materials in area of installation for minimum period of 24 hours prior to installation.

B. Maintain minimum 70 degrees F ambient temperature 24 hours prior to, during and 24 hours after installation.

C. Ventilate installation area during installation and for 72 hours after installation.

D. Do not commence with carpet installation until painting and finishing work is complete and ceilings and overhead work has been tested, approved, and completed.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturers:
   1. Manufacturers and products specified on Drawings.
   2. Substitutions: See Section 01 6000 - Product Requirements.
      a. Acceptability of substituted items may be determined solely on the basis of design, appearance or finish.

2.02 ACCESSORIES

A. Subfloor Filler: White premix latex; type recommended by flooring material manufacturer.

B. Metal Edge Trim: Satin natural anodized extruded aluminum, style, configuration, and dimensions to suit application, for setting using tile mortar or adhesive.
   1. Applications:
      a. Open edges of tile carpeting.
      b. Transition between floor finishes of different heights.
   2. Acceptable Manufacturers:
      a. Schluter-Systems: www.schluter.com/#sle.
      b. Futura Industries Corp./Futura Transitions: www.futuratransitions.com.
      c. Genesis APS International: www.genesis-aps.com/#sle.
      d. Substitutions: See Section 01 6000 - Product Requirements.

C. Resilient Wall Base: Specified in Section 09 6500.

D. Carpet Tile Adhesive: Recommended by carpet tile manufacturer; releasable type.
   1. Comply with volatile organic compound (VOC) content and emissions restrictions specified in Section 01 6116 - VOC Content and Emissions Restrictions.

E. Miscellaneous Materials: Provide other items recommended by carpet manufacturer and installer for the indicated conditions of carpet use, and as required for complete installation.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that subfloor surfaces are smooth and flat within tolerances specified for that type of work and are ready to receive carpet tile.

B. Verify that subfloor surfaces are dust-free and free of substances that could impair bonding of adhesive materials to subfloor surfaces.

C. Cementitious Subfloor Surfaces: Verify that substrates are ready for flooring installation by testing for moisture and alkalinity (pH).
   1. Test as Follows:
      a. Alkalinity (pH): ASTM F710.
      b. Internal Relative Humidity: ASTM F2170.
      c. Moisture Vapor Emission: ASTM F1869.
   2. Obtain instructions if test results are not within limits recommended by flooring material manufacturer and adhesive materials manufacturer.

D. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

A. Prepare floor substrates as recommended by flooring and adhesive manufacturers.

B. Remove subfloor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with subfloor filler.

C. Apply, trowel, and float filler to achieve smooth, flat, hard surface. Prohibit traffic until filler is cured.

D. Vacuum clean substrate.

3.03 INSTALLATION

A. Starting installation constitutes acceptance of subfloor conditions.

B. Install carpet tile in accordance with manufacturer's instructions and CRI 104 (Commercial).

C. Blend carpet from different cartons to ensure minimal variation in color match.

D. Cut carpet tile clean. Fit carpet tight to intersection with vertical surfaces without gaps.

E. Lay carpet tile in indicated pattern, with pile direction alternating to next unit, set parallel to building lines unless otherwise indicated on Drawings.

F. Locate change of color or pattern between rooms under door centerline.

G. Fully adhere carpet tile to substrate.

H. Trim carpet tile neatly at walls and around interruptions.

I. Install edge strips at unprotected or exposed edges, where flooring terminates, and where indicated.
   1. Metal Strips: Attach to substrate before installation of flooring using stainless steel screws.

3.04 CLEANING

A. Remove excess adhesive without damage, from floor, base, and wall surfaces.

B. Clean and vacuum carpet surfaces.

END OF SECTION

SECTION 09 8430

ACOUSTICAL WALL UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Acoustical wall units.

1.02 REFERENCE STANDARDS

A. ASTM C423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's printed data sheets for products specified.

C. Shop Drawings: Fabrication and installation details, panel layout, and fabric orientation.

D. Samples: Submit two samples of each type of panel specified; minimum 6 by 6 inch in size, illustrating material, finish, construction, and edge details.

E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Extra Panels: Quantity equal to 5 percent of total installed, but not less than one of each type.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: Acceptable to the manufacturer of the acoustical products being installed.

B. Basis of Design: Specifications are based on acoustical accessory types by specified basis of design manufacturer. Acoustical accessory types manufactured by other acceptable manufacturers are permitted, subject to compliance with specified requirements; and provided that deviations in design, weight, profile, and performance are minor, and do not detract substantially from the indicated design intent.
   1. Comply with requirements specified in Section 01 4000 and Section 01 6000.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect acoustical units from moisture during shipment, storage, and handling. Deliver in factory-wrapped bundles; do not open bundles until units are needed for installation.

B. Store units flat, in dry, well-ventilated space; do not stand on end.

C. Protect edges from damage.

1.06 MOCK-UP

A. Comply with general mock-up requirements specified in Section 01 4000.

B. Construct mock-up of acoustical units at location as indicated by Architect.
   1. Do not proceed with remaining work until Architect approves workmanship and appearance.
   2. Approved mock-up may remain as part of the Work.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design Manufacturers:
   1. Manufacturer and products as specified on Drawings.
   2. Substitutions: Section 01 6000 - Product Requirements.

B. Provide all acoustical products of each type specified herein or on Drawings by same manufacturer.

2.02 ACOUSTICAL UNITS - GENERAL

A. Surface Burning Characteristics: Flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.

B. Acoustical Absorption: Perform testing in accordance with ASTM C423, Type A mounting method unless otherwise indicated or specified.

2.03 FABRICATION

A. Tolerances: Fabricate to finished tolerance of plus or minus 1/16 inch for thickness, overall length and width, and squareness from corner to corner.

2.04 ACCESSORIES

A. Wall Mounting Accessories: Manufacturer's standard accessories for concealed support, designed to allow panel or unit removal, unless otherwise required by manufacturer for specified acoustical units.

B. Panel Adhesive: Acceptable to acoustical panel manufacturer for application as indicated.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates for conditions detrimental to installation of acoustical units. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install acoustical units in locations as indicated, following manufacturer's installation instructions.

B. Install mounting accessories and supports in accordance with shop drawings.

C. Align panels accurately, with edges plumb and top edges level. Scribe to fit accurately at adjoining work and penetrations.

D. Install acoustical units to construction tolerances of plus or minus 1/16 inch for the following:
1. Plumb and level.
2. Flatness.
3. Width of joints.

3.03 CLEANING

A. Clean upon completion of installation from dust and other foreign materials, following manufacturer's instructions.

3.04 PROTECTION

A. Provide protection of installed acoustical panels until Date of Substantial Completion.

B. Replace panels that cannot be cleaned and repaired to satisfaction of the Architect.

END OF SECTION

SECTION 09 9113

EXTERIOR PAINTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.

B. Field application of paints.

1.02 DEFINITIONS

A. Comply with ASTM D16 for interpretation of terms used in this section.

B. Gloss Ratings: ASTM D523; on 60 and 85 degree gloss meters:
1. MPI Gloss Level 1 (Flat): Not more than five units at 60 degrees and 10 units at 85 degrees.
2. MPI Gloss Level 2 (Velvet): Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees.
3. MPI Gloss Level 3 (Eggshell): 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees.
4. MPI Gloss Level 4 (Satin): 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees.
5. MPI Gloss Level 5 (Semi-Gloss): 35 to 70 units at 60 degrees.
6. MPI Gloss Level 6 (Gloss): 70 to 85 units at 60 degrees.
7. MPI Gloss Level 7 (High Gloss): More than 85 units at 60 degrees.

1.03 REFERENCE STANDARDS

A. ASTM D523 - Standard Test Method for Specular Gloss.

B. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications.

C. SSPC-SP 1 - Solvent Cleaning.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide complete list of products to be used, with the following information for each:
1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
2. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
3. Manufacturer's installation instructions.

C. Samples: Submit two painted samples, illustrating selected colors and textures for each color and system selected with specified coats cascaded. Submit on aluminum sheet, 8 x 10 inch in size.

D. Manufacturer's Instructions: Indicate special surface preparation procedures and substrate conditions requiring special attention.

E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. See Section 01 6000 - Product Requirements, for additional provisions.
2. Extra Paint and Finish Materials: 1 gallon of each color; from the same product run, store where directed.
3. Label each container with color in addition to the manufacturer's label.

1.05 QUALITY ASSURANCE

A. Applicator Qualifications: Company specializing in performing the type of work specified with minimum three years experience.

B. Basis of Design: Specifications are based on paint types and systems by specified basis of design manufacturer. Paint types and systems manufactured by other acceptable manufacturers are permitted, subject to compliance with specified requirements; and provided that deviations in formulation, compatibility, and performance are minor, and do not detract substantially from the indicated design intent.
1. Comply with requirements specified in Section 01 4000 and Section 01 6000.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.07 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the paint product manufacturer's temperature ranges.

B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

C. Do not apply exterior paint and finishes during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.

D. Minimum Application Temperatures for Latex Paints: 50 degrees F for exterior; unless required otherwise by manufacturer's instructions.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Provide paints and finishes used in any individual system from the same manufacturer; no exceptions.

B. Basis of Design Manufacturer:
1. Sherwin-Williams Company: www.sherwin-williams.com/#sle.
2. Substitutions: See Section 01 6000 - Product Requirements.

C. Other Acceptable Manufacturers:
1. Benjamin Moore & Co.: www.benjaminmoore.com.
2. Comex Group; Kwal Paint: www.thecomexgroup.com.
3. PPG Paints: www.ppgpaints.com/#sle.
4. Substitutions: See Section 01 6000 - Product Requirements.

D. Acceptable Manufacturers - Primers and Sealers: Same manufacturer as top coats; no exceptions.

2.02 PAINTS AND FINISHES - GENERAL

A. Paints and Finishes: Ready-mixed, unless required to be a field-catalyzed paint.
1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
2. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
3. Supply each paint material in quantity required to complete entire project's work from a single production run.
4. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is described explicitly in manufacturer's product instructions.

B. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.

C. Colors: As scheduled on Drawings.

2.03 PAINT SYSTEMS

A. Exterior Surfaces to be Painted, Unless Otherwise Indicated: Including primed metal.
   1. Top Coat(s): Exterior Acrylic Latex Coating:
      a. Two top coats; touch-up with rust-inhibitive primer as recommended by top coat manufacturer.
      b. Semi-gloss: Two coats of latex enamel.
      c. Acceptable Product:
         1) Sherwin-Williams Pro Industrial Acrylic, B66-650 Series.
         2) Substitutions: Section 01 6000 - Product Requirements.
   2. Top Coat Sheen:
      a. Semi-Gloss: MPI gloss level 5; use this sheen at all locations unless otherwise indicated or specified.
   3. Primers: As recommended by top coat manufacturer for specific substrate.

2.04 ACCESSORY MATERIALS

A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.

B. Patching Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially effect proper application.

C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

D. Test shop-applied primer for compatibility with subsequent cover materials.

3.02 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to application.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces for finishing.

D. Seal surfaces that might cause bleed through or staining of topcoat.

E. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

F. Ferrous Metal:
   1. Solvent clean according to SSPC-SP 1.
   2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces.

3.03 APPLICATION

A. Apply products in accordance with manufacturer's written instructions.

B. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

C. Apply each coat to uniform appearance.

D. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply additional coats until complete hide is achieved.

E. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

F. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.05 PROTECTION

A. Protect finishes until completion of project.

B. Touch-up damaged finishes after Substantial Completion.

END OF SECTION

SECTION 09 9123

INTERIOR PAINTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.

B. Field application of paints.

1.02 DEFINITIONS

A. Comply with ASTM D16 for interpretation of terms used in this section.

B. Gloss Ratings: ASTM D523; on 60 and 85 degree gloss meters:
1. MPI Gloss Level 1 (Flat): Not more than five units at 60 degrees and 10 units at 85 degrees.
2. MPI Gloss Level 2 (Velvet): Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees.
3. MPI Gloss Level 3 (Eggshell): 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees.
4. MPI Gloss Level 4 (Satin): 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees.
5. MPI Gloss Level 5 (Semi-Gloss): 35 to 70 units at 60 degrees.
6. MPI Gloss Level 6 (Gloss): 70 to 85 units at 60 degrees.
7. MPI Gloss Level 7 (High Gloss): More than 85 units at 60 degrees.

1.03 REFERENCE STANDARDS

A. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications.

B. ASTM D523 - Standard Test Method for Specular Gloss.

C. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual.

D. SSPC-SP 1 - Solvent Cleaning.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide complete list of products to be used, with the following information for each:
1. Manufacturer's name, product name and/or catalog number, and general product category (e.g., "alkyd enamel").
2. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
3. Manufacturer's installation instructions.

C. Samples: Submit two painted samples, illustrating selected colors for each color and system selected with specified coats cascaded. Submit on tempered hardboard, 8 x 10 inch in size.

D. Certification: By manufacturer that paints and finishes comply with VOC limits specified.

E. Manufacturer's Instructions: Indicate special surface preparation procedures and substrate conditions requiring special attention.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. See Section 01 6000 - Product Requirements, for additional provisions.
2. Extra Paint and Finish Materials: 1 gallon of each color; from the same product run, store where directed.
3. Label each container with color in addition to the manufacturer's label.

1.05 QUALITY ASSURANCE

A. Applicator Qualifications: Company specializing in performing the type of work specified with minimum three years experience.

B. Basis of Design: Specifications are based on paint types and systems by specified basis of design manufacturer. Paint types and systems manufactured by other acceptable manufacturers are permitted, subject to compliance with specified requirements; and provided that deviations in formulation, compatibility, and performance are minor, and do not detract substantially from the indicated design intent.
   1. Comply with requirements specified in Section 01 4000 and Section 01 6000.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.07 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.

B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

C. Do not apply materials when relative humidity exceeds 85 percent, at temperatures less than 5 degrees F above the dew point, or to damp or wet surfaces.

D. Minimum Application Temperatures for Paints: 50 degrees F for interiors unless required otherwise by manufacturer's instructions.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Provide paints and finishes used in any individual system from the same manufacturer; no exceptions.

B. Basis of Design Manufacturer:
   1. Sherwin-Williams Company: www.sherwin-williams.com/#sle.
   2. Substitutions: See Section 01 6000 - Product Requirements.

C. Other Acceptable Manufacturers:
   1. Benjamin Moore & Co.: www.benjaminmoore.com.
   2. Comex Group; Kwal Paint: www.thecomexgroup.com.
   3. PPG Paints: www.ppgpaints.com/#sle.
   4. Substitutions: See Section 01 6000 - Product Requirements.

D. Acceptable Manufacturers - Primer Sealers: Same manufacturer as top coats; no exceptions.

2.02 PAINTS AND FINISHES - GENERAL

A. Paints and Finishes: Ready-mixed, unless intended to be a field-catalyzed paint.
   1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
   2. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
   3. Supply each paint material in quantity required to complete entire project's work from a single production run.
   4. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.

B. Painting Materials: Comply with volatile organic compound (VOC) content and emissions restrictions specified in Section 01 6116 - VOC Content and Emissions Restrictions.

C. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.

D. Colors: As scheduled on Drawings.
   1. Extend colors to surface edges; colors may change at any edge as directed by Architect.

2.03 PAINT SYSTEMS

A. Interior Surfaces to be Painted, Unless Otherwise Indicated: Including gypsum board.
   1. Two top coats and one coat primer.
   2. Top Coat(s): Institutional Low Odor/VOC Interior Latex.
      a. Acceptable Products:
         1) Sherwin-Williams ProMar 200 Zero VOC Interior Latex, Flat.
         2) Sherwin-Williams ProMar 200 Zero VOC Interior Latex, Low Sheen.
         3) Sherwin-Williams ProMar 200 Zero VOC Interior Latex, Semi-Gloss.
         4) Substitutions: Section 01 6000 - Product Requirements.
   3. Top Coat Sheen:
      a. Flat: MPI gloss level 1; use this sheen for ceilings and other overhead surfaces.
      b. Eggshell: MPI gloss level 3; use this sheen at all locations unless otherwise indicated or specified.
      c. Semi-Gloss: MPI gloss level 5; use this sheen at painted doors and frames, painted wood trim, metal fabrications not otherwise specified, and other scheduled locations.
   4. Primer: As recommended by top coat manufacturer for specific substrate.

B. Medium Duty Door/Trim: For surfaces subject to frequent contact by occupants, including primed metals:
   1. Medium duty applications include doors, door frames, railings, handrails, and guardrails.
   2. Two top coats and one coat primer.
   3. Top Coat(s): High Performance Architectural Interior Latex.
      a. Acceptable Products:
         1) Sherwin-Williams Pro Industrial Pre-Catalyzed Waterbased Epoxy, Semi-Gloss. (MPI #141)
         2) Substitutions: Section 01 6000 - Product Requirements.

2.04 ACCESSORY MATERIALS

A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.

B. Patching Material: Latex filler.

C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin application of paints and finishes until substrates have been adequately prepared.

B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

E. Test shop-applied primer for compatibility with subsequent cover materials.

F. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces is below the following maximums:
   1. Gypsum Wallboard: 12 percent.

3.02 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to application.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.

D. Seal surfaces that might cause bleed through or staining of topcoat.

E. Gypsum Board: Fill minor defects with filler compound. Spot prime defects after repair.

F. Ferrous Metal:
   1. Solvent clean according to SSPC-SP 1.
   2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces.

3.03 APPLICATION

A. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".

B. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

C. Apply each coat to uniform appearance in thicknesses specified by manufacturer.

D. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply as many coats as necessary for complete hide.

E. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

F. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.05 PROTECTION

A. Protect finishes until completion of project.

B. Touch-up damaged finishes after Substantial Completion.

END OF SECTION

SECTION 10 1400

SIGNAGE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Room and door signs.

B. Interior directional and informational signs.

C. Traffic signs.

D. Signs required for Building Code compliance and building occupancy.

1.02 REFERENCE STANDARDS

A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines.

B. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design.

C. ICC A117.1 - Accessible and Usable Buildings and Facilities.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's printed product literature for each type of sign, indicating sign styles, font, foreground and background colors, locations, overall dimensions of each sign.

C. Signage Schedule: Provide information sufficient to completely define each sign for fabrication, including room number, room name, other text to be applied, sign and letter sizes, fonts, and colors.
   1. When room numbers to appear on signs differ from those on Drawings, include the drawing room number on schedule.
   2. When content of signs is indicated to be determined later, request such information from Owner through Architect at least 2 months prior to start of fabrication; upon request, submit preliminary schedule.
   3. Submit for approval by Owner through Architect prior to fabrication.

D. Samples: Submit two samples of each type of sign, of size similar to that required for project, illustrating sign style, font, and method of attachment.

1.04 QUALITY ASSURANCE

A. Basis of Design: Specifications are based on sign types by specified basis of design manufacturer. Sign types manufactured by other acceptable manufacturers are permitted, subject to compliance with specified requirements; and provided that deviations in design, profile, and finishes are minor, and do not detract substantially from the indicated design intent.
   1. Comply with requirements specified in Section 01 4000 and Section 01 6000.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Package signs as required to prevent damage before installation.

B. Package room and door signs in sequential order of installation, labeled by floor or building.

C. Store tape adhesive at normal room temperature.

1.06 FIELD CONDITIONS

A. Do not install tape adhesive when ambient temperature is lower than recommended by manufacturer.

B. Maintain this minimum temperature during and after installation of signs.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design Manufacturers:
   1. Styles and Design: Manufacturers and products as specified on Drawings.
   2. Substitutions: See Section 01 6000 - Product Requirements.

B. Unless otherwise specified for an individual product or material, supply all products specified in this Section from the same manufacturer.

2.02 SIGNAGE APPLICATIONS - GENERAL

A. Accessibility Compliance: Signs are required to comply with ADA Standards and ICC A117.1 and applicable building codes, unless otherwise indicated; in the event of conflicting requirements, comply with the most comprehensive and specific requirements.

B. Code-Required Door and Room Signs: Provide all signs required by Authority Having Jurisdiction (AHJ) for building occupancy; determine requirements and report to Owner and Architect prior to making specified submittals. Include cost of these signs in Contract Sum.

2.03 ACCESSORIES

A. Mounting Devices: Except as specified for each sign type, provide mounting devices specifically recommended by manufacturer for indicated application; concealed upon finished installation.

B. Concealed Screws: Stainless steel, galvanized steel, chrome plated, or other non-corroding metal.

C. Tape Adhesive: Double sided tape, permanent adhesive.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install neatly, with horizontal edges level.

C. Locate signs and mount at heights in accordance with ADA Standards and ICC A117.1.

D. Locate signs where indicated. If no location is indicated, obtain Architect's instructions.

E. Protect from damage until Date of Substantial Completion; repair or replace damaged items.

END OF SECTION

SECTION 10 1435

DIMENSIONAL SIGN CHARACTERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fabricated aluminum monument sign characters and symbols.

B. Lighting for back-lit sign characters.

C. Mounting hardware and attachment accessories.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate installation of power utility services to back-lit sign characters with requirements specified in Division 26.

1.03 REFERENCE STANDARDS

A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum.

B. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

C. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes [Metric].

D. IEC 60529 - Degrees of Protection Provided by Enclosures (IP Code).

E. NAAMM AMP 500-06 - Metal Finishes Manual.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate sign styles, lettering font, locations, overall dimensions of each sign.

C. Samples: Submit two samples illustrating type, style, letter font, and colors specified, and method of attachment.

1.05 DELIVERY, STORAGE, AND PROTECTION

A. Package signs, labeled in character groups.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturers:
1. Adelphia Graphic Systems, Inc.: www.agsinfo.com.
2. Avalanche Sign Contracting: www.avalanchesigns.com.
3. ASI Sign Systems, Inc.: www.asisign.com.
4. Best Sign Systems, Inc.: www.bestsigns.com.
5. Boyd Sign Systems: www.boyddesigngroup.com.
6. Inpro: www.inprocorp.com/#sle.
7. Mohawk Sign Systems, Inc.: www.mohawksign.com.
8. Seton Identification Products: www.seton.com/aec.
9. Vomar Products, Inc.: www.vomarproducts.com.
10. Substitutions: See Section 01 6000 - Product Requirements.

2.02 MATERIALS

A. Aluminum Sheet and Extrusions: ASTM B221 (ASTM B221M); 6063-T5 minimum alloy and temper properties; alloy and temper recommended by aluminum producer or finisher for type, use, and finish indicated, minimum 0.090 inches thick.

B. Aluminum Castings: Alloy and temper recommended by aluminum producer or finisher for casting process used, and for type; use, and finish indicated.

2.03 ACCESSORIES

A. LED Tape Lighting Systems: Provide all power supplies, drivers, cables, connectors, channels, covers, mounting accessories, and interfaces as necessary to complete installation.
   1. LED Tape - General Requirements:
      a. Listed.
      b. Designed for field cutting in accordance with listing.
      c. Wet Location Applications: IEC 60529, IP 68 (waterproof) rated.
   2. White LED Tape:
      a. Color Rendering Index (CRI): Not less than 90.

B. Mounting Hardware: Non-corrosive, concealed fasteners and mounting pins or brackets as designed by manufacturer to suit mounting conditions.

2.04 FABRICATION

A. Cast Characters and Symbols: Produce smooth, even, flat surfaces, precisely formed lines and profiles, free from pits, scale, sand holes, and other surface defects. Cast lugs into backs of characters and symbols and tap to receive threaded mounting studs.

B. Fabricated Characters and Symbols: Cut components from solid sheet and plate material. Produce smooth, even, flat surfaces, and precisely cut lines and edges.
   1. Aluminum: Fabricate by heliarc welding process.

C. Character and Symbol Sizes: As detailed on Drawings.

2.05 FINISHES

A. Finishes, General: Comply with NAAMM AMP 500-06.
   1. Complete mechanical finishes before fabrication. After fabrication, finish joints, bends, abrasions and surface blemishes to match sheet.
   2. Protect mechanical finishes on exposed surfaces from damage.
   3. Apply organic and anodic finishes to formed metal after fabrication unless otherwise indicated.
   4. Appearance: Limit variations in appearance of adjacent to one-half the range represented in approved samples. Noticeable variations in the same piece are not acceptable. Install components within the range of approved samples to minimize contrast.

B. Aluminum Finishes:
   1. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils thick.
   2. Touch-Up Materials: As recommended by coating manufacturer for field application.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install sign characters in accordance with manufacturer's instructions.

B. Provide heavy-weight paper template to establish character spacing and to locate holes for fasteners.

C. Mounting: Mount characters and symbols at projection distance of 1/4 inch from wall surface.

D. Locate character composition on wall surface, level, unless otherwise indicated.

END OF SECTION

SECTION 10 2113.15

REINFORCED COMPOSITE TOILET COMPARTMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Paper and phenolic composite toilet compartments.

B. Urinal screens.

1.02 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design.

B. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

C. NFPA 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the work with placement of support framing and anchors in walls and ceilings.
   2. Coordinate location and installation of toilet accessories mounted on or in immediate proximity to toilet partitions.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate partition plan, elevation views, dimensions, details of wall supports, door swings.

C. Product Data: Provide data on panel construction, hardware, and accessories.

D. Samples: Submit manufacturer's full range of available colors and patterns, for selection.

E. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

1.05 QUALITY ASSURANCE

A. Basis of Design: Specifications are based on partition types by specified basis of design manufacturer and product(s). Partition types manufactured by other acceptable manufacturers are permitted, subject to compliance with specified requirements; and provided that deviations in design, composition, and profile are minor, and do not detract substantially from the indicated design intent.
   1. Comply with requirements specified in Section 01 4000 and Section 01 6000.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design Manufacturer:
   1. Bobrick Washroom Equipment, Inc.; SierraSeries: www.bobrick.com; www.paperstoneproducts.com.
   2. Substitutions: See Section 01 6000 - Product Requirements.

2.02 COMPONENTS

A. Toilet Compartments: Solid, seamless, paper and phenolic resin composite panels, floor-mounted headrail-braced.
   1. Comply with NFPA 286, Class B, for finish surfaces of partition systems.

B. Paper Composite Doors, Panels, and Pilasters: Solid, 100 percent post-consumer recycled paper and water-based petroleum-free phenolic resin panels with 1/8 inch raduised edges; VOC-free and urea-formaldehyde-free; stain resistant to domestic chemicals and cleaners.
   1. Solid Color: As selected by Architect from manufacturer's full range of available standards; satin finish.

C. Door and Panel Dimensions:
   1. Door and Pilaster Thickness: 3/4 inch.
   2. Panel Thickness: 1/2 inch.
   3. Door Width: 24 inch; 32 inch at ambulatory accessible stalls.
   4. Door Width for Handicapped Use: 36 inch, out-swinging.
   5. Height: 58 inch.

D. Urinal Screens: Wall mounted with continuous panel brackets.
   1. Minimum Size: 24 inches wide x 48 inches high, bottom edge positioned 12 inches above floor surface.

2.03 ACCESSORIES

A. Pilaster Shoes: Formed ASTM A666, Type 304 stainless steel with No. 4 finish, 3 inches high, concealing floor fastenings.
   1. Provide adjustment for floor variations with screw jack through steel saddles integral with pilaster.

B. Head Rails: Hollow stainless steel tube, 1 x 1-5/8 inch size, with anti-grip strips and cast socket wall brackets.

C. Wall and Pilaster Brackets: Satin stainless steel.

D. Attachments, Screws, and Bolts: Stainless steel, tamper proof type.
   1. For attaching panels and pilasters to brackets: Through-bolts and nuts; tamper proof.

E. Hardware: Satin stainless steel:
   1. Pivot hinges, gravity type, adjustable for door close positioning; two per door.
   2. Nylon bearings.
   3. Thumb turn door latch with exterior emergency access feature. Comply with ADA Standards at accessible compartment stalls.
   4. Door strike and keeper with rubber bumper; mounted on pilaster in alignment with door latch.
   5. Coat hook with rubber bumper; one per compartment, mounted on door.
   6. Provide door pull for outswinging doors.

F. Optional Privacy Features: Provide manufacturer's optional privacy features, including the following:
   1. Rabetted (overlapped) latch jambs on door edges.
   2. Continuous panel and pilaster brackets, including wall brackets, to prevent visibility into stalls.
   3. Applied, continuous, resilient or articulating pivacy strips at hinge and latch jambs on door edges to prevent visibility into stalls when door is in closed and latched position.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated on Drawings.

B. Verify correct spacing of and between plumbing fixtures.

C. Verify correct location of built-in framing, anchorage, and bracing.

3.02 INSTALLATION

A. Install partitions secure, rigid, plumb, and level in accordance with manufacturer's instructions.

B. Maintain 3/8 to 1/2 inch space between wall and panels and between wall and end pilasters.

C. Attach panel brackets securely to walls using anchor devices. Adjust locations of brackets as required to eliminate conflict with wall tile edges and othet transitions between dissimilar wall finish materials.

D. Attach panels and pilasters to brackets. Locate head rail joints at pilaster center lines.

E. Field touch-up of scratches or damaged finish will not be permitted. Replace damaged or scratched materials with new materials.

3.03 TOLERANCES

A. Maximum Variation From True Position: 1/4 inch.

B. Maximum Variation From Plumb: 1/8 inch.

3.04 ADJUSTING

A. Adjust and align hardware to uniform clearance at vertical edge of doors, not exceeding 3/16 inch.

B. Adjust hinges to position doors in partial opening position when unlatched. Return out-swinging doors to closed position.

C. Adjust adjacent components for consistency of line or plane.

END OF SECTION

SECTION 10 2113.19

SOLID PLASTIC TOILET COMPARTMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Solid plastic toilet compartments.

B. Urinal and vestibule screens.

1.02 REFERENCE STANDARDS

A. NFPA 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth.

1.03 ADMINISTRATIVE REQUIREMENTS

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on panel construction, hardware, and accessories.

C. Shop Drawings: Indicate partition plan, elevation views, dimensions, details of wall supports, door swings.

D. Samples: Submit manufacturer's full range of available colors, for selection.

E. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

1.05 QUALITY ASSURANCE

A. Basis of Design: Specifications are based on partition types by specified basis of design manufacturer and product(s). Partition types manufactured by other acceptable manufacturers are permitted, subject to compliance with specified requirements; and provided that deviations in design, composition, and profile are minor, and do not detract substantially from the indicated design intent.
   1. Comply with requirements specified in Section 01 4000 and Section 01 6000.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design Manufacturer:
   1. Scranton Products; Aria Partitions: www.scrantonproducts.com/#sle.
   2. Substitutions: Section 01 6000 - Product Requirements.

2.02 PLASTIC TOILET COMPARTMENTS

A. Solid Plastic Toilet Compartments: Factory fabricated doors, pilasters, and divider panels made of solid color molded high density polyethylene (HDPE); floor-mounted headrail-braced.
   1. Comply with NFPA 286, Class B, for finish surfaces of partition systems.
   2. Color: As selected by Architect from manufacturer's full line.

B. Doors:
   1. Thickness: 1 inch.
   2. Width: 24 inch; 32 inch at ambulatory accessible stalls.
   3. Width for Handicapped Use: 36 inch, out-swinging.
   4. Height: As indicated on Drawings.

C. Panels:
   1. Thickness: 1 inch.
   2. Height and Depth: As indicated on Drawings.

D. Pilasters:
   1. Thickness: 1 inch.
   2. Width: As required to fit space; minimum 3 inch.

E. Screens: Without doors; to match compartments; mounted to wall with continuous panel brackets.
   1. Urinal Screens - Minimum Size: 24 inches wide x 48 inches high, bottom edge positioned 12 inches above floor surface.

2.03 ACCESSORIES

A. Pilaster Shoes: Stainless steel, satin finish, 3 inches high; concealing floor fastenings.
   1. Provide adjustment for floor variations with screw jack through steel saddles integral with pilaster.

B. Head Rails: Extruded aluminum, anti-grip profile.
   1. Size: Manufacturer's standard size.

C. Wall and Pilaster Brackets: Stainless steel; manufacturer's standard type for conditions indicated on drawings.

D. Attachments, Screws, and Bolts: Stainless steel, tamper proof type.
   1. For attaching panels and pilasters to brackets: Through-bolts and nuts; tamper proof.

E. Hinges: Stainless steel, manufacturer's standard finish.
   1. Pivot hinges, gravity type, adjustable for door close positioning; two per door.

F. Door Hardware: Stainless steel, manufacturer's standard finish.
   1. Door Latch: Slide type with exterior emergency access feature.
   2. Door Strike and Keeper with Rubber Bumper: Mount on pilaster in alignment with door latch.
   3. Provide door pull for outswinging doors.

G. Coat Hook: One per compartment, mounted on door.

H. Optional Privacy Features: Provide manufacturer's optional privacy features, including the following:
   1. Rabetted (overlapped) latch jambs on door edges.
   2. Continuous panel and pilaster brackets, including wall brackets, to prevent visibility into stalls.
   3. Applied, continuous, resilient or articulating pivacy strips at hinge and latch jambs on door edges to prevent visibility into stalls when door is in closed and latched position.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated on Drawings.

B. Verify correct spacing of and between plumbing fixtures.

C. Verify correct location of built-in framing, anchorage, and bracing.

3.02 INSTALLATION

A. Install partitions secure, rigid, plumb, and level in accordance with manufacturer's instructions.

B. Maintain 3/8 inch to 1/2 inch space between wall and panels and between wall and end pilasters.

C. Attach panel brackets securely to walls using anchor devices. Adjust locations of brackets as required to eliminate conflict with wall tile edges and othet transitions between dissimilar wall finish materials.

D. Attach panels and pilasters to brackets. Locate head rail joints at pilaster center lines.

E. Field touch-up of scratches or damaged finish will not be permitted. Replace damaged or scratched materials with new materials.

3.03 TOLERANCES

A. Maximum Variation From True Position: 1/4 inch.

B. Maximum Variation From Plumb: 1/8 inch.

3.04 ADJUSTING

A. Adjust and align hardware to uniform clearance at vertical edge of doors, not exceeding 3/16 inch.

B. Adjust hinges to position doors in partial opening position when unlatched. Return out-swinging doors to closed position.

C. Adjust adjacent components for consistency of line or plane.

END OF SECTION

SECTION 10 2239

FOLDING PANEL PARTITIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Top-supported folding panel partitions, horizontal opening.

1.02 REFERENCE STANDARDS

A. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

B. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes [Metric].

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

D. ASTM E557 - Standard Guide for Architectural Design and Installation Practices for Sound Isolation between Spaces Separated by Operable Partitions.

E. ASTM F793 - Standard Classification of Wall Covering by Use Characteristics.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on partition materials, operation, hardware and accessories, electric operating components, track switching components, and colors and finishes available.

C. Shop Drawings: Indicate opening sizes, track layout, details of track and required supports, static and dynamic loads, location and details of pass door and frame, adjacent construction and finish trim, and stacking depth.

D. Certificates: Certify that partition system meets or exceeds specified acoustic requirements.

E. Manufacturer's Instructions: Indicate special procedures, perimeter conditions requiring special attention, and installation sequence.

F. Maintenance Data: Include recommended cleaning methods, cleaning materials, and stain removal methods. Describe cleaning materials detrimental to finish surfaces and hardware finish.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project:
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Furnish extra panel finish materials, matching installed materials, in quantity to cover both sides of two typical panels when installed.
   3. Package maintenance materials with protective covering for storage, .identified with descriptive labels.
   4. Tools: One each of every special tool required for operation of partition system.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified this Section with minimum three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of this Section with minimum five years of documented experience.

C. Basis of Design: Specifications are based on partition systems and model numbers by the specified basis of design manufacturer. Partition systems manufactured by other acceptable manufacturers are permitted, subject to compliance with all specified performance requirements; and provided that deviations in dimensions, sizes, style, and finish are minor, and do not detract substantially from the indicated design intent.
   1. Comply with requirements specified in Section 01 4000 and Section 01 6000.

1.05 FIELD MEASUREMENTS

A. Verify partition openings and storage arrangements by field measurements before fabrication, and indicate measurements on shop drawings.

B. Where field dimensions cannot be made without delaying the work, establish required opening and storage dimensions as instructed by the manufacturer and maintain those dimensions for actual installation of partitions.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until installation.

B. Protectively package and sequence panels in order for installation. Clearly mark packages and panels with numbering system used in shop drawings. Do not use permanent markings on panels.

1.07 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within two year period after Date of Substantial Completion.

C. Provide two year manufacturer warranty against defects in material and workmanship, excluding abuse.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design Manufacturer:
   1. Advanced Equipment Corporation: www.advancedequipment.com.
      a. Partition Model: ALPHA Series T Panel Construction.
   2. Substitutions: See Section 01 6000 - Product Requirements.

B. Other Acceptable Manufacturers:
   1. Hufcor, Inc.: www.hufcor.com/#sle.
   2. Kwik-Wall Company: www.kwik-wall.com.
   3. Moderco, Inc.: www.moderco.com/#sle.
   4. Modernfold, a DORMA Group Company: www.modernfold.com/#sle.
   5. Substitutions: See Section 01 6000 - Product Requirements.

2.02 FOLDING PANEL PARTITIONS - HORIZONTAL OPENING

A. Folding Panel Partitions: Side opening; individual panels; side stacking; manually operated.

B. Panel Construction:
   1. Frame: 16 gauge, 0.0598 inch thick formed sheet steel frame top, bottom, jambs, and intermediates; welded construction, with acoustical insulation fill.
   2. Panel Substrate Facing: Steel sheet, manufacturer's standard thickness.
   3. Hinges: Continuous piano type; manufacturer's standard gage and thickness; stainless steel.
   4. Hardware: Latching door handles of cast steel, satin chrome finish; lock cylinder keyed to building keying system; pull bars.
   5. Panel Properties:
      a. Thickness With Finish: 3-1/2 inches.
      b. Width: Equal widths, unless otherwise indicated.
      c. Weight: 8.5 lb/sq ft.

C. Panel Finishes:
   1. Facing: Vinyl coated fabric.
   2. Exposed Metal Trim: Custom powder coated paint finish; color as selected by Architect from manufacturer's full line.

D. Acoustic Seals: Provide types of seals that produce operable panel partitions that comply with specified acoustical performance requirements, made from materials and to profiles that minimize sound leakage, and tight-fitting at contact surfaces. Seals to provide continuous seal between adjacent panels, and between operable panel partition perimeter and adjacent surfaces when partition is fully extended, closed, and in place.
   1. Vertical Seals: Deep-nesting, interlocking astragals mounted on each edge of panel, with continuous acoustical seal.
   2. Horizontal Top Seals: Extruded PVC or PVC-faced, mechanically retractable type, exerting a uniform constant pressure on track when extended.
   3. Horizontal Bottom Seals: PVC-faced, constant force contact seal exerting uniform constant pressure on floor when extended, ensuring horizontal and vertical sealing, and resisting panel movement; extension and retraction by operating handle or built-in operating mechanism automatically by movement of partition with operating range not less than 1.5 inch clearance between retracted seal and floor finish.

E. Suspension System:
   1. Track: Formed steel; 1-1/4 by 1-1/4 inch size; thickness and profile designed to support loads, steel sub-channel and track connectors, and track switches.
   2. Carriers: Nylon wheels on trolley carrier at top of every second panel, sized to carry imposed loads, with threaded pendant bolt for vertical adjustment.

F. Performance:
   1. Acoustic Performance:
      a. Sound Transmission Class (STC): Minimum 54 calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90, on panel size of 100 sq ft.
   2. Surface Burning Characteristics of Panel Finish: Flame spread/smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84.
   3. Installed partition system track capable of supporting imposed loads, with maximum deflection of 1/360 of span.

G. Accessories:
   1. Ceiling Closure: White enameled ceiling closure; aluminum jamb and head molding, fittings and attachments.
   2. Acoustic Sealant: As recommended by partition manufacturer.

2.03 MATERIALS

A. General Requirements:

B. Aluminum Extrusions: ASTM B221 (ASTM B221M), 6063 alloy, T6 temper.

C. Vinyl Coated Fabric: ASTM F793, Category VI, polyvinyl fluoride (PVC) finish for washability and improved flame retardance; color as selected by Architect from manufacturer's standard range.

D. Acoustic Insulation:
   1. Type: As required for acoustic performance indicated.
   2. Thickness: As required for acoustic performance indicated.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify track supports are laterally braced and will permit track to be level within 1/4 inch of required position and parallel to the floor surface.

C. Verify floor flatness of 1/8 inch in 10 feet, non-cumulative.

D. Verify wall plumbness of 1/8 inch in 10 feet, non-cumulative.

3.02 INSTALLATION

A. Install partition in accordance with manufacturer's instructions and ASTM E557.

B. Fit and align partition assembly and pocket doors level and plumb.

C. Lubricate moving components.

D. Install acoustic sealant to achieve required acoustic performance.

3.03 ADJUSTING

A. Adjust partition assembly to provide smooth operation from stacked to full open position. Do not over-compress acoustic seals.

B. Visually inspect partition in full extended position for light leaks to identify a potential acoustical leak.

C. Adjust partition assembly to achieve lightproof seal.

3.04 CLEANING

A. Clean finish surfaces and partition accessories.

3.05 CLOSEOUT ACTIVITIES

A. Demonstrate operation of partition and identify potential operational problems.

END OF SECTION

SECTION 10 2619

WALL PROTECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Corner guards.

1.02 REFERENCE STANDARDS

A. ASTM D256 - Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics.

B. ASTM D543 - Standard Practices for Evaluating the Resistance of Plastics to Chemical Reagents.

C. ASTM F476 - Standard Test Methods for Security of Swinging Door Assemblies.

D. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Indicate physical dimensions, features, wall mounting brackets with mounted measurements, anchorage details, and rough-in measurements.

C. Shop Drawings: Include plans, elevation, sections, and attachment details. Show design and spacing of supports for protective corridor handrails, required to withstand structural loads.

D. Samples: Submit samples illustrating component design, configurations, joinery, color and finish.
   1. Submit two sections of corner guards, 12 inches long.

E. Maintenance Data: Manufacturer's instructions for care and cleaning of each type of product. Include information about both recommended and potentially detrimental cleaning materials and methods.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver wall and door protection items in original, undamaged protective packaging. Label items to designate installation locations.

B. Do not deliver products to project site until areas for storage and installation are fully enclosed, and interior temperature and humidity are in compliance with manufacturer's recommendations for each type of item.

C. Store products in either horizontal or vertical position, in compliance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturers:
   1. Manufacturers and products as specified on Drawings.
   2. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PERFORMANCE REQUIREMENTS

A. Impact Strength: Unless otherwise noted, provide protection products and assemblies that have been successfully tested for compliance with applicable provisions of ASTM D256 and/or ASTM F476.

B. Chemical and Stain Resistance: Unless otherwise noted, provide protection products and assemblies with chemical and stain resistance complying with applicable provisions of ASTM D543.

C. Fungal Resistance: Unless otherwise noted, provide protection products and assemblies which pass ASTM G21 testing.

2.03 ACCESSORIES

A. Adhesives and Primers: As recommended by manufacturer.
   1. Comply with volatile organic compound (VOC) product requirements specified in Section 01 6116.

B. Mounting Brackets and Attachment Hardware: Appropriate to component and substrate.

2.04 SOURCE QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Provide wall and door protection systems of each type from a single source and manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as instructed by the manufacturer.

B. Verify that substrate surfaces for adhered items are clean and smooth.
   1. Test painted or wall covering surfaces for adhesion in inconspicuous area, as recommended by manufacturer. Follow adhesive manufacturer's recommendations for remedial measures at locations and/or application conditions where adhesion test's results are unsatisfactory.

C. Start of installation constitutes acceptance of project conditions.

3.02 INSTALLATION

A. Install components in accordance with manufacturer's instructions, level and plumb, secured rigidly in position to supporting construction.

3.03 TOLERANCES

A. Maximum Variation From Required Height: 1/4 inch.

B. Maximum Variation From Level or Plane For Visible Length: 1/4 inch.

3.04 CLEANING

A. Clean wall and door protection items of excess adhesive, dust, dirt, and other contaminants.

END OF SECTION

SECTION 10 2813

TOILET AND UTILITY ROOM ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Commercial toilet accessories.

B. Utility room accessories.

1.02 REFERENCE STANDARDS

A. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.

B. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

C. ASTM B456 - Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium.

D. ASTM C1036 - Standard Specification for Flat Glass.

E. ASTM C1503 - Standard Specification for Silvered Flat Glass Mirror.

F. ASTM F446 - Standard Consumer Safety Specification for Grab Bars and Accessories Installed in the Bathing Area.

G. ICC A117.1 - Accessible and Usable Buildings and Facilities.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate locations of accessories with other work to avoid interference, and to assure proper operation and servicing of accessory units.
   2. Coordinate location and installation of toilet accessories mounted on or in immediate proximity to toilet partitions.
   3. Coordinate the work with the placement of internal wall reinforcement, concealed ceiling supports, and reinforcement of toilet partitions to receive anchor attachments.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit data on accessories describing size, finish, details of function, and attachment methods.

C. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention.

1.05 QUALITY ASSURANCE

A. Provide accessories by the same manufacturer for each type of accessory unit, and for units exposed in the same areas, to ensure matching of finishes.

B. Comply with ASTM F446 for grab bars and accessories, including, anchorage, test methods, and performance.

C. Basis of Design: Specifications and Drawings are based on accessory types and model numbers by the specified basis of design manufacturer. Accessory types manufactured by other acceptable manufacturers are permitted, subject to compliance with specified requirements, and provided that deviations in dimensions and profile are minor, and do not detract substantially from the indicated design intent.
   1. Comply with requirements specified in Section 01 4000 and Section 01 6000.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver accessories to site until rooms in which they are to be installed are ready to receive them.

B. Pack accessories individually in a manner to protect accessory and its finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design Manufacturer:
   1. Manufacturers and products as specified on Drawings.
   2. Substitutions: Section 01 6000 - Product Requirements.

2.02 MATERIALS

A. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.
   1. Grind welded joints smooth.
   2. Fabricate units made of metal sheet of seamless sheets with flat surfaces.

B. Keys: Provide two keys for each accessory to Owner.

C. Stainless Steel Sheet: ASTM A666, Type 304.

D. Stainless Steel Tubing: ASTM A269/A269M, Grade TP304 or TP316.

E. Mirror Glass: Annealed float glass, ASTM C1036 Type I, Class 1, Quality Q2, with silvering, protective and physical characteristics complying with ASTM C1503.

F. Fasteners, Screws, and Bolts: Hot dip galvanized; tamper-proof; security type.

G. Expansion Shields: Fiber, lead, or rubber as recommended by accessory manufacturer for component and substrate.

2.03 FINISHES

A. Stainless Steel: Satin finish, unless otherwise noted.

B. Chrome/Nickel Plating: ASTM B456, SC 2, satin finish, unless otherwise noted.

C. Back paint components where contact is made with building finishes to prevent electrolysis.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify exact location of accessories for installation.

C. For electrically-operated accessories, verify that electrical power connections are ready and in the correct locations.

D. Verify that field measurements are as indicated on Drawings.

E. See Section 06 1000 and 09 2116, as applicable, for installation of blocking, reinforcing plates, and concealed anchors in walls and ceilings.

3.02 PREPARATION

A. Deliver inserts and rough-in frames to site for timely installation.

B. Provide templates and rough-in measurements as required.

C. Before starting work notify Architect in writing of any conflicts detrimental to installation or operation of units.

D. Verify with Architect exact locations of accessories.

3.03 INSTALLATION

A. Install accessories in accordance with manufacturers' instructions in locations indicated on drawings.

B. Install plumb and level, securely and rigidly anchored to substrate.

C. Mounting Heights: As required by accessibility regulations, unless otherwise indicated on Drawings.

D. Use concealed fasteners wherever possible.

E. Where exposed mounting devices and fasteners are necessary, provide such devices finished to match accessory; use security type fasteners for all exposed accessory mountings.

F. Unless otherwise indicated, align accessory units with adjacent fixtures and other elements within the same area. Conform to ICC A117.1 for mounting structural strength, positions, and mounting heights.

3.04 PROTECTION

A. Protect installed accessories from damage due to subsequent construction operations.

B. Protect adjacent or adjoining finished surfaces and work from damage during installation of work of this Section.

C. Protect exposed accessory finishes from damage until final acceptance of the Work.

3.05 CLEANING AND ADJUSTMENT

A. Clean and polish all exposed surfaces after installation, and after removal of labels and protective coatings or coverings.

B. Test and adjust accessories for proper and smooth operation.

END OF SECTION

SECTION 10 4400

FIRE PROTECTION SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fire extinguishers.

B. Fire extinguisher cabinets.

C. Accessories.

1.02 REFERENCE STANDARDS

A. FM (AG) - FM Approval Guide.

B. NFPA 10 - Standard for Portable Fire Extinguishers.

C. UL (DIR) - Online Certifications Directory.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Manufacturer's Installation Instructions: Indicate special criteria and wall opening coordination requirements.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

D. Maintenance Data: Include test, refill or recharge schedules and re-certification requirements.

1.04 FIELD CONDITIONS

A. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturers:
1. Activar Construction Products Group, Inc. - JL Industries: www.activarcpg.com/#sle.
2. Kidde, a unit of United Technologies Corp.: www.kidde.com.
3. Larsen's Manufacturing Co.: www.larsensmfg.com.
4. Nystrom, Inc.: www.nystrom.com.
5. Potter-Roemer: www.potterroemer.com/#sle.
6. Substitutions: See Section 01 6000 - Product Requirements.

2.02 FIRE EXTINGUISHERS

A. General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.
1. Provide extinguishers labeled by UL (DIR) or FM (AG) for purpose specified and as indicated.

B. Multipurpose Dry Chemical Type Fire Extinguishers: Carbon steel tank, with pressure gauge.
1. Stored Pressure Operated: Deep Drawn.
2. Class: A:B:C type.
3. Size: 10 pound.
4. Finish: Baked polyester powder coat, red color.
5. Temperature Range: -65 degrees F to 120 degrees F.

2.03 CABINETS

A. Non-Fire Rated Cabinet Construction:
1. Formed primed steel sheet; 0.036 inch thick base metal.

B. Cabinet Configuration: Semi-recessed type, unless otherwise indicated or specified.
   1. Sized to accommodate scheduled items and accessories.
   2. Semi-Recessed Cabinets: Maximum 4 inch projection from wall surface, including handles and other components.
   3. Trimless type.
   4. Provide cabinet enclosure with right angle inside corners and seams, and with formed perimeter trim and door stiles.

C. Door: 0.036 inch metal thickness, reinforced for flatness and rigidity with nylon catch. Hinge doors for 180 degree opening with continuous piano hinge.

D. Door Glazing: Tempered glass, clear, 1/8 inch thick, and set in resilient channel glazing gasket.

E. Cabinet Mounting Hardware: Appropriate to cabinet, with pre-drilled holes for placement of anchors.

F. Fabrication: Weld, fill, and grind components smooth.

G. Finish of Cabinet Exterior Trim and Door: Baked enamel, color as selected by Architect.

H. Finish of Cabinet Interior: White colored enamel.

2.04 ACCESSORIES

A. Lettering: “FIRE EXTINGUISHER” decal, or vinyl self-adhering, pre-spaced black lettering in accordance with authorities having jurisdiction (AHJ).

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify rough openings for cabinet are correctly sized and located.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Fire Extinguisher Cabinets: Install cabinets plumb and level in wall openings, maximum 30 inches from finished floor to inside bottom of cabinet.

C. Secure rigidly in place.

D. Place extinguishers in cabinets.

END OF SECTION

SECTION 10 8210

EQUIPMENT SCREENS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pre-formed thermoplastic panel equipment screens.

B. Attachment frame system.

C. System accessories.

D. Design engineering of equipment screen system.

1.02 REFERENCE STANDARDS

A. ASCE 7 - Minimum Design Loads for Buildings and Other Structures; American Society of Civil Engineers.

B. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

C. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes [Metric].

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate the Work with installation of affected rooftop equipment.

B. Preinstallation Meeting: Convene one week before starting work of this Section.
   1. Convene under general provisions of Section 01 7000.
   2. Require attendance of parties directly concerned with the work of this Section, including those who are required to coordinate with the work, and those who are required to protect the work upon completion. Include the manufacturer's technical representative.
   3. Review installation procedures and coordination required with related work, and conditions which could affect successful performance of the Work.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate system and panel layout plan and elevations, component connection details, clearance dimensions, tolerances, frame details, and details of interface with adjacent construction and equipment.

C. Product Data: Provide data describing system characteristics, standard detail sheets, and system limitations.

D. Samples: Submit samples of available plastic panel colors, for selection.

E. Certificate: Submit manufacturer's certification that products meet or exceed specified requirements.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this Section, with not less than three years of documented experience.

B. Installer Qualifications: Company specializing in performing the work of this Section with minimum three years of experience.

C. Perform design under direct supervision of a Professional Engineer experienced in design of this Work and licensed in Colorado.

D. Basis of Design: Drawing details are based on screen and support profiles by specified basis of design manufacturer. Similar profiles by other acceptable manufacturers are permitted, subject to compliance with all specified performance characteristics, and provided that deviations in dimension, profile, performance, and finish are minor and do not detract from the indicated design intent.
   1. Comply with requirements specified in Section 01 4000 and Section 01 6000.

1.06 DELIVERY, STORAGE, AND PROTECTION

A. Provide wrapping to protect pre-finished panel surfaces. Do not use adhesive papers or sprayed coatings which bond when exposed to sunlight or weather.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design Manufacturer:
   1. CityScapes, Inc.: www.cityscapesinc.com.
      a. Screen System: Envisor Screening System.
   2. Substitutions: See Section 01 6000 - Product Requirements.

2.02 DESIGN REQUIREMENTS

A. General: Design system to resist snow, wind, suction, and uplift loading at any point in the system without damage or permanent set.

B. Framing: Comply with minimum criteria according to ASCE 7.

2.03 MATERIALS

A. Aluminum Framing: ASTM B221 (ASTM B221M); alloy and temper according to manufacturer’s standards.

B. Metal Panels: Rigid galvalume metal sheets; minimum 24 gage thickness.

2.04 ACCESSORIES

A. Fasteners and Anchors: Stainless steel type; sized and configured to comply with design requirements.

2.05 FABRICATION

A. Factory-form panel system with continuous interlocking panel connections and indicated or required components. Form components true to shape, accurate in size, square, and free from distortion or visual defects.

B. Cut panels to precise lengths required for proper fit on designated equipment units.
   1. Panel Configuration: Vertical.
   2. Profile: Basis of Design Manufacturer's "Vertical Perforated" profile.
   3. Top Trim: Basis of Design Manufacturer's "2-Step" profile; 5-1/2 inch vertical dimension.

C. Trim and Closures: Fabricated from minimum 24 gage metal, finished with manufacturer’s standard coating system; provide top trim as indicated.

D. Framing: Fabricate and assemble components in largest practical sizes for delivery to site.
   1. Construct corner frames to required shape with joints tightly fitted and welded.
   2. Supply components required for anchorage of framing. Fabricate anchors and related components of material and finish as required to comply with specified design requirements.

2.06 FINISHES

A. Modified Silicone Polyester Coating: Pigmented Organic Coating System, AAMA 2603; baked enamel finish system.

B. Aluminum Surfaces: Mill finish.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that equipment items are ready to receive work and unit dimensions are as indicated on shop drawings.

3.02 INSTALLATION

A. Install equipment screen system in accordance with manufacturer's instructions.

B. Install system level and plumb.

C. Secure screen assembly to equipment units without damaging operation of unit. Secure to internal equipment frame wherever possible.

D. Provide corner and mid-span attachments as required to support panels uniformly.

E. Insert panels into structural supports, except where fixed attachment points are indicated or required. Set panels tight to adjacent panels for uniform fit.

F. Separate dissimilar metals with primer, bituminous coating, or other material to separate metals and prevent corrosion.

G. Do not cut or abrade finishes that cannot be restored during installation.

3.03 TOLERANCES

A. Maximum Variation From True Position: 1/4 inch.

B. Maximum Offset From True Alignment: 1/4 inch.

3.04 CLEANING

A. Clean surfaces and components immediately prior to Substantial Completion.

END OF SECTION

SECTION 11 3013

RESIDENTIAL APPLIANCES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Kitchen appliances.

1.02 REFERENCE STANDARDS

A. UL (DIR) - Online Certifications Directory.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate clearance requirements and utility service rough-in locations with casework in which appliances are to be installed.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's data indicating dimensions, capacity, and operating features of each piece of residential equipment specified.

C. Installation Instructions: Submit manufacturer's printed installation instructions for each appliance type, including clearance requirements and utility service location requirements.

D. Copies of Warranties: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Electric Appliances: Listed and labeled by UL (DIR) and complying with NEMA Standards (National Electrical Manufacturers Association).

B. Basis of Design: Specifications are based on appliance models and types by the specified basis of design manufacturer. Appliances manufactured by other acceptable manufacturers are permitted, subject to compliance with all specified requirements; and provided that deviations in dimensions, sizes, style, function, and finish are minor, and do not detract substantially from the indicated design intent.
   1. Comply with requirements specified in Section 01 4000 and Section 01 6000.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design Manufacturer:
   1. Manufacturers and models as scheduled on Drawings.
   2. Substitutions: See Section 01 6000 - Product Requirements.

2.02 APPLIANCES - GENERAL

A. Appliances Eligible for Energy Star Rating: Energy Star Rated.

2.03 ACCESSORIES

A. Provide appliances with light bulbs, power cords, and other standard accessories supplied by the manufacturer or required for complete and functional installation of each appliance unit.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify utility rough-ins are provided and correctly located.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

3.03 ADJUSTING

A. Adjust equipment to provide efficient operation.

3.04 CLEANING

A. Remove packing materials from equipment and properly discard.

B. Wash and clean equipment.

END OF SECTION

SECTION 11 9600

MISCELLANEOUS EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Miscellaneous equipment.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate the installation of equipment items with size, location and installation of service utilities.

B. Sequencing: Ensure that utility connections are achieved in an orderly and expeditious manner.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide product data for specified equipment items.

C. Project Record Documents: Accurately record actual locations of embedded utilities and components that will be concealed from view upon completion of work.

D. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the work of this Section with minimum three years of experience.

B. Basis of Design: Specifications are based on equipment items by specified basis of design manufacturer. Equipment items manufactured by other acceptable manufacturers are permitted, subject to compliance with specified requirements; and provided that deviations in design, weight, and profile are minor, and do not detract substantially from the indicated design intent.
   1. Comply with requirements specified in Section 01 4000 and Section 01 6000.

1.05 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion.

C. Provide five year manufacturer warranty for trolley motor and associated controls.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design Manufacturers:
   1. Manufacturers and products as specified on Drawings.
   2. Substitutions: See Section 01 6000 - Product Requirements.

2.02 EQUIPMENT

A. See Drawings for schedule of equipment items.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

3.02 ADJUSTING

A. Adjust operating components for smooth operation.

3.03 CLEANING

A. Clean equipment items immediately before Substantial Completion.

3.04 CLOSEOUT ACTIVITIES

A. Demonstrate proper operation of equipment to Owner's designated representative.

B. Demonstration: Demonstrate operation of system to Owner's personnel.
   1. Use operation and maintenance data as reference during demonstration.
   2. Briefly describe function, operation, and maintenance of each component.

C. Training: Train Owner's personnel on operation and maintenance of system.
   1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
   2. Provide minimum of two hours of training.
   3. Instructor: Manufacturer's training personnel.
   4. Location: At project site.

3.05 PROTECTION

A. Protect installed equipment items from subsequent construction operations.

END OF SECTION

SECTION 12 2400

WINDOW SHADES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Interior manual roller shades.

B. Interior motorized roller shades.

C. Motor controls.

1.02 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design.

B. NFPA 70 - National Electrical Code.

C. NFPA 701 - Standard Methods of Fire Tests for Flame Propagation of Textiles and Films.

D. UL 325 - Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems.

E. WCMA A100.1 - Safety of Window Covering Products.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Where motorized shades are to be controlled by control systems provided under other sections, coordinate the work with other trades to provide compatible products.
   2. Coordinate the work with other trades to provide rough-in of electrical wiring as required for installation of hardwired motorized shades.
   3. Coordinate with window installation and placement of concealed blocking to support shades.

B. Sequencing:
   1. Do not fabricate shades until field dimensions for each opening have been taken with field conditions in place.
   2. Do not install shades until final surface finishes and painting are complete.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets, including materials, finishes, fabrication details, dimensions, profiles, mounting requirements, and accessories.
   1. Motorized Shades: Include power requirements and standard wiring diagrams for specified products.

C. Shop Drawings: Include shade schedule indicating size, location and keys to details, head, jamb and sill details, mounting dimension requirements for each product and condition, and operation direction.
   1. Motorized Shades: Provide schematic system riser diagram indicating component interconnections. Include requirements for interface with other systems.

D. Certificates: Manufacturer's documentation that line voltage components are UL listed or UL recognized.

E. Source Quality Control Submittals: Provide test reports indicating compliance with specified fabric properties.

F. Selection Samples: Include fabric samples in full range of available colors and patterns.
   1. Motorized Shades: Include finish selections for controls.

G. Manufacturer's Instructions: Include instructions for storage, handling, protection, examination, preparation, and installation of product.

H. Project Record Documents: Record actual locations of control systems and show interconnecting wiring.

I. Operation and Maintenance Data: List of all components with part numbers, sources of supply, and operation and maintenance instructions; include copy of shop drawings.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing work of this type with minimum three years of documented experience with shading systems of similar size and type.
   1. Factory training and demonstrated experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver shades in manufacturer's unopened packaging, labeled to identify each shade for each opening.

B. Handle and store shades in accordance with manufacturer's recommendations.

1.07 FIELD CONDITIONS

A. Do not install products under environmental conditions outside manufacturer's absolute limits.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design Manufacturer:
   1. As specified on Drawings for each shade and fabric type.
   2. Substitutions: See Section 01 6000 - Product Requirements.

B. Source Limitations: Furnish products produced by a single manufacturer and obtained from a single supplier.

2.02 ROLLER SHADES

A. General:
   1. Provide shade system components that are easy to remove or adjust without removal of mounted shade brackets.
   2. Provide shade system that operates smoothly when shades are raised or lowered.
   3. Manually Operated Shades: Comply with ADA Standards for operating pull force; maximum 5 lb.
   4. Comply with volatile organic compound (VOC) content and emissions restrictions specified in Section 01 6116 - VOC Content and Emissions Restrictions.
   5. Motorized Shades: Motor system housed inside roller tube, controlling shade movement via motor controls indicated; listed or recognized to UL 325.
      a. Comply with NFPA 70.
      b. Electrical Components: Listed, classified, and labeled as suitable for the purpose intended. Where applicable, system components to be FCC compliant.
      c. Motors: Size and configuration as recommended by manufacturer for the type, size, and arrangement of shades to be operated; integrated into shade operating components and concealed from view; fully compatible with controls to be installed.

B. Roller Shades:
   1. Description: Single or double roller, manually or motor operated fabric window shades; as indicated on Drawings.
      a. Drop Position: Regular roll.
      b. Mounting: Wall mounted.
      c. Fabric: As selected by Architect from manufacturer's full line
   2. Brackets and Mounting Hardware: As recommended by manufacturer for mounting indicated and to accommodate shade fabric roll-up size and weight.
      a. Material: Steel, 1/8 inch thick.
      b. Double Roller Brackets: Configured for light-filtering and room-darkening shades in one opening.
         1) Light-Filtering Fabric: Room-side of opening.
         2) Room-Darkening Fabric: Glass-side of opening.
      c. Multiple Shade Band Operation: Provide hardware as necessary to operate more than one shade band using a single clutch operator.

3. Roller Tubes:
    a. Material: Extruded aluminum.
    b. Size: As recommended by manufacturer; selected for suitability for installation conditions, span, and weight of shades.
    c. Fabric Attachment: Utilize extruded channel in tube to accept vinyl spline welded to fabric edge. Shade band to be removable and replaceable without removing roller tube from brackets or inserting spline from the side of the roller tube.
    d. Roller tubes to be capable of being removed and reinstalled without affecting roller shade limit adjustments.
4. Hembars: Designed to maintain bottom of shade straight and flat.
    a. Style: Full wrap fabric covered bottom bar, flat profile with heat sealed closed ends.
5. Clutch Operator: Manufacturer's standard material and design integrated with bracket/brake assembly.
    a. Provide a permanently lubricated brake assembly mounted on an oil-impregnated hub with wrapped spring clutch.
    b. Brake must withstand minimum pull force of 50 pounds in the stopped position.
    c. Mount clutch/brake assembly on the support brackets, fully independent of the roller tube components.
6. Drive Chain: Continuous loop stainless steel beaded ball chain, 95 pound minimum breaking strength. Provide upper and lower limit stops.
    a. Chain Retainer: Chain tensioning device complying with WCMA A100.1.
7. Managed Lift: Required lifting force of 3 pounds to a maximum of 8.5 pounds for single-band or multi-band shades up to 5 bands and a maximum of 30 pounds hanging weight.
8. Accessories:
    a. Fascia: Extruded aluminum, size as required to conceal shade mounting, attachable to brackets without exposed fasteners; fabric wrapped finish to match shade.
        1) Configuration: Captured, fascia stops at captured bracket end.
    b. Fasteners: Noncorrosive, and as recommended by shade manufacturer.

2.03 SHADE FABRIC

A. Fabric: Nonflammable, color-fast, impervious to heat and moisture, and able to retain its shape under normal operation.
1. Acceptable Manufacturers:
    a. Manufacturer and product as specified on Drawings.
    b. Substitutions: See Section 01 6000 - Product Requirements.
2. Material: 100 percent polyester.
3. Performance Requirements:
    a. Flammability: Pass NFPA 701 large and small tests.
    b. Fungal Resistance: No growth when tested according to ASTM G21.
4. Openness Factor: As selected by Architect from manufacturer's full line.
5. Roll Width: 72 inches.
6. Color: As selected by Architect from manufacturer’s full range of colors.
7. Fabrication:
    a. Fabric Orientation: Railroaded, fabric is turned 90 degrees off the roll.
    b. Battens: Full width of shade, enclose in welded shade fabric pocket.

2.04 MOTOR CONTROLS

A. Unless specifically indicated to be excluded, provide all required equipment, conduit, boxes, wiring, connectors, hardware, supports, accessories, software, system programming, etc. as necessary for a complete operating system that provides the control intent indicated.

B. Provide all components and connections necessary to interface with other systems as indicated.

C. Manual Controls:
1. Control Functions:
    a. Raise: Raise controlled shade(s) only while button is pressed.
    b. Lower: Lower controlled shade(s) only while button is pressed.
    c. Presets: For selection of predetermined shade positions.
    d. Multiple Shade Groups: Provide individual controls for each shade group as indicated.

2. Wall Controls: Provided by shade manufacturer.
    a. Finish: To be selected by Architect.
    b. Button Engraving: Manufacturer's standard engraving, unless otherwise indicated.

2.05 ROLLER SHADE FABRICATION

A. Field measure finished openings prior to ordering or fabrication.

B. Dimensional Tolerances: Fabricate shades to fit openings within specified tolerances.
1. Vertical Dimensions: Fill openings from head to sill with 1/2 inch space between bottom bar and window stool.
2. Horizontal Dimensions - Inside Mounting: Fill openings from jamb to jamb.
3. Horizontal Dimensions - Outside Mounting: Cover window frames, trim, and casings completely.

C. At openings requiring continuous multiple shade units with separate rollers, locate roller joints at window mullion centers; butt rollers end-to-end.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine finished openings for deficiencies that may preclude satisfactory installation.

B. Start of installation shall be considered acceptance of substrates.

3.02 PREPARATION

A. Prepare surfaces using methods recommended by manufacturer for achieving best result for substrate under the project conditions.

B. Coordinate with window installation and placement of concealed blocking to support shades.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions and approved shop drawings, using mounting devices as indicated.

B. Replace shades that exceed specified dimensional tolerances at no extra cost to Owner.

C. Adjust level, projection, and shade centering from mounting bracket. Verify there is no telescoping of shade fabric. Ensure smooth shade operation.

3.04 SYSTEM STARTUP

A. Motorized Shade System: Provide services of a manufacturer's authorized representative to perform system startup.

3.05 CLEANING

A. Clean soiled shades and exposed components as recommended by manufacturer.

B. Replace shades that cannot be cleaned to "like new" condition.

3.06 CLOSEOUT ACTIVITIES

A. Demonstration: Demonstrate operation and maintenance of window shade system to Owner's personnel.

B. Training: Train Owner's personnel on operation and maintenance of system.
1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
2. Provide minimum of two hours training by manufacturer's authorized personnel at location designated by the Owner.

3.07 PROTECTION

A. Protect installed products from subsequent construction operations.

B. Touch-up, repair, or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 12 2600

INTERIOR DAYLIGHTING DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Louvered daylighting devices.

1.02 REFERENCE STANDARDS

A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum.

B. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

C. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes [Metric].

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

C. Shop Drawings: Include mounting dimension requirements for each product and condition.

D. Verification Samples: Minimum size 6 inches square, representing actual materials and color.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in installing work of the type specified in this Section, and with at least three years of documented experience and approved by manufacturer.

B. Source Limitations: Obtain daylighting devices through one source from a single manufacturer.

C. Basis of Design: Specifications are based on daylighting device types by specified basis of design manufacturer and product(s). Daylight device types manufactured by other acceptable manufacturers are permitted, subject to compliance with specified requirements; and provided that deviations in design, performance, and profile are minor, and do not detract substantially from the indicated design intent.
   1. Comply with requirements specified in Section 01 4000 and Section 01 6000.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to project site in manufacturer's original, unopened, undamaged containers with identification labels intact.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design Manufacturer:
   1. LightLouver, LLC; LightLouver Daylighting System: www.lightlouver.com.
   2. Substitutions: See Section 01 6000 - Product Requirements.

2.02 LOUVERED DAYLIGHTING DEVICES

A. Description: Shop fabricated, shop finished, fixed daylight louvers with flat panels anchored directly to interior vertical curtain wall or storefront mullions.

B. Mounting: Interior face of mullions.

C. Configuration: As indicated on Drawings.

D. Sizes: As indicated on Drawings.

E. Louver Framing: Manufacturer's standard extruded or formed-aluminum framing members of wall thickness required and reinforced as required to support loads.
   1. Finish: Class I natural anodized.
      a. Factory finish all surfaces that will be exposed in completed assemblies.

2.03 FABRICATION

A. General: Fabricate components for assembly following approved shop drawings and manufacturer's standard installation instructions.

B. Shop fabricate to the greatest extent possible; disassemble if necessary for shipping.

C. After fabrication, clearly mark components to identify their locations in project.

2.04 MATERIALS

A. Extruded Aluminum: Alloy and temper recommended by manufacturer for strength and application of required finish; ASTM B221 (ASTM B221M) 6063-T6, 6105-T5, or 6061-T6 alloy and temper.

2.05 FINISHES

A. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils thick.

B. Touch-Up Materials: As recommended by coating manufacturer for field application.

2.06 ACCESSORIES

A. Fasteners and Accessories: Nonmagnetic stainless steel; noncorrosive and compatible with aluminum members, anchors, and other components.

PART 3 EXECUTION

3.01 EXAMINATION

A. Field Measurements: Verify actual locations of structural supports for lightshelves by field measurements before fabrication and indicate measurements on shop drawings.

B. Verification of Conditions: Verify compliance with requirements for installation tolerances and other conditions affecting performance of the work.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Do not install damaged components.

C. Fit joints to produce hairline joints free of burrs and distortion.

D. Install components plumb and true in alignment with established lines and grades.

E. Touch-up minor damage to factory-applied finish; replace components that cannot be satisfactorily repaired.

3.03 CLEANING

A. Remove protective material from prefinished aluminum surfaces.

3.04 PROTECTION

A. Protect installed products from damage until Date of Substantial Completion.

END OF SECTION

SECTION 12 3600

COUNTERTOPS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Countertops for architectural wood casework.

B. Wall-hung counters and vanity tops.

1.02 REFERENCE STANDARDS

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate sizing and configuration of countertops with associated casework and adjacent construction.
   2. Coordinate sizing and locations of cutouts for plumbing fixtures with base cabinet configurations for proper alignments as indicated on Drawings.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Specimen warranty.

C. Shop Drawings: Complete details of materials and installation; combine with shop drawings of cabinets and casework specified in other Sections.
   1. Include countertop seam/joint locations; approval of locations is required prior to fabrication.

D. Installation Instructions: Manufacturer's installation instructions and recommendations.

E. Maintenance Data: Manufacturer's instructions and recommendations for maintenance and repair of countertop surfaces.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing work of the type specified in this Section, with not less than three years of documented experience.

1.06 MOCK-UP

A. See Section 01 4000 - Quality Requirements for additional requirements.

B. Mock-Up: Full size mock-up of each specified countertop type, in conjunction with complete base unit.
   1. Locate where directed.
   2. Mock up may remain as part of the work.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.08 FIELD CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturers:
   1. Manufacturers and products as specified on Drawings.
   2. Substitutions: See Section 01 6000 - Product Requirements.
      a. Acceptability of substituted items may be determined solely on the basis of design, appearance or finish.

2.02 MATERIALS

A. Adhesives and Joint Fillers: Chemical resistant waterproof adhesive as recommended by manufacturer of materials being joined; color as selected by fabricator to blend with primary surface color to conceal appearance of joint.
   1. Comply with volatile organic compound (VOC) content and emissions restrictions specified in Section 01 6116 - VOC Content and Emissions Restrictions.

B. Joint Sealant: Mildew-resistant silicone sealant, clear color.
   1. Comply with volatile organic compound (VOC) content and emissions restrictions specified in Section 01 6116 - VOC Content and Emissions Restrictions.

2.03 ACCESSORIES

A. Grommets: Standard plastic grommets for cut-outs, in color as selected by Architect.

B. Countertop Support Brackets:
   1. Material: Tempered, fabricated steel brackets designed for in-wall mounting as indicated; sizes and configurations as indicated on Drawings.
   2. Acceptable Product:
      a. Rakks/Rangine Corporation; EH-Series - Counter Support Brackets; www.rakks.com.
      b. Substitutions: See Section 01 6000 - Product Requirements.

2.04 FABRICATION

A. General: Fabricate tops and splashes in the largest sections practicable, with top surface of joints flush.
   1. Join lengths of tops using best method recommended by manufacturer.
   2. Fabricate to overhang fronts and ends of cabinets 1 inch except where top butts against cabinet or wall.
   3. Seams: Arrange seams symmetrically or in orderly locations, minimum 12 inches from edges of sink and similar cutouts.
   4. Prepare all cutouts accurately to size; replace tops having improperly dimensioned or unnecessary cutouts or fixture holes.

B. Provide back/end splash wherever counter edge abuts vertical surface unless otherwise indicated.
   1. Secure to walls with contact surfaces set in waterproof adhesive.
   2. Height: 4 inches, unless otherwise indicated.

C. Natural Stone Countertops: Fabricate tops in largest pratical pieces as determined by slab size and orientation of natural features; join pieces with adhesive sealant and joint filler in accordance with manufacturer's recommendations and instructions.

D. Solid Surfacing and Composite Countertops: Fabricate tops up to 144 inches long in one piece; join pieces with adhesive sealant and joint filler in accordance with manufacturer's recommendations and instructions.

E. Wall-Mounted Countertops: Provide skirts, aprons, brackets, and braces as indicated on Drawings, finished to match.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

C. Verify that wall surfaces have been finished and mechanical and electrical services and outlets are installed in proper locations.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

A. Install vanities in accordance with manufacturer's instructions, and as detailed on Drawings.

B. Install countertop support brackets securely to wall blocking; see Section 06 1000 for additional requirements.

C. Securely attach countertops to cabinets using concealed fasteners. Make flat surfaces level; shim where required.

D. Securely attach countertop brackets to structural framing as detailed on Drawings; securely attach countertops to brackets using concealed fasteners.

E. Install grommets in countertops where indicated on Drawings; coordinate precise locations with Owner or Architect prior to drilling holes for grommets.

F. Seal joint between back/end splashes and vertical surfaces.

3.04 TOLERANCES

A. Variation From Horizontal: 1/8 inch in 10 feet, maximum.

B. Offset From Wall, Countertops: 1/8 inch maximum; 1/16 inch minimum.

C. Field Joints: 1/8 inch wide, maximum.

3.05 CLEANING

A. Clean countertops surfaces thoroughly.

3.06 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

SECTION 12 9313

INDOOR BICYCLE RACKS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Bicycle racks, indoor locations.

1.02 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.

B. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.

C. ICC-ES AC308 - Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.

C. Selection Samples: For each finish product specified, color chips representing manufacturer's full range of available colors and patterns.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Handle racks and accessories with sufficient care to prevent scratches and other damage to the finish.

PART 2 PRODUCTS

2.01 BICYCLE RACKS AND ACCESSORIES

A. Indoor Bicycle Racks: Device designed for indoor storage of bicycles; allows user-provided lock to simultaneously secure one wheel and part of the frame on each bicycle parked or racked.
   1. Style: Indoor, wall mounted, single level, vertical, single-sided storage rack with fixed arms and locking loops.
   2. Finish: Powder coat, maintenance-free and weather-resistant.
   3. Color: As selected by Architect from manufacturer's complete range of available colors.
   4. Basis of Design Product:
      a. DERO Bike Rack Co.; BikeFile Wall Mount: www.dero.com.
      b. Substitutions: See Section 01 6000 - Product Requirements.

2.02 MATERIALS

A. Tube: Carbon steel, ASTM A500/A500M.

B. Bar, Round and Flat, Carbon Steel: ASTM A36/A36M.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine surfaces to receive bicycle racks and accessories..

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

C. Do not begin installation until unsatisfactory substrates have been properly repaired.

3.02 PREPARATION

A. Ensure surfaces to receive bicycle racks and accessories are clean, flat, and level.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install bicycle racks level, plumb, square, and correctly located as indicated on Drawings.

C. Post-Installed Anchors: Comply with ICC-ES AC308.

3.04 CLEANING

A. Clean installed work to like-new condition. Do not use cleaning materials or methods that could damage finish.

3.05 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

SECTION 22 0517

SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Sleeves.
2. Stack-sleeve fittings.
3. Sleeve-seal systems.
4. Sleeve-seal fittings.
5. Grout.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.

C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.

D. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

E. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

2.2 STACK-SLEEVE FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Smith, Jay R. Mfg. Co.
2. Zurn Specification Drainage Operation; Zurn Plumbing Products Group.

B. Description: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring, bolts, and nuts for membrane flashing.

1. Underdeck Clamp: Clamping ring with setscrews.

2.3 SLEEVE-SEAL SYSTEMS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Advance Products & Systems, Inc.
2. Metraflex Company (The).
3. Pipeline Seal and Insulator, Inc.

B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.

1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
2. Pressure Plates: Stainless steel.
3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

2.4 SLEEVE-SEAL FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Presealed Systems.

B. Description: Manufactured plastic, sleeve-type, waterstop assembly made for imbedding in concrete slab or wall. Unit has plastic or rubber waterstop collar with center opening to match piping OD.

2.5 GROUT

A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Nonshrink; recommended for interior and exterior applications.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch 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. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
2. 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.

3. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.

D. Install sleeves for pipes passing through interior partitions.

1. Cut sleeves to length for mounting flush with both surfaces.
2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Section "Joint Sealants."

E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section "Penetration Firestopping."

3.2 STACK-SLEEVE-FITTING INSTALLATION

A. Install stack-sleeve fittings in new slabs as slabs are constructed.

1. Install fittings that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
2. Secure flashing between clamping flanges for pipes penetrating floors with membrane waterproofing. Comply with requirements for flashing specified in Section "Sheet Metal Flashing and Trim."
3. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level.
4. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
5. Using grout, seal the space around outside of stack-sleeve fittings.

B. Fire-Barrier Penetrations: Maintain indicated fire rating of floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section "Penetration Firestopping."

3.3 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.

3.4 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.

3.5 SLEEVE AND SLEEVE-SEAL SCHEDULE

A. Use sleeves and sleeve seals for the following piping-penetration applications:

1. Exterior Concrete Walls above Grade:

    a. Piping Smaller Than NPS 6: Sleeve-seal fittings.
    b. Piping NPS 6 and Larger: Cast-iron wall sleeves.

2. Exterior Concrete Walls below Grade:

    a. Piping Smaller Than NPS 6: Sleeve-seal fittings.

        1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

    b. Piping NPS 6 and Larger: Cast-iron wall sleeves with sleeve-seal system.

        1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

3. Concrete Slabs-on-Grade:

    a. Piping Smaller Than NPS 6: Sleeve-seal fittings.

1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

b. Piping NPS 6 and Larger: Cast-iron wall sleeves with sleeve-seal system.

1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

4. Concrete Slabs above Grade:

a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves, Stack-sleeve fittings, or Molded-PE or -PP sleeves.
b. Piping NPS 6 and Larger: Galvanized-steel-pipe sleeves or Stack-sleeve fittings.

5. Interior Partitions:

a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves.
b. Piping NPS 6 and Larger: Galvanized-steel-sheet sleeves or Cast-iron wall sleeves.

END OF SECTION

SECTION 22 0523

GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Brass ball valves.
2. Bronze ball valves.
3. Bronze swing check valves.
4. Bronze gate valves.
5. Bronze globe valves.

B. Related Sections:

1. Section "Identification for Plumbing Piping and Equipment" for valve tags and schedules.
2. Section "Domestic Water Piping" for valves applicable only to this piping.
3. Section "Sanitary Waste Piping Specialties" for valves applicable only to this piping.
4. Section "Storm Drainage Piping Specialties" for valves applicable only to this piping.

1.3 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.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of valve indicated.

1.5 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 B31.1 for power piping valves.
3. ASME B31.9 for building services piping valves.

C. NSF Compliance: NSF 61 for valve materials for potable-water service.

1.6 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

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Refer to valve schedule articles for applications of valves.

B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

C. Valve Sizes: Same as upstream piping unless otherwise indicated.

D. Valve Actuator Types:
1. Handwheel: For valves other than quarter-turn types.
2. Handlever: For quarter-turn valves NPS 6 and smaller.
3. Wrench: For plug valves with square heads. Furnish Owner with 1 wrench for every 5 plug valves, for each size square plug-valve head.

E. Valves in Insulated Piping: With 2-inch stem extensions and the following features:

1. Gate Valves: With rising stem.
2. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.

F. Valve-End Connections:
1. 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.

2.2 BRASS BALL VALVES

A. Two-Piece, Full-Port, Brass Ball Valves with Brass Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Crane Co.; Crane Valve Group; Crane Valves.
b. Hammond Valve.
c. Milwaukee Valve Company.
d. NIBCO INC.

2. Description:

a. Standard: MSS SP-110.
b. SWP Rating: 150 psig.
c. CWP Rating: 600 psig.
d. Body Design: Two piece.
e. Body Material: Forged brass.
f. Ends: Threaded.
g. Seats: PTFE or TFE.
h. Stem: Brass.
i. Ball: Chrome-plated brass.
j. Port: Full.

B. Two-Piece, Full-Port, Brass Ball Valves with Stainless-Steel Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Crane Co.; Crane Valve Group; Crane Valves.
b. Hammond Valve.
c. Milwaukee Valve Company.

2. Description:

a. Standard: MSS SP-110.
b. SWP Rating: 150 psig.
c. CWP Rating: 600 psig.
d. Body Design: Two piece.
e. Body Material: Forged brass.
f. Ends: Threaded.
g. Seats: PTFE or TFE.

h. Stem: Stainless steel.
i. Ball: Stainless steel, vented.
j. Port: Full.

2.3 BRONZE BALL VALVES

A. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim:

1. Manufacturers: Subject to compliance with requirements,:

a. Crane Co.; Crane Valve Group; Crane Valves.
b. Hammond Valve.
c. Milwaukee Valve Company.
d. NIBCO INC.
e. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-110.
b. SWP Rating: 150 psig.
c. CWP Rating: 600 psig.
d. Body Design: Two piece.
e. Body Material: Bronze.
f. Ends: Threaded.
g. Seats: PTFE or TFE.
h. Stem: Bronze.
i. Ball: Chrome-plated brass.
j. Port: Full.

B. Two-Piece, Full-Port, Bronze Ball Valves with Stainless-Steel Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Crane Co.; Crane Valve Group; Crane Valves.
b. Hammond Valve.
c. Milwaukee Valve Company.
d. NIBCO INC.
e. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-110.
b. SWP Rating: 150 psig.
c. CWP Rating: 600 psig.
d. Body Design: Two piece.
e. Body Material: Bronze.
f. Ends: Threaded.
g. Seats: PTFE or TFE.
h. Stem: Stainless steel.
i. Ball: Stainless steel, vented.
j. Port: Full.

2.4 BRONZE SWING CHECK VALVES

A. Class 125, Bronze Swing Check Valves with Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Stockham Division.
c. Hammond Valve.
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 3.
b. CWP Rating: 200 psig.
c. Body Design: Horizontal flow.
d. Body Material: ASTM B 62, bronze.
e. Ends: Threaded.
f. Disc: Bronze.

B. Class 150, Bronze Swing Check Valves with Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Stockham Division.
c. Milwaukee Valve Company.
d. NIBCO INC.

2. Description:

a. Standard: MSS SP-80, Type 3.
b. CWP Rating: 300 psig.
c. Body Design: Horizontal flow.
d. Body Material: ASTM B 62, bronze.
e. Ends: Threaded.
f. Disc: Bronze.

2.5 BRONZE GATE VALVES

A. Class 125, NRS Bronze Gate Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Stockham Division.
c. Hammond Valve.
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 1.
b. CWP Rating: 200 psig.
c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
d. Ends: Threaded or solder joint.
e. Stem: Bronze.
f. Disc: Solid wedge; bronze.
g. Packing: Asbestos free.
h. Handwheel: Malleable iron[**, bronze, or aluminum**].

B. Class 125, RS Bronze Gate Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Stockham Division.
c. Hammond Valve.
d. 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 2.
b. CWP Rating: 200 psig.
c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
d. Ends: Threaded or solder joint.
e. Stem: Bronze.
f. Disc: Solid wedge; bronze.
g. Packing: Asbestos free.
h. Handwheel: Malleable iron, bronze, or aluminum.

C. Class 150, RS Bronze Gate Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Stockham Division.
c. Hammond Valve.
d. 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 2.
b. CWP Rating: 300 psig.
c. Body Material: ASTM B 62, bronze with integral seat and union-ring bonnet.
d. Ends: Threaded.
e. Stem: Bronze.

f. Disc: Solid wedge; bronze.
g. Packing: Asbestos free.
h. Handwheel: Malleable iron, bronze, or aluminum.

2.6 BRONZE GLOBE VALVES

A. Class 125, Bronze Globe Valves with Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Stockham Division.
c. Hammond Valve.
d. 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 1.
b. CWP Rating: 200 psig.
c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
d. Ends: Threaded or solder joint.
e. Stem and Disc: Bronze.
f. Packing: Asbestos free.
g. Handwheel: Malleable iron, bronze, or aluminum.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

E. Install chainwheels on operators for butterfly gate and plug valves NPS 4 and larger and more than 96 inches above floor. Extend chains to 60 inches above finished floor.

F. Install check valves for proper direction of flow and as follows:

1. Swing Check Valves: In horizontal position with hinge pin level.
2. Center-Guided and Plate-Type Check Valves: In horizontal or vertical position, between flanges.
3. Lift Check Valves: With stem upright and plumb.

3.3 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valve applications are not indicated, use the following:

1. Shutoff Service: Ball or gate valves.
2. Throttling Service: Globe valves.
3. Pump-Discharge Check Valves:

    a. NPS 2 and Smaller: Bronze swing check valves with bronze disc.

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.

3.5 DOMESTIC, HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller:

1. Bronze and Brass Valves: May be provided with solder-joint ends instead of threaded ends.
2. Ball Valves: Two piece, full port, brass or bronze with bronze or stainless-steel trim.
3. Bronze Swing Check Valves: Class 150, bronze disc.
4. Bronze Gate Valves: Class 150, NRS.
5. Bronze Globe Valves: Class 150, bronze disc.

END OF SECTION

SECTION 22 0529

HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Metal framing systems.
4. Thermal-hanger shield inserts.
5. Fastener systems.

B. Related Sections:

1. Section "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
2. Section "Expansion Fittings and Loops for Plumbing Piping" for pipe guides and anchors.
3. Section "Vibration and Seismic Controls for Plumbing Piping and Equipment" for vibration isolation devices.

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following; include Product Data for components:

1. Trapeze pipe hangers.
2. Metal framing systems.

C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Detail fabrication and assembly of trapeze hangers.

2. Design Calculations: Calculate requirements for designing trapeze hangers.

1.5 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.6 QUALITY ASSURANCE

A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pre-galvanized or hot dipped.
3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
4. Hanger Rods: Continuous-thread rod, nuts, and washer made of galvanized carbon steel or stainless steel.

B. Copper Pipe Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel or stainless steel.

2.2 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.3 METAL FRAMING SYSTEMS

A. MFMA Manufacturer Metal Framing Systems:

1. Description: Shop- or field-fabricated pipe-support assembly for supporting multiple parallel pipes.
2. Standard: MFMA-4.
3. Channels: Continuous slotted steel channel with inturned lips.
4. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.

5. Hanger Rods: Continuous-thread rod, nuts, and washer made of galvanized carbon steel or stainless steel.
6. Metallic Coating: Hot-dipped galvanized or Mill galvanized.
7. Paint Coating: Epoxy.
8. Plastic Coating: Polyurethane or Epoxy.

2.4 THERMAL-HANGER SHIELD INSERTS

A. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig minimum compressive strength and vapor barrier.

B. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig ASTM C 552 or Type II cellular glass with 100-psig minimum compressive strength.

C. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

D. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

E. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.5 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Expansion Anchors: Insert-wedge-type, stainless- steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.6 MISCELLANEOUS MATERIALS

A. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.

D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

E. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

F. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

G. Install hangers and supports to allow controlled thermal movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

H. Install lateral bracing with pipe hangers and supports to prevent swaying.

I. 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.

J. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

K. 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.

L. 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. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:

    a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.

5. Pipes NPS 8 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.2 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.

3.3 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

    1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.4 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel pipe hangers and supports, metal trapeze pipe hangers, and metal framing systems and attachments for general service applications.

F. Use copper-plated pipe hangers and copper or stainless-steel attachments for copper piping and tubing.

G. Use thermal-hanger shield inserts for insulated piping and tubing.

H. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of non-insulated or insulated, stationary pipes NPS 1/2 to NPS 30.
2. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
3. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.
4. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
5. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of non-insulated, stationary pipes NPS 3/4 to NPS 8.
6. Adjustable Band Hangers (MSS Type 9): For suspension of non-insulated, stationary pipes NPS 1/2 to NPS 8.
7. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of non-insulated, stationary pipes NPS 1/2 to NPS 8.
8. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of non-insulated, stationary pipes NPS 3/8 to NPS 8.
9. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
10. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.

I. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
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.

J. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
2. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
3. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
4. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

K. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.

3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:

    a. Light (MSS Type 31): 750 lb.

13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.

L. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

M. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

N. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

O. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION

SECTION 22 0553

IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.
4. Valve tags.
5. Warning tags.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

D. Valve numbering scheme.

E. Valve Schedules: For each piping system to include in maintenance manuals.

1.4 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

2.1 EQUIPMENT LABELS

A. Metal Labels for Equipment:

1. Material and Thickness: Brass, 0.032-inch; Stainless steel, 0.025-inch; Aluminum, 0.032-inch; or anodized aluminum, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
3. 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.
4. Fasteners: Stainless-steel rivets or self-tapping screws.

B. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 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 160 deg F.
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.

C. 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.

2.2 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.

B. Letter Color: White.

C. Background Color: Red.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

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. Label Content: Include caution and warning information, plus emergency notification instructions.

2.3 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: At least 1-1/2 inches high.

2.4 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; Stainless steel, 0.025-inch; Aluminum, 0.032-inch; or anodized aluminum, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Fasteners: Brass wire-link chain or S-hook.

B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch 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.

2.5 WARNING TAGS

A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.

1. Size: Approximately 4 by 7 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

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

A. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.

B. Pipe Label Color Schedule:

1. Domestic Water Piping:

   a. Background Color: Green.
   b. Letter Color: White.

2. Sanitary Waste and Storm Drainage Piping:

   a. Background Color: Black.
   b. Letter Color: White.

3.4 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, square.
   b. Hot Water: 1-1/2 inches, square.

2. Valve-Tag Color:

   a. Cold Water: Green.
   b. Hot Water: Green.

3. Letter Color:

   a. Cold Water: White.
   b. Hot Water: White.

3.5 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION

SECTION 22 0719

PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes insulating the following plumbing piping services:

1. Domestic cold-water piping.
2. Domestic hot-water piping.
3. Domestic recirculating hot-water piping.
4. Supplies and drains for handicap-accessible lavatories and sinks.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied, if any).

B. LEED Submittals:

1. Product Data for Credit IEQ 4.1: For adhesives and sealants, documentation including printed statement of VOC content and chemical components.
2. Product Data for Credit IEQ 4.2: For coatings and paints, documentation including printed statement of VOC content.
3. Laboratory Test Reports for Credit IEQ 4: For adhesives and sealants, documentation indicating that product complies with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

C. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84 by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

C. Comply with the following applicable standards and other requirements specified for miscellaneous components:

1. Supply and Drain Protective Shielding Guards: ICC A117.1.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.7 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section "Hangers and Supports for Plumbing Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

C. Coordinate installation and testing of heat tracing.

1.8 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.

1. Products: Subject to compliance with requirements, provide 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.

G. Mineral-Fiber, Preformed Pipe Insulation:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Johns Manville; Micro-Lok.
b. Knauf Insulation; 1000-Degree Pipe Insulation.
c. Owens Corning; Fiberglas Pipe Insulation.

2. Type I, 850 Deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ-SSL. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.2 INSULATING CEMENTS

A. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.

1. Products: Subject to compliance with requirements, provide the following:

a. Ramco Insulation, Inc.; Super-Stik.

B. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449.

1. Products: Subject to compliance with requirements, provide the following:

a. Ramco Insulation, Inc.; Ramcote 1200 and Quik-Cote.

2.3 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.

1. Products: Subject to compliance with requirements, provide 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. Childers CP-82.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127.
b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70.
c. Mon-Eco Industries, Inc.; 22-25.

2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

D. 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 one of the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.
b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-20 or 85-60.
c. Mon-Eco Industries, Inc.; 22-25.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.4 COATINGS AND MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Vapor-Barrier Coatings: Water based; suitable for indoor or outdoor use on below-ambient services.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-80/30-90.
b. Childers CP-38.
c. Vimasco Corporation; 749.

2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
5. Color: White.

C. Vapor-Barrier Coatings: Solvent based; suitable for outdoor use on below-ambient services.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Encacel X/V.
b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 60-95/60-90.

2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 30-mil dry film thickness.
3. Service Temperature Range: Minus 50 to plus 220 deg F.
4. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.
5. Color: White.

D. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-10/11.
b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 46-50.
c. Vimasco Corporation; WC-1/WC-5.

2. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Solids Content: 60 percent by volume and 66 percent by weight.
5. Color: White.
6. Color: White.

2.5 SEALANTS

A. Joint Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Permanently flexible sealant.
3. Service Temperature Range: Minus 100 to plus 200 deg F.
4. Color: White, tan, or gray.
5. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
6. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

B. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, provide the following:

    a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: White.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.6 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.7 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. ABI, Ideal Tape Division; 428 AWF ASJ.
    b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0836.
    c. Compac Corporation; 104 and 105.

d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.

2. Width: 3 inches.
3. Thickness: 11.5 mils.
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

2.8 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Pipe Covers,:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Insul-Tect Products Co.; a subsidiary of MVG Molded Products.
b. McGuire Manufacturing.
c. Truebro; a brand of IPS Corporation.
d. 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.

B. Protective Shielding Piping Enclosures,:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Truebro; a brand of IPS Corporation.
b. Zurn Industries, LLC; Tubular Brass Plumbing Products Operation.

2. Description: Manufactured plastic enclosure for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with ADA requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

1. Verify that systems to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.

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 4 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 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches 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.

3.4 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 Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.

1. Comply with requirements in Section "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

C. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section "Penetration Firestopping."

3.5 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate 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.
6. 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.
7. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
8. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

3.6 INSTALLATION OF MINERAL-FIBER INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.

2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as 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.

3.7 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.8 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.

3.9 INDOOR PIPING INSULATION SCHEDULE

A. Domestic Cold Water:

1. NPS 1 and Smaller: Insulation shall be one of the following:
   a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch thick.

2. NPS 1-1/4 and Larger: Insulation shall be one of the following:
   a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

B. Domestic Hot and Recirculated Hot Water:

1. NPS 1-1/4 and Smaller: Insulation shall be one of the following:
   a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

2. NPS 1-1/2 and Larger: Insulation shall be one of the following:
   a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1-1/2 inch thick.

C. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities:

1. All Pipe Sizes: Insulation shall be the following:

   a. Flexible Elastomeric: 1/2 inch thick.

3.10 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Piping, Concealed:

1. None.

D. Piping, Exposed:

1. None.

END OF SECTION

SECTION 22 1116

DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Aboveground domestic water pipes, tubes, and fittings inside buildings.

1.3 ACTION SUBMITTALS

A. Product Data: For transition fittings and dielectric fittings.

B. LEED Submittals:

1. Product Data for Credit IEQ 4.1: For solvent cements and adhesive primers, documentation including printed statement of VOC content.
2. Laboratory Test Reports for Credit IEQ 4: For solvent cements and adhesive primers, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

1.4 INFORMATIONAL SUBMITTALS

A. System purging and disinfecting activities report.

B. Field quality-control reports.

1.5 FIELD CONDITIONS

A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:

1. Notify Owner no fewer than seven days in advance of proposed interruption of water service.
2. Do not interrupt water service without Owner's written permission.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

B. Potable-water piping and components shall comply with NSF 14 and NSF 61.

2.2 COPPER TUBE AND FITTINGS

A. Hard Copper Tube: ASTM B 88, Type L water tube, drawn temper.

B. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings.

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.

E. Copper Pressure-Seal-Joint Fittings:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Elkhart Products Corporation.
   b. NIBCO Inc.
2. Fittings for NPS 2 and Smaller: Wrought-copper fitting with EPDM-rubber, O-ring seal in each end.
3. Fittings for NPS 2-1/2 to NPS 4: Cast-bronze or wrought-copper fitting with EPDM-rubber, O-ring seal in each end.

F. Copper-Tube, Extruded-Tee Connections:
1. Manufacturers: Subject to compliance with requirements, provide products by the following:
   a. T-Drill Industries Inc.
2. Description: Tee formed in copper tube according to ASTM F 2014.

2.3 PIPING JOINING MATERIALS

A. Solder Filler Metals: ASTM B 32, lead-free alloys.

B. Flux: ASTM B 813, water flushable.

C. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

2.4 TRANSITION FITTINGS

A. General Requirements:

1. Same size as pipes to be joined.
2. Pressure rating at least equal to pipes to be joined.
3. End connections compatible with pipes to be joined.

B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

C. Sleeve-Type Transition Coupling: AWWA C219.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Cascade Waterworks Manufacturing.
   b. Dresser, Inc.; Piping Specialties Products.
   c. JCM Industries.
   d. Viking Johnson.

2.5 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. Capitol Manufacturing Company; member of the Phoenix Forge Group.
   b. Hart Industries International, Inc.
   c. Watts; a division of Watts Water Technologies, Inc.

2. Standard: ASSE 1079.
3. Pressure Rating: 150 psig.
4. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric Nipples:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Grinnell Mechanical Products; Tyco Fire Products LP.
   b. Precision Plumbing Products, Inc.
   c. Victaulic Company.

2. Standard: IAPMO PS 66.
3. Electroplated steel nipple complying with ASTM F 1545.
4. Pressure Rating and Temperature: 300 psig at 225 deg F.
5. End Connections: Male threaded or grooved.
6. Lining: Inert and noncorrosive, propylene.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install shutoff valve immediately upstream of each dielectric fitting.

C. Install domestic water piping level without pitch and plumb.

D. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.

E. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.

G. Install piping to permit valve servicing.

H. 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.

I. Install piping free of sags and bends.

J. Install fittings for changes in direction and branch connections.

K. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.

L. Install pressure gages on suction and discharge piping for each plumbing pump and packaged booster pump. Comply with requirements for pressure gages in Section "Meters and Gages for Plumbing Piping."

M. Install thermostats in hot-water circulation piping. Comply with requirements for thermostats in Section "Domestic Water Pumps."

N. Install thermometers on inlet and outlet piping from each water heater. Comply with requirements for thermometers in Section "Meters and Gages for Plumbing Piping."

O. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section "Sleeves and Sleeve Seals for Plumbing Piping."

P. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section "Sleeves and Sleeve Seals for Plumbing Piping."

Q. Install escutcheons for piping penetrations of walls, ceilings, and floors.

3.2 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

D. Brazed Joints for Copper Tubing: Comply with CDA's "Copper Tube Handbook," "Brazed Joints" chapter.

E. Soldered Joints for Copper Tubing: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."

F. Pressure-Sealed Joints for Copper Tubing: Join copper tube and pressure-seal fittings with tools recommended by fitting manufacturer.

G. Extruded-Tee Connections: Form tee in copper tube according to ASTM F 2014. Use tool designed for copper tube; drill pilot hole, form collar for outlet, dimple tube to form seating stop, and braze branch tube into collar.

H. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

3.3 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.

3.4 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 couplings or unions.

3.5 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for pipe hanger, support products, and installation in Section "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.

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.

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.

3.6 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.

C. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:

1. Domestic Water Booster Pumps: Cold-water suction and discharge piping.
2. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
3. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code.
4. Equipment: Cold- and hot-water-supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

3.7 IDENTIFICATION

A. Identify system components. Comply with requirements for identification materials and installation in Section "Identification for Plumbing Piping and Equipment."

B. Label pressure piping with system operating pressure.

3.8 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Piping Inspections:

a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:

1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.
2) Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.

c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

2. Piping Tests:

a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
d. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
f. Prepare reports for tests and for corrective action required.

B. Domestic water piping will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.9 ADJUSTING

A. Perform the following adjustments before operation:

1. Close drain valves, hydrants, and hose bibbs.
2. Open shutoff valves to fully open position.
3. Open throttling valves to proper setting.
4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.

a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide hot-water flow in each branch.
b. Adjust calibrated balancing valves to flows indicated.

5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.10 CLEANING

A. Clean and disinfect potable domestic water piping as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
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. Aboveground domestic water piping, NPS 2 and smaller, shall be one of the following:

1. Hard copper tube, ASTM B 88, Type L; cast- or wrought-copper, solder-joint fittings; and brazed or soldered joints.
2. Hard copper tube, ASTM B 88, Type L; copper pressure-seal-joint fittings; and pressure-sealed joints.

3.12 VALVE SCHEDULE

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Shutoff Duty: Use ball or gate valves for piping NPS 2 and smaller. Use butterfly, ball, or gate valves with flanged ends for piping NPS 2-1/2 and larger.
2. Throttling Duty: Use ball or globe valves for piping NPS 2 and smaller. Use butterfly or ball valves with flanged ends for piping NPS 2-1/2 and larger.
3. Hot-Water Circulation Piping, Balancing Duty: Calibrated Memory-stop balancing valves.
4. Drain Duty: Hose-end drain valves.

B. Use check valves to maintain correct direction of domestic water flow to and from equipment.

C. Iron grooved-end valves may be used with grooved-end piping.

END OF SECTION

SECTION 22 1119

DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Vacuum breakers.
2. Backflow preventers.
3. Balancing valves.
4. Water pressure reducing valves.
5. Temperature-actuated, water mixing valves.
6. Strainers.
7. Outlet boxes.
8. Hose stations.
9. Hose bibbs.
10. Wall hydrants.
11. Drain valves.
12. Water-hammer arresters.
13. Air vents.
14. Trap-seal primer valves.

B. Related Requirements:

1. Section "Meters and Gages for Plumbing Piping" for thermometers, pressure gages, and flow meters in domestic water piping.
2. Section "Domestic Water Piping" for water meters.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For domestic water piping specialties.

1. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PIPING SPECIALTIES

A. Potable-water piping and components shall comply with NSF 61 and NSF 14.

2.2 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig unless otherwise indicated.

2.3 VACUUM BREAKERS

A. Pipe-Applied, Atmospheric-Type Vacuum Breakers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Conbraco Industries, Inc.
    b. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
    c. 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 or Chrome plated, as indicated.

B. Hose-Connection Vacuum Breakers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Conbraco Industries, Inc.
    b. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
    c. Woodford Manufacturing Company; a division of WCM Industries, Inc.
    d. Zurn Industries, LLC; Plumbing Products Group; Wilkins Water Control Products.

2. Standard: ASSE 1011.
3. Body: Bronze, non-removable, with manual drain.
4. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
5. Finish: Chrome or nickel plated or Rough bronze, as indicated.

C. Pressure Vacuum Breakers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Conbraco Industries, Inc.
    b. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
    c. Zurn Industries, LLC; Plumbing Products Group; Wilkins Water Control Products.

2. Standard: ASSE 1020.
3. Operation: Continuous-pressure applications.
4. Pressure Loss: 5 psig maximum, through middle third of flow range.
5. Accessories:

    a. Valves: Ball type, on inlet and outlet.

2.4 BACKFLOW PREVENTERS

A. Beverage-Dispensing-Equipment Backflow Preventers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Conbraco Industries, Inc.
    b. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
    c. Zurn Industries, LLC; Plumbing Products Group; Wilkins Water Control Products.

2. Standard: ASSE 1022.
3. Operation: Continuous-pressure applications.
4. Size: NPS 1/4 or NPS 3/8, as indicated.
5. Body: Stainless steel.
6. End Connections: Threaded.

B. Dual-Check-Valve Backflow Preventers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Conbraco Industries, Inc.
    b. Mueller Co. Ltd.; a subsidiary of Mueller Water Products 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 1024.
3. Operation: Continuous-pressure applications.
4. Size: NPS 1/2 NPS 3/4 NPS 1, as indicated.
5. Body: Bronze with union inlet.

C. Hose-Connection Backflow Preventers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Conbraco Industries, Inc.
    b. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
    c. Woodford Manufacturing Company; a division of WCM Industries, Inc.

2. Standard: ASSE 1052.
3. Operation: Up to 10-foot head of water back pressure.
4. Inlet Size: NPS 1/2 or NPS 3/4, as indicated.
5. Outlet Size: Garden-hose thread complying with ASME B1.20.7.
6. Capacity: At least 3-gpm flow.

2.5 WATER PRESSURE-REDUCING VALVES

A. Water Regulators:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Conbraco Industries, Inc.
    b. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
    c. Zurn Industries, LLC; Plumbing Products Group; Wilkins Water Control Products.

2. Standard: ASSE 1003.
3. Pressure Rating: Initial working pressure of 150 psig.
4. Design Inlet Pressure: Existing TBD.
5. Design Outlet Pressure Setting: As required for systems to be filled.
6. Body: Bronze 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.
7. Valves for Booster Heater Water Supply: Include integral bypass.
8. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and NPS 3.

2.6 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. NIBCO Inc.
    c. TACO Incorporated.
    d. 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.

2.7 TEMPERATURE-ACTUATED, WATER MIXING VALVES

A. Water-Temperature Limiting Devices:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Armstrong International, Inc.
    b. Conbraco Industries, Inc.

c. Leonard Valve Company.
d. Powers; a division of Watts Water Technologies, Inc.
e. Symmons Industries, Inc.
f. TACO Incorporated.
g. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
h. Zurn Industries, LLC; Plumbing Products Group; Wilkins Water Control Products.

2. Standard: ASSE 1017.
3. Pressure Rating: 125 psig.
4. Type: Thermostatically controlled, water mixing valve.
5. Material: Bronze body with corrosion-resistant interior components.
6. Connections: Threaded union inlets and outlet.
7. Accessories: Check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.
8. Tempered-Water Setting: As indicated.
9. Tempered-Water Design Flow Rate: As indicated.
10. Valve Finish: Chrome plated.

B. Individual-Fixture, Water Tempering Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Conbraco Industries, Inc.
b. Leonard Valve Company.
c. Powers; 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 1016, thermostatically controlled, water tempering valve.
3. Pressure Rating: 125 psig minimum unless otherwise indicated.
4. Body: Bronze body with corrosion-resistant interior components.
5. Temperature Control: Adjustable.
6. Inlets and Outlet: Threaded.
7. Finish: Rough or chrome-plated bronze.
8. Tempered-Water Setting: As indicated.
9. Tempered-Water Design Flow Rate: As indicated.

2.8 STRAINERS FOR DOMESTIC WATER PIPING

A. Y-Pattern Strainers:

1. Pressure Rating: 125 psig minimum unless otherwise indicated.
2. Body: Bronze for NPS 2 and smaller; cast iron with interior lining that complies with AWWA C550 or that is FDA approved, epoxy coated and for NPS 2-1/2 and larger.
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 inch.
b. Strainers NPS 2-1/2 to NPS 4: 0.062 inch.
c. Strainers NPS 5 and Larger: 0.10 inch.

6. Drain: Factory-installed, hose-end drain valve.

2.9 OUTLET BOXES

A. Appliance Outlet Boxes:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Acorn Engineering Company.
   b. IPS Corporation.
   c. Plastic Oddities.

2. Mounting: Recessed.
3. Material and Finish: Plastic box and faceplate.
4. Faucet: Valved fitting complying with ASME A112.18.1. Include NPS 1/2 or smaller copper tube outlet.
5. Supply Shutoff Fitting: NPS 1/2 gate, globe, or ball valve and NPS 1/2 copper, water tubing.

2.10 HOSE BIBBS

A. Hose Bibbs:

1. Standard: ASME A112.18.1 for sediment faucets.
2. Body Material: Bronze.
3. Seat: Bronze, replaceable.
4. Supply Connections: 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 non-removable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
8. Finish for Equipment Rooms: Rough bronze, or chrome or nickel plated.
9. Finish for Service Areas: Rough bronze.
10. Finish for Finished Rooms: Chrome or nickel plated.
11. Operation for Equipment Rooms: Wheel handle or operating key.
12. Include operating key with each operating-key hose bibb.
13. Include integral wall flange with each chrome- or nickel-plated hose bibb.

2.11 WALL HYDRANTS

A. Non-freeze Wall Hydrants:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Josam Company.
   b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
   c. Watts Drainage Products.
   d. Woodford Manufacturing Company; a division of WCM Industries, Inc.
   e. Zurn Industries, LLC; Plumbing Products Group; Specification Drainage Products.

2. Standard: ASME A112.21.3M for concealed or exposed-outlet, as indicated, 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.
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 or Chrome plated.
10. Outlet: Exposed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
11. Nozzle and Wall-Plate Finish: Polished nickel bronze.
12. Operating Keys: Two with each wall hydrant.

B. Vacuum Breaker Wall Hydrants:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Smith, Jay. R. Mfg. Co.; Division of Smith Industries, Inc.
    b. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
    c. Woodford Manufacturing Company; a division of WCM Industries, Inc.
    d. Zurn Industries, LLC; Plumbing Products Group; Light Commercial Products.

2. Standard: ASSE 1019, Type A or Type B.
3. Type: Freeze-resistant, automatic draining with integral air-inlet valve.
4. Classification: Type A, for automatic draining with hose removed or Type B, for automatic draining with hose removed or with hose attached and nozzle closed.
5. Pressure Rating: 125 psig.
6. Operation: Loose key.
7. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
8. Inlet: NPS 3/4.
9. Outlet: Exposed with garden-hose thread complying with ASME B1.20.7.

2.12 DRAIN VALVES

A. Ball-Valve-Type, Hose-End Drain Valves:

1. Standard: MSS SP-110 for standard-port, two-piece ball valves.
2. Pressure Rating: 400-psig 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.

2.13 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. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
    e. Watts Drainage Products.
    f. Zurn Industries, LLC; Plumbing Products Group; Specification Drainage Products.

2. Standard: ASSE 1010 or PDI-WH 201.
3. Type: Metal bellows or Copper tube with piston.
4. Size: ASSE 1010, Sizes AA and A through F, or PDI-WH 201, Sizes A through F.

2.14 AIR VENTS

A. Bolted-Construction Automatic Air Vents:

1. Body: Bronze.
2. Pressure Rating and Temperature: 125-psig minimum pressure rating at 140 deg F.
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.

2.15 TRAP-SEAL PRIMER DEVICE

A. Supply-Type, Trap-Seal Primer Device:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Precision Plumbing Products, Inc.
    b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
    c. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.

2. Standard: ASSE 1018.
3. Pressure Rating: 125 psig minimum.
4. Body: Bronze.
5. Inlet and Outlet Connections: NPS 1/2 threaded, union, or solder joint.
6. Gravity Drain Outlet Connection: NPS 1/2 threaded or solder joint.
7. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.

1. Locate backflow preventers in same room as connected equipment or system.
2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe-to-floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are unacceptable for this application.
3. Do not install bypass piping around backflow preventers.

B. Install water regulators with inlet and outlet shutoff valves. Install pressure gages on inlet and outlet.

C. Install water-control valves with inlet and outlet shutoff valves. Install pressure gages on inlet and outlet.

D. Install balancing valves in locations where they can easily be adjusted.

E. Install temperature-actuated, water mixing valves with check stops or shutoff valves on inlets and with shutoff valve on outlet.

1. Install cabinet-type units recessed in or surface mounted on wall as specified.

F. Install Y-pattern strainers for water on supply side of each control valve, water pressure-reducing valve, solenoid valve, and pump.

G. Install outlet boxes recessed in wall or surface mounted on wall. Install 2-by-4-inch fire-retardant-treated-wood blocking, wall reinforcement between studs. Comply with requirements for fire-retardant-treated-wood blocking in Section "Rough Carpentry."

H. Install water-hammer arresters in water piping according to PDI-WH 201.

I. Install air vents at high points of water piping. Install drain piping and discharge onto floor drain.

J. Install supply-type, trap-seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.

3.2 CONNECTIONS

A. Comply with requirements for ground equipment in Section "Grounding and Bonding for Electrical Systems."

B. Fire-retardant-treated-wood blocking is specified in Section "Low-Voltage Electrical Power Conductors and Cables" for electrical connections.

3.3 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Test each 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.

3.4 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

SECTION 22 1123

DOMESTIC WATER PUMPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. In-line, sealless centrifugal pumps.

1.3 DEFINITIONS

A. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include materials of construction, rated capacities, certified performance curves with operating points plotted on curves, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. LEED Submittals:

1. Product Data for Prerequisite EA 2: Documentation indicating that units comply with applicable requirements in ASHRAE/IESNA 90.1, without amendments, Section 7 - "Service Water Heating."

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For domestic water pumps to include in operation and maintenance manuals.

1.6 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. UL Compliance: Comply with UL 778 for motor-operated water pumps.

PART 2 - PRODUCTS

2.1 IN-LINE, SEALLESS CENTRIFUGAL PUMPS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Armstrong Pumps Inc.
   2. Bell & Gossett Domestic Pump; ITT Corporation.
   3. Grundfos Pumps Corp.
   4. TACO Incorporated.

B. Description: Factory-assembled and -tested, in-line, close-coupled, canned-motor, sealless, overhung-impeller centrifugal pumps.

C. Pump Construction:

   1. Pump and Motor Assembly: Hermetically sealed, replaceable-cartridge type with motor and impeller on common shaft and designed for installation with pump and motor shaft horizontal.
   2. Casing: Bronze, with threaded or companion-flange connections.
   3. Impeller: Plastic.
   4. Motor: Single speed, unless otherwise indicated.

D. Capacities and Characteristics: As Scheduled.

   1. Minimum Working Pressure: 125 psig.
   2. Maximum Continuous Operating Temperature: 220 deg F.
   3. Electrical Characteristics: As Scheduled.

2.2 MOTORS

A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section "Common Motor Requirements for Plumbing 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.

2.3 CONTROLS

A. Thermostats: Electric; adjustable for control of hot-water circulation pump.

   1. Type: Water-immersion temperature sensor, for installation in piping.
   2. Range: 65 to 200 deg F.
   3. Enclosure: NEMA 250, Type 4X.
   4. Operation of Pump: On or off.
   5. Transformer: Provide if required.
   6. Power Requirement: 24 V, ac.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of domestic-water-piping system to verify actual locations of connections before pump installation.

3.2 PUMP INSTALLATION

A. Comply with HI 1.4.

B. Install in-line, sealless centrifugal pumps with shaft horizontal unless otherwise indicated.

C. Install thermostats in hot-water return piping.

3.3 CONNECTIONS

A. Comply with requirements for piping specified in Section "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to pumps to allow service and maintenance.

C. Connect domestic water piping to pumps. Install suction and discharge piping equal to or greater than size of pump nozzles.

D. Install shutoff valve and strainer on suction side of each pump, and check, shutoff, and throttling valves on discharge side of each pump. Install valves same size as connected piping. Comply with requirements for valves specified in Section "General-Duty Valves for Plumbing Piping" and comply with requirements for strainers specified in Section "Domestic Water Piping Specialties."

1. Install pressure gage at suction of each pump and pressure gage at discharge of each pump. Install at integral pressure-gage tappings where provided or install pressure-gage connectors in suction and discharge piping around pumps. Comply with requirements for pressure gages and snubbers specified in Section "Meters and Gages for Plumbing Piping."

E. Interlock pump between water heater and hot-water storage tank with water heater burner and time-delay relay.

3.4 IDENTIFICATION

A. Comply with requirements for identification specified in Section "Identification for Plumbing Piping and Equipment" for identification of pumps.

3.5 ADJUSTING

A. Adjust domestic water pumps to function smoothly, and lubricate as recommended by manufacturer.

B. Adjust initial temperature set points.

END OF SECTION

SECTION 22 1316

SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Pipe, tube, and fittings.

1.3 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:

1. Soil, Waste, and Vent Piping: 10-foot head of water.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. LEED Submittals:

1. Product Data for Credit IEQ 4.1: For solvent cements and adhesive primers, documentation including printed statement of VOC content.
2. Laboratory Test Reports for Credit IEQ 4: For solvent cements and adhesive primers, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Shop Drawings: For sovent drainage system. Include plans, elevations, sections, and details.

1.5 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

1.7 PROJECT CONDITIONS

A. Interruption of Existing Sanitary Waste Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:

1. Notify Owner no fewer than seven days in advance of proposed interruption of sanitary waste service.
2. Do not proceed with interruption of sanitary waste service without Owner's written permission.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 74, Service class.

B. Gaskets: ASTM C 564, rubber.

C. Calking Materials: ASTM B 29, pure lead and oakum or hemp fiber.

2.3 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 888 or CISPI 301.

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. Fernco Inc.
c. Mission Rubber Company; a division of MCP Industries, Inc.
d. Tyler Pipe.

2. Standards: ASTM C 1277 and CISPI 310.
3. Description: Stainless-steel corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

PART 3 - EXECUTION

3.1 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 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.

M. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

N. Install steel piping according to applicable plumbing code.

O. Install buried piping inside building between wall and floor penetrations and connection to sanitary sewer piping outside building with restrained joints. Anchor pipe to wall or floor. Install thrust-block supports at vertical and horizontal offsets.

P. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

Q. Install sleeves for piping penetrations of walls, ceilings, and floors.

R. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section "Sleeves and Sleeve Seals for Plumbing Piping."

S. Install escutcheons for piping penetrations of walls, ceilings, and floors.

3.2 JOINT CONSTRUCTION

A. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.

B. 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.

3.3 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for pipe hanger and support devices and installation specified in Section "Hangers and Supports for Plumbing Piping and Equipment."

1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
2. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
3. Vertical Piping: MSS Type 8 or Type 42, clamps.
4. Install individual, straight, horizontal piping runs:

    a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
    b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
    c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.

5. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
6. Base of Vertical Piping: MSS Type 52, spring hangers.

B. Support horizontal piping and tubing within 12 inches of each fitting, valve, 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. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.

F. Install supports for vertical cast-iron soil piping every 15 feet.

G. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4: 84 inches with 3/8-inch rod.
2. NPS 1-1/2: 108 inches with 3/8-inch rod.
3. NPS 2: 10 feet with 3/8-inch rod.
4. NPS 2-1/2: 11 feet with 1/2-inch rod.
5. NPS 3: 12 feet with 1/2-inch rod.
6. NPS 4 and NPS 5: 12 feet with 5/8-inch rod.

H. Install supports for vertical steel piping every 15 feet.

I. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.4 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect drainage and vent piping to the following:

1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.
2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.
4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
5. Comply with requirements for backwater valves, cleanouts, and drains specified in Section "Sanitary Waste Piping Specialties."

C. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

3.5 IDENTIFICATION

A. Identify exposed sanitary waste and vent piping. Comply with requirements for identification specified in Section "Identification for Plumbing Piping and Equipment."

3.6 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.

3.7 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.

3.8 PIPING SCHEDULE

A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.

B. Aboveground, soil and waste piping NPS 4 and smaller shall be any of the following:
1. Hubless, cast-iron soil pipe and fittings and sovent stack fittings; CISPI hubless-piping couplings; and coupled joints.

C. Aboveground, vent piping NPS 4 and smaller shall be any of the following:
1. Hubless, cast-iron soil pipe and fittings; CISPI hubless-piping couplings; and coupled joints.

D. Underground, soil, waste, and vent piping NPS 4 and smaller shall be any of the following:

1. Service class, cast-iron soil piping; gaskets; and gasketed or calking materials; and calked joints.

E. Underground, soil and waste piping NPS 5 and larger shall be any of the following:

1. Service class, cast-iron soil piping; gaskets; and gasketed or calking materials; and calked joints.

END OF SECTION

SECTION 22 1319

SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Cleanouts.
   2. Floor drains.
   3. Miscellaneous sanitary drainage piping specialties.

1.3 DEFINITIONS

A. ABS: Acrylonitrile-butadiene-styrene plastic.

B. FOG: Fats, oils, and greases.

C. FRP: Fiberglass-reinforced plastic.

D. HDPE: High-density polyethylene plastic.

E. PE: Polyethylene plastic.

F. PP: Polypropylene plastic.

G. PVC: Polyvinyl chloride plastic.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For drainage piping specialties to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS

2.1 CLEANOUTS

A. Exposed Metal Cleanouts:

1. ASME A112.36.2M, Cast-Iron Cleanouts:

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Josam Company.
2) Smith, Jay R. Mfg. Co.
3) Tyler Pipe.
4) Watts Drainage Products.
5) Zurn Plumbing Products Group.

2. ASME A112.3.1, Stainless-Steel Cleanouts:
3. Standard: ASME A112.36.2M for cast iron; ASME A112.3.1 for stainless steel for cleanout test tee.
4. Size: Same as connected drainage piping
5. Body Material: Hub-and-spigot, cast-iron soil pipe T-branch; Hubless, cast-iron soil pipe test tee; or Stainless-steel tee with side cleanout as required to match connected piping.
6. Closure: Countersunk, brass or cast-iron plug for cast iron cleanouts.
7. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
8. Closure: Stainless-steel plug with seal for stainless-steel cleanouts.

B. Metal Floor Cleanouts:

1. ASME A112.36.2M, Cast-Iron Cleanouts:

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Josam Company.
2) Smith, Jay R. Mfg. Co.
3) Tyler Pipe.
4) Watts Drainage Products.
5) Zurn Plumbing Products Group.

2. ASME A112.36.2M, Stainless-Steel Cleanouts:

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Josam Company.
2) Smith, Jay R. Mfg. Co.

3. Standard: ASME A112.36.2M for adjustable housing threaded, adjustable housing cleanout.
4. Size: Same as connected branch.
5. Type: Adjustable housing Threaded, adjustable housing.
6. Body or Ferrule: Cast iron or Stainless steel.
7. Clamping Device: Required.

8. Closure: Brass plug with tapered threads.
9. Adjustable Housing Material: Cast iron with threads.
10. Frame and Cover Material and Finish: Nickel-bronze, copper alloy or Stainless steel.
11. Frame and Cover Shape: As required by Architect.
12. Top Loading Classification: Medium Duty.
13. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout for cast iron cleanouts.
14. Standard: ASME A112.3.1.
15. Size: Same as connected branch.
16. Housing: Cast iron or Stainless steel.

C. Cast-Iron Wall Cleanouts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Josam Company; Josam Div.
    b. Smith, Jay R. Mfg. Co.
    c. Tyler Pipe; Wade Div.
    d. Watts Drainage Products.
    e. 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 or Hubless, cast-iron soil pipe test tee as required to match connected piping.
5. Closure: Countersunk, drilled-and-threaded brass plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
7. Wall Access: Round, nickel-bronze, copper-alloy, or stainless-steel wall-installation frame and cover.

2.2 FLOOR DRAINS

A. Cast-Iron Floor Drains:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Josam Company; Josam Div.
    b. Smith, Jay R. Mfg. Co.
    c. Tyler Pipe; Wade Div.
    d. Watts Drainage Products.
    e. Zurn Plumbing Products Group.

2. Standard: ASME A112.6.3.
3. Pattern: Floor drain.
4. Body Material: Gray iron.
5. Seepage Flange: Required.
6. Anchor Flange: Required.
7. Clamping Device: Required.
8. Outlet: Bottom.
9. Top or Strainer Material: Bronze, Nickel bronze, or Stainless steel.
10. Top Shape: As required by Architect.
11. Top Loading Classification: Medium Duty, unless otherwise noted.

12. Trap Material: Cast iron.
13. Trap Pattern: Deep-seal P-trap.
14. Trap Features: Trap-seal primer valve drain connection.

2.3 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. Air-Gap Fittings:

1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.
2. Body: Bronze or cast iron.
3. Inlet: Opening in top of body.
4. Outlet: Larger than inlet.
5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:

1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
2. Locate at each change in direction of piping greater than 45 degrees.
3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
4. Locate at base of each vertical soil and waste stack.

B. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

C. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

D. Install 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 percent slope, but not less than 1/4-inch total depression.
b. Radius, 30 to 60 Inches: Equivalent to 1 percent slope.

c. Radius, 60 Inches or Larger: Equivalent to 1 percent 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. Assemble open drain fittings and install with top of hub 2 inches above floor.

F. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.

1. Exception: Fitting may be omitted if trap has trap-seal primer connection.
2. Size: Same as floor drain inlet.

G. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.

3.2 CONNECTIONS

A. Comply with requirements in Section "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

C. Ground equipment according to Section "Grounding and Bonding for Electrical Systems."

D. Connect wiring according to Section "Low-Voltage Electrical Power Conductors and Cables."

3.3 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.4 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

SECTION 22 3400

FUEL-FIRED, DOMESTIC-WATER HEATERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Commercial, gas-fired, high-efficiency, storage, domestic-water heaters.

1.3 ACTION SUBMITTALS

A. Product Data: For each type and size of domestic-water heater indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. LEED Submittals:

   1. Product Data for Prerequisite EA 2: Documentation indicating that units comply with applicable requirements in ASHRAE/IESNA 90.1, Section 7, "Service Water Heating."

C. Shop Drawings:

   1. Wiring Diagrams: For power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of commercial, gas-fired and gas-fired, tankless, domestic-water heater, from manufacturer.

B. Domestic-Water Heater Labeling: Certified and labeled by testing agency acceptable to authorities having jurisdiction.

C. Source quality-control reports.

D. Field quality-control reports.

E. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fuel-fired, domestic-water heaters to include in emergency, operation, and maintenance manuals.

1.6 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. ASHRAE/IESNA Compliance: Fabricate and label fuel-fired, domestic-water heaters to comply with ASHRAE/IESNA 90.1.

C. ASME Compliance:

1. Where ASME-code construction is indicated, fabricate and label commercial, domestic-water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
2. Where ASME-code construction is indicated, fabricate and label commercial, finned-tube, domestic-water heaters to comply with ASME Boiler and Pressure Vessel Code: Section IV.

D. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61 Annex G, "Drinking Water System Components - Health Effects."

1.7 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of fuel-fired, domestic-water heaters that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including storage tank and supports.
b. Faulty operation of controls.
c. Deterioration of metals, metal finishes, and other materials beyond normal use.

2. Warranty Periods: From date of Substantial Completion.

a. Commercial, Gas-Fired, Storage, Domestic-Water Heaters:

1) Storage Tank: Three years.
2) Controls and Other Components: Three years.

b. Commercial, Finned-Tube, Gas-Fired, Domestic-Water Heaters:

1) Heat Exchanger: Five years.
2) Controls and Other Components: Three years.

3) Separate Hot-Water Storage Tanks: Three years.

c. Gas-Fired, Tankless, Domestic-Water Heaters:

1) Heat Exchanger: Five years.
2) Controls and Other Components: Three years.

d. Compression Tanks: Five years.

PART 2 - PRODUCTS

2.1 COMMERCIAL, GAS-FIRED, STORAGE, DOMESTIC-WATER HEATERS

A. Commercial, Gas-Fired, High-Efficiency, Storage, Domestic-Water Heaters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. AERCO International, Inc.
   b. AO Smith
   c. Bradford White Corporation.
   d. Lochinvar Corporation.
   e. PVI Industries, LLC.
   f. Rheem Manufacturing Company.
   g. Smith, A. O. Water Products Co.; a division of A. O. Smith Corporation.
   h. State Industries.

2. Standard: ANSI Z21.10.3/CSA 4.3.
3. Description: Manufacturer's proprietary design to provide at least 95 percent combustion efficiency at optimum operating conditions.
4. Storage-Tank Construction: ASME-code steel with 150-psig minimum working-pressure rating.

   a. Tappings: Factory fabricated of materials compatible with tank. Attach tappings to tank before testing.

      1) NPS 2 and Smaller: Threaded ends according to ASME B1.20.1.
      2) NPS 2-1/2 and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges and according to ASME B16.24 for copper and copper-alloy flanges.

   b. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
   c. Lining: Glass, Nickel plate, or Sheet copper complying with NSF 61 barrier materials for potable-water tank linings, including extending lining into and through tank fittings and outlets.

5. Factory-Installed Storage-Tank Appurtenances:

   a. Anode Rod: Replaceable magnesium.
   b. Dip Tube: Required unless cold-water inlet is near bottom of tank.
   c. Drain Valve: Corrosion-resistant metal complying with ASSE 1005.
   d. Insulation: Comply with ASHRAE/IESNA 90.1. Surround entire storage tank except connections and controls.
   e. Jacket: Steel with enameled finish.

f. Burner or Heat Exchanger: Comply with UL 795 or approved testing agency requirements for gas-fired, high-efficiency, domestic-water heaters and natural-gas fuel.
g. Temperature Control: Adjustable thermostat.
h. Safety Controls: Automatic, high-temperature-limit and low-water cutoff devices or systems.
i. Combination Temperature-and-Pressure Relief Valves: ANSI Z21.22/CSA 4.4-M. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select one relief valve with sensing element that extends into storage tank.

B. Capacity and Characteristics: As Scheduled.

2.2 DOMESTIC-WATER HEATER ACCESSORIES

A. Domestic-Water Compression Tanks:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. AMTROL Inc.
b. Smith, A. O. Water Products Co.; a division of A. O. Smith Corporation.
c. State Industries.
d. Taco, Inc.

2. Description: Steel, pressure-rated tank constructed with welded joints and factory-installed butyl-rubber diaphragm. Include air pre-charge 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: 7 gal. minimum.
c. Air Pre-charge Pressure: 50 psig.

B. Drain Pans: Corrosion-resistant metal with raised edge. Comply with ANSI/CSA LC 3. Include dimensions not less than base of domestic-water heater, and include drain outlet not less than NPS 3/4 with ASME B1.20.1 pipe threads or with ASME B1.20.7 garden-hose threads.

C. Piping-Type Heat Traps: Field-fabricated piping arrangement according to ASHRAE/IESNA 90.1 or ASHRAE 90.2.

D. Heat-Trap Fittings: ASHRAE 90.2.

E. Gas Shutoff Valves: ANSI Z21.15/CSA 9.1-M, manually operated. Furnish for installation in piping.

F. Gas Pressure Regulators: ANSI Z21.18/CSA 6.3, appliance type. Include pressure rating as required to match gas supply.

G. Combination Temperature-and-Pressure Relief Valves: Include relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select relief valves with sensing element that extends into storage tank.

1. Gas-Fired, Domestic-Water Heaters: ANSI Z21.22/CSA 4.4-M.

H. Vacuum Relief Valves: ANSI Z21.22/CSA 4.4-M.

I. Condensate neutralizing kit.

2.3 VENTING KITS

A. Kit: Complete system, Type AL29-4C stainless steel, pipe, vent terminal, thimble, indoor plate, vent adapter, condensate trap and dilution tank, and sealant.

B. Combustion-Air Intake: Complete system, stainless steel, pipe, vent terminal with screen, inlet air coupling, and sealant.

2.4 SOURCE QUALITY CONTROL

A. Factory Tests: Test and inspect assembled domestic-water heaters and storage tanks specified to be ASME-code construction, according to ASME Boiler and Pressure Vessel Code.

B. Hydrostatically test commercial domestic-water heaters and storage tanks to minimum of one and one-half times pressure rating before shipment.

C. Domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Section "Quality Requirements" for retesting and re-inspecting requirements and Section "Execution" for requirements for correcting the Work.

D. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 DOMESTIC-WATER HEATER INSTALLATION

A. Commercial, Domestic-Water Heater Mounting: Install commercial domestic-water heaters on concrete base. Comply with requirements for concrete base specified in Section "Cast-in-Place Concrete."

1. Exception: Omit concrete bases for commercial domestic-water heaters if installation on stand, bracket, suspended platform, or directly on floor is indicated.
2. Maintain manufacturer's recommended clearances.
3. Arrange units so controls and devices that require servicing are accessible.
4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.

5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
6. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
7. Install anchor bolts to elevations required for proper attachment to supported equipment.
8. Anchor domestic-water heaters to substrate.

B. Install domestic-water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.

1. Install shutoff valves on domestic-water-supply piping to domestic-water heaters and on domestic-hot-water outlet piping. Comply with requirements for shutoff valves specified in Section "General-Duty Valves for Plumbing Piping."

C. Install gas-fired, domestic-water heaters according to NFPA 54.

1. Install gas shutoff valves on gas supply piping to gas-fired, domestic-water heaters without shutoff valves.
2. Provide gas pressure regulators on gas supplies to gas-fired, domestic-water heaters without gas pressure regulators if gas pressure regulators are required to reduce gas pressure at burner.
3. Install automatic gas valves on gas supplies to gas-fired, domestic-water heaters if required for operation of safety control.
4. Comply with requirements for gas shutoff valves, gas pressure regulators, and automatic gas valves specified in Section "Facility Natural-Gas Piping."

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 domestic-water heaters that do not have tank drains. Comply with requirements for hose-end drain valves specified in Section "Domestic Water Piping Specialties."

E. Install thermometer on outlet piping of domestic-water heaters. Comply with requirements for thermometers specified in Section "Meters and Gages for Plumbing Piping."

F. Install piping-type heat traps on inlet and outlet piping of domestic-water heater storage tanks without integral or fitting-type heat traps.

G. Fill domestic-water heaters with water.

H. Charge domestic-water compression tanks with air.

3.2 CONNECTIONS

A. Comply with requirements for domestic-water piping specified in Section "Domestic Water Piping."

B. Comply with requirements for gas piping specified in Section "Facility Natural-Gas Piping."

C. Drawings indicate general arrangement of piping, fittings, and specialties.

D. Where installing piping adjacent to fuel-fired, domestic-water heaters, allow space for service and maintenance of water heaters. Arrange piping for easy removal of domestic-water heaters.

3.3 IDENTIFICATION

A. Identify system components. Comply with requirements for identification specified in Section "Identification for Plumbing Piping and Equipment."

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections.
   1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
   2. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.
   3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Domestic-water heaters will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

3.5 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain commercial, gas-fired, storage and gas-fired, tankless domestic-water heaters.

END OF SECTION

SECTION 22 4213.13

COMMERCIAL WATER CLOSETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Water closets.
2. Flushometer valves.
3. Toilet seats.

B. Related Requirements:

1. Section "Healthcare Plumbing Fixtures" for healthcare water closets.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for water closets.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. LEED Submittals:
1. Product Data for Prerequisite WE 1 and Credit WE 2: Documentation indicating flow and water consumption requirements.

C. Shop Drawings: Include diagrams for power, signal, and control wiring.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For flushometer valves and electronic sensors to include in operation and maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that are packaged with protective covering for storage and identified with labels describing contents.

1. Flushometer-Valve Repair Kits: Equal to 10 percent of amount of each type installed, but no fewer than one of each type.

PART 2 - PRODUCTS

2.1 FLOOR-MOUNTED, BOTTOM-OUTLET WATER CLOSETS

A. Water Closets: Floor mounted, bottom outlet, top spud.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. American Standard America.
    b. Crane Plumbing, L.L.C.
    c. Gerber Plumbing Fixtures LLC.
    d. Kohler Co.
    e. TOTO USA, INC.
    f. 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, Child, and Handicapped/elderly, complying with ICC/ANSI A117.1 as scheduled.
    f. Rim Contour: Elongated.
    g. Water Consumption: Dual flush as scheduled.
    h. Spud Size and Location: NPS 1-1/2; top.
    i. Color: White.

3. Bowl-to-Drain Connecting Fitting: ASTM A 1045 or ASME A112.4.3.
4. Flushometer Valve: As Scheduled.
5. Toilet Seat: As Scheduled.

2.2 WALL-MOUNTED WATER CLOSETS

A. Water Closets: Wall mounted, top spud, accessible, as scheduled.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. American Standard America.
    b. Crane Plumbing, L.L.C.
    c. Gerber Plumbing Fixtures LLC.
    d. Kohler Co.
    e. TOTO USA, INC.
    f. 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 and Handicapped/elderly, complying with ICC/ANSI A117.1 as scheduled.
    f. Rim Contour: Elongated.
    g. Water Consumption: Dual flush as scheduled.
    h. Spud Size and Location: NPS 1-1/2; top.

3. Flushometer Valve: As Scheduled.
4. Toilet Seat: As Scheduled.
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. Include additional extension coupling, faceplate, and feet for installation in wide pipe space.

2.3 FLUSHOMETER VALVES

A. Solenoid-Actuator, Diaphragm Flushometer Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Coyne & Delany Co.
    b. Sloan Valve Company.
    c. 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. Panel Finish: Chrome plated or stainless steel.
8. Style: Exposed.
9. Actuator: Solenoid complying with UL 1951, and listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
10. Trip Mechanism: Hard-wired electronic sensor complying with UL 1951, and listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
11. Consumption: 1.28 gal. per flush.
12. Minimum Inlet: NPS 1.
13. Minimum Outlet: NPS 1-1/4.

2.4 TOILET SEATS

A. Toilet Seats:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. American Standard America.
    b. Bemis Manufacturing Company.
    c. Church Seats.
    d. Kohler Co.
    e. Olsonite Seat Co.
    f. TOTO USA, INC.
    g. Zurn Industries, LLC; Commercial Brass and Fixtures.

2. Standard: IAPMO/ANSI Z124.5.
3. Material: Plastic.
4. Type: Commercial (Standard).
5. Shape: Elongated rim, open front.
6. Hinge: Self-sustaining, check.
7. Hinge Material: Non-corroding metal.
8. Seat Cover: Not required.
9. Color: White.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before 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.

3.2 INSTALLATION

A. Water-Closet Installation:

1. Install level and plumb according to roughing-in drawings.
2. Install floor-mounted water closets on bowl-to-drain connecting fitting attachments to piping or building substrate.
3. Install accessible, 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.
3. Install floor-mounted, back-outlet water closets attached to building floor substrate, onto waste-fitting seals; and attach to support.
4. Install wall-mounted, back-outlet water-closet supports with waste-fitting assembly and waste-fitting seals; and affix to building substrate.

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.
5. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

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.

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 Section "Joint Sealants."

3.3 CONNECTIONS

A. Connect water closets with water supplies and soil, waste, and vent piping. Use size fittings required to match water closets.

B. Comply with water piping requirements specified in Section "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Section "Sanitary Waste and Vent Piping."

D. Where installing piping adjacent to water closets, allow space for service and maintenance.

3.4 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.

C. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

3.5 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

SECTION 22 4213.16

COMMERCIAL URINALS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Urinals.
2. Flushometer valves.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for urinals.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. LEED Submittals:
1. Product Data for Prerequisite WE 1 and Credit WE 2: Documentation indicating flow and water consumption requirements.

C. Shop Drawings: Include diagrams for power, signal, and control wiring.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For flushometer valves and electronic sensors to include in operation and maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that are packaged with protective covering for storage and identified with labels describing contents.

1. Flushometer-Valve Repair Kits: Equal to 10 percent of amount of each type installed, but no fewer than one of each type.
2. Waterless Urinal Trap-Seal Cartridges: Equal to 200 percent of amount of each type installed, but no fewer than 12 of each type.
3. Waterless Urinal Trap-Seal Liquid: Equal to 1 gal. for each urinal installed.

PART 2 - PRODUCTS

2.1 WALL-HUNG URINALS

A. Urinals: 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, L.L.C.
    c. Gerber Plumbing Fixtures LLC.
    d. Kohler Co.
    e. TOTO USA, INC.

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: As Scheduled.
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. Include rectangular, steel uprights.

2.2 URINAL FLUSHOMETER VALVES

A. Solenoid-Actuator, Diaphragm Flushometer Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Coyne & Delany Co.
    b. Sloan Valve Company.
    c. 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. Panel Finish: Chrome plated or stainless steel.

8. Style: Exposed.
9. Actuator: Solenoid complying with UL 1951; listed and labeled as defined in NFPA 70, by a qualified testing agency; and marked for intended location and application.
10. Trip Mechanism: Hard-wired electronic sensor complying with UL 1951; listed and labeled as defined in NFPA 70, by a qualified testing agency; and marked for intended location and application.
11. Consumption: 0.125g. per flush.
12. Minimum Inlet: NPS 3/4.
13. Minimum Outlet: NPS 3/4.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before 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.

3.2 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, according to ICC/ANSI A117.1.
4. Install trap-seal liquid in waterless urinals.

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 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.
4. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

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.

E. Joint Sealing:

1. Seal joints between urinals and 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 Section "Joint Sealants."

3.3 CONNECTIONS

A. Connect urinals with water supplies and soil, waste, and vent piping. Use size fittings required to match urinals.

B. Comply with water piping requirements specified in Section "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Section "Sanitary Waste and Vent Piping."

D. Where installing piping adjacent to urinals, allow space for service and maintenance.

3.4 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.

3.5 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

SECTION 22 4216.13

COMMERCIAL LAVATORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Lavatories.
2. Faucets.

B. Related Requirements:

1. Section "Healthcare Plumbing Fixtures" for healthcare lavatories.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for lavatories.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. LEED Submittals:
1. Product Data for Prerequisite WE 1 and Credit WE 2: Documentation indicating flow and water consumption requirements.

C. Shop Drawings: Include diagrams for power, signal, and control wiring of automatic faucets.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Counter cutout templates for mounting of counter-mounted lavatories.

1.5 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 Section "Operation and Maintenance Data," include the following:

a. Servicing and adjustments of automatic faucets.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Faucet Washers and O-Rings: Equal to 10 percent of amount of each type and size installed.
2. Faucet Cartridges and O-Rings: Equal to 5 percent of amount of each type and size installed.

PART 2 - PRODUCTS

2.1 COUNTER-MOUNTED LAVATORIES

A. Lavatory: Oval, undercounter mounted.

1. Manufacturer: As scheduled or approved equal.

2. Faucet: As scheduled or approved equal.

2.2 WALL-MOUNTED LAVATORIES

A. Lavatory: Vitreous china, wall mounted, with back.
1. Manufacturers: As scheduled or approved equal.

2. Faucet: As Scheduled or approved equal.
3. Support: ASME A112.6.1M, Type II, concealed-arm lavatory carrier. Include rectangular, steel uprights.

2.3 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: Automatic-type, hard-wired, electronic-sensor-operated, mixing, solid-brass valve.
1. Manufacturer: As scheduled or approved equal.

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: As Scheduled.
6. Body Material: Commercial, solid brass.
7. Finish: Polished chrome plate.
8. Maximum Flow Rate: 0.35 gpm.

9. Mounting Type: Deck, concealed.
10. Spout: Rigid type.
11. Spout Outlet: Aerator.

2.4 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 or NPS 1/2.
2. Chrome-plated, soft-copper flexible tube or ASME A112.18.6, braided- or corrugated-stainless-steel, flexible hose riser.

2.5 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, two-piece, cast-brass trap and ground-joint swivel elbow with 0.032-inch- thick brass tube to wall or 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

3.1 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.

3.2 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, according to 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 "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 Section "Joint Sealants."

F. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible lavatories. Comply with requirements in Section "Plumbing Piping Insulation."

3.3 CONNECTIONS

A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with water piping requirements specified in Section "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Section "Sanitary Waste and Vent Piping."

3.4 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.

3.5 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

SECTION 22 4216.16

COMMERCIAL SINKS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Service basins.
2. Service sinks.
3. Utility sinks.
4. Handwash sinks.
5. Sink faucets.
6. Laminar-flow, faucet-spout outlets.
7. Supply fittings.
8. Waste fittings.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for sinks.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. LEED Submittals:
1. Product Data for Prerequisite WE 1 and Credit WE 2: Documentation indicating flow and water consumption requirements.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Counter cutout templates for mounting of counter-mounted lavatories.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For sinks to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Faucet Washers and O-Rings: Equal to 10 percent of amount of each type and size installed.
2. Faucet Cartridges and O-Rings: Equal to 5 percent of amount of each type and size installed.

PART 2 - PRODUCTS

2.1 SERVICE BASINS

A. Service Basins: Molded stone, floor mounted.

1. Manufacturers: As scheduled or approved equal.

2. Mounting: On floor and flush to wall.
3. Faucet: As scheduled or approved equal.

2.2 UTILITY SINKS

A. Utility Sinks: Stainless steel, counter mounted.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Elkay Manufacturing Co.
b. Just Manufacturing.

2. Fixture:

a. Standard: ASME A112.19.3/CSA B45.4.
b. Number of Compartments: As Scheduled.
c. Overall Dimensions: As Scheduled.
d. Metal Thickness: 0.050 inch.
e. Compartments:

1) Dimensions: As Scheduled.
2) Drain: As scheduled

3. Faucets: As Scheduled.
4. Supply Fittings:

a. Standard: ASME A112.18.1/CSA B125.1.
b. Supplies: Chrome-plated brass compression stop with inlet connection matching water-supply piping type and size.

1) Operation: Loose key.
2) Risers: NPS 1/2, chrome-plated, soft-copper flexible tube or ASME A112.18.6, braided or corrugated stainless-steel flexible hose.

5. Waste Fittings:

    a. Standard: ASME A112.18.2/CSA B125.2.
    b. Traps:

        1) Size: NPS 1-1/2.
        2) Material: Chrome-plated, two-piece, cast-brass trap and ground-joint swivel elbow with 0.032-inch- thick brass tube to wall; and stainless-steel wall flange.

    c. Continuous Waste:

        1) Size: NPS 1-1/2.
        2) Material: Chrome-plated, 0.032-inch- thick brass tube.

6. Mounting: On counter with sealant.

2.3 HANDWASH SINKS

A. Handwash Sinks: Stainless steel, wall mounted.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. AERO Manufacturing Company.
    b. Eagle Group; Foodservice Equipment Division.
    c. Elkay Manufacturing Co.
    d. Just Manufacturing.

2. Fixture:

    a. Standards: ASME A112.19.3/CSA B45.4 and NSF/ANSI 2.
    b. Type: Basin with radius corners, back for faucet, and support brackets.
    c. Nominal Size: As Scheduled.

3. Faucet: As Scheduled.
4. Supply Fittings: Comply with requirements in "Supply Fittings" Article.
5. Waste Fittings: Comply with requirements in "Waste Fittings" Article.
6. Support: ASME A112.6.1M, Type II, sink carrier.

2.4 SUPPLY FITTINGS

A. NSF Standard: Comply with NSF/ANSI 61 Annex G, "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 or NPS 1/2
2. Chrome-plated, soft-copper flexible tube or ASME A112.18.6, braided or corrugated stainless-steel flexible hose.

2.5 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, two-piece, cast-brass trap and ground-joint swivel elbow with 0.032-inch- thick brass tube to wall or one-piece, cast-brass trap with swivel 0.029-inch-thick tubular brass wall bend; and chrome-plated brass or steel wall flange.

2.6 GROUT

A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Nonshrink; recommended for interior and exterior applications.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before 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.

3.2 INSTALLATION

A. Install sinks level and plumb according to roughing-in drawings.

B. Install supports, affixed to building substrate, for wall-hung sinks.

C. Install accessible wall-mounted sinks at handicapped/elderly mounting height according to ICC/ANSI A117.1.

D. Set floor-mounted sinks in leveling bed of cement grout.

E. Install water-supply piping with stop on each supply to each sink faucet.

1. Exception: Use ball or gate valves if supply stops are not specified with sink. Comply with valve requirements specified in Section "General-Duty Valves for Plumbing Piping."
2. Install stops in locations where they can be easily reached for operation.

F. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings.

G. 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 Section "Joint Sealants."

H. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible sinks. Comply with requirements in Section "Plumbing Piping Insulation."

3.3 CONNECTIONS

A. Connect sinks with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with water piping requirements specified in Section "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Section "Sanitary Waste and Vent Piping."

3.4 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.

3.5 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

SECTION 22 4716

PRESSURE WATER COOLERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes pressure water coolers and related components.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of pressure water cooler.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. LEED Submittals:

1. Product Data for Prerequisite WE 1 and Credit WE 2: Documentation indicating flow and water consumption requirements.

C. Shop Drawings: Include diagrams for power, signal, and control wiring.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For pressure water coolers to include in maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Filter Cartridges: Equal to 5 percent of quantity installed for each type and size indicated, but no fewer than 2 of each.

PART 2 - PRODUCTS

2.1 PRESSURE WATER COOLERS

A. Pressure Water Coolers: Wall mounted, wheelchair accessible.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Elkay Manufacturing Co.
      b. Halsey Taylor.
      c. Haws Corporation.

   2. Cabinet: Bi-level with two attached cabinets and with a bi-level skirt kit, all stainless steel, as scheduled.
   3. Bubbler: One, with adjustable stream regulator, located on each cabinet deck.
   4. Bottle Filler: One.
   5. Control: Push button or Push bar.
   6. Drain: Grid with NPS 1-1/4 tailpiece.
   7. Supply: NPS 3/8 with shutoff valve.
   8. Waste Fitting: ASME A112.18.2/CSA B125.2, NPS 1-1/4 brass P-trap.
   9. Filter: One or more water filters complying with NSF 42 and NSF 53 for cyst and lead reduction to below EPA standards; with capacity sized for unit peak flow rate.
   10. Cooling System: Electric, with hermetically sealed compressor, cooling coil, air-cooled condensing unit, corrosion-resistant tubing, refrigerant, corrosion-resistant-metal storage tank, and adjustable thermostat.

      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.

   11. Capacities and Characteristics:

      a. Cooled Water: 8 gph.
      b. Ambient-Air Temperature: 90 deg F.
      c. Inlet-Water Temperature: 80 deg F.
      d. Cooled-Water Temperature: 50 deg F.
      e. Electrical Characteristics:

         1) Motor Horsepower: 1/4 minimum.
         2) Volts: 120-V ac.
         3) Phase: Single.
         4) Hertz: 60.
         5) Minimum Circuit Ampacity: 20.
         6) Maximum Overcurrent Protection: 20.

   12. Support: ASME A112.6.1M, Type I water-cooler carrier.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for water-supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before fixture installation.

B. Examine walls and floors for suitable conditions where fixtures will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install fixtures level and plumb according to roughing-in drawings. For fixtures indicated for children, install at height required by authorities having jurisdiction.

B. Install off-the-floor carrier supports, affixed to building substrate, for wall-mounted fixtures.

C. Install mounting frames, affixed to building construction, and attach recessed, pressure water coolers to mounting frames.

D. Install water-supply piping with shutoff valve on supply to each fixture to be connected to domestic-water distribution piping. Use ball or gate valve. Install valves in locations where they can be easily reached for operation. Valves are specified in Section "General-Duty Valves for Plumbing Piping."

E. Install trap and waste piping on drain outlet of each fixture to be connected to sanitary drainage system.

F. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons where required to conceal protruding fittings.

G. Seal joints between fixtures and walls using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section "Joint Sealants."

3.3 CONNECTIONS

A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with water piping requirements specified in Section "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Section "Sanitary Waste and Vent Piping."

3.4 ADJUSTING

A. Adjust fixture flow regulators for proper flow and stream height.

B. Adjust pressure water-cooler temperature settings.

3.5 CLEANING

A. After installing fixture, inspect unit. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.

B. Clean fixtures, on completion of installation, according to manufacturer's written instructions.

C. Provide protective covering for installed fixtures.

D. Do not allow use of fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION

SECTION 23 0517

SLEEVES AND SLEEVE SEALS FOR HVAC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Sleeves.
2. Stack-sleeve fittings.
3. Grout.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.

C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.

D. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

2.2 STACK-SLEEVE FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Smith, Jay R. Mfg. Co.
2. Zurn Specification Drainage Operation; Zurn Plumbing Products Group.

B. Description: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring, bolts, and nuts for membrane flashing.

1. Underdeck Clamp: Clamping ring with setscrews.

2.3 GROUT

A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Nonshrink; recommended for interior and exterior applications.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch 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. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Section "Joint Sealants."

E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section "Penetration Firestopping."

3.2 STACK-SLEEVE-FITTING INSTALLATION

A. Install stack-sleeve fittings in new slabs as slabs are constructed.

1. Install fittings that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
2. Secure flashing between clamping flanges for pipes penetrating floors with membrane waterproofing. Comply with requirements for flashing specified in Section 076200 "Sheet Metal Flashing and Trim."
3. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level.
4. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
5. Using grout, seal the space around outside of stack-sleeve fittings.

B. Fire-Barrier Penetrations: Maintain indicated fire rating of floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section "Penetration Firestopping."

3.3 SLEEVE AND SLEEVE-SEAL SCHEDULE

A. Use sleeves and sleeve seals for the following piping-penetration applications:

1. Concrete Slabs above Grade:

   a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves or Stack-sleeve fittings.
   b. Piping NPS 6 and Larger: Galvanized-steel-pipe sleeves or Stack-sleeve fittings.

2. Interior Partitions:

   a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves.
   b. Piping NPS 6 and Larger: Galvanized-steel-sheet sleeves.

END OF SECTION

SECTION 23 0519

METERS AND GAGES FOR HVAC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Liquid-in-glass thermometers.
   2. Thermowells.
   3. Dial-type pressure gages.
   4. Gage attachments.
   5. Test plugs.

B. Related Sections:

   1. Section "Facility Natural-Gas Piping" for gas meters.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Wiring Diagrams: For power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of meter and gage, from manufacturer.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For meters and gages to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 LIQUID-IN-GLASS THERMOMETERS

A. Metal-Case, Compact-Style, Liquid-in-Glass Thermometers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Trerice, H. O. Co.
    b. Weksler.

2. Standard: ASME B40.200.
3. Case: Cast aluminum; 6-inch nominal size.
4. Case Form: Straight unless otherwise indicated.
5. Tube: Glass with magnifying lens and blue or red organic liquid.
6. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F.
7. Window: Glass or plastic.
8. Stem: Aluminum or brass and of length to suit installation.

    a. Design for Air-Duct Installation: With ventilated shroud.
    b. Design for Thermowell Installation: Bare stem.

9. Connector: 3/4 inch, with ASME B1.1 screw threads.
10. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

2.2 THERMOWELLS

A. Thermowells:

1. Standard: ASME B40.200.
2. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.
3. Material for Use with Copper Tubing: CNR or CUNI.
4. Material for Use with Steel Piping: CRES.
5. Type: Stepped shank unless straight or tapered shank is indicated.
6. External Threads: NPS 1/2, NPS 3/4, or NPS 1, ASME B1.20.1 pipe threads.
7. Internal Threads: 1/2, 3/4, and 1 inch, with ASME B1.1 screw threads.
8. Bore: Diameter required to match thermometer bulb or stem.
9. Insertion Length: Length required to match thermometer bulb or stem.
10. Lagging Extension: Include on thermowells for insulated piping and tubing.
11. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.

B. Heat-Transfer Medium: Mixture of graphite and glycerin.

2.3 PRESSURE GAGES

A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Ashcroft Inc.
    b. Marsh Bellofram.
    c. Miljoco Corporation.
    d. Trerice, H. O. Co.
    e. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.

f. Weiss Instruments, Inc.

2. Standard: ASME B40.100.
3. Case: Liquid-filled, sealed type(s); cast aluminum or drawn steel; 4-1/2-inch nominal diameter.
4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
5. Pressure Connection: Brass, with NPS 1/4 or NPS 1/2, 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. Ring: Stainless steel.
11. Accuracy: Grade B, plus or minus 2 percent of middle half of scale range.

2.4 GAGE ATTACHMENTS

A. Snubbers: ASME B40.100, brass; with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and piston-type surge-dampening device. Include extension for use on insulated piping.

B. Siphons: Loop-shaped section of brass or steel pipe with NPS 1/4 or NPS 1/2 pipe threads.

C. Valves: Brass ball, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads.

2.5 TEST PLUGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Miljoco Corporation.
2. Peterson Equipment Co., Inc.
3. Trerice, H. O. Co.
4. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
5. 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 or NPS 1/2, ASME B1.20.1 pipe thread.

E. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F.

F. Core Inserts: Chlorosulfonated polyethylene synthetic and EPDM self-sealing rubber.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. EMCO Flow Systems; a division of Spirax Sarco, Inc.
b. Siemens Energy & Automation, Inc.

2. Description: Meter with flow sensor, temperature sensors, transmitter, indicator, and connecting wiring.
3. Flow Sensor: Transit-time ultrasonic type with transmitter.
4. Temperature Sensors: Insertion-type or strap-on transducer.
5. Indicator: Solid-state, integrating-type meter with integral battery pack.

    a. Data Output: Six-digit electromechanical counter with readout in kilowatts per hour or British thermal units.
    b. Battery Pack: Five-year lithium battery.

6. Accuracy: Plus or minus 1 percent.
7. Display: Visually indicates total fluid volume in gallons and thermal-energy flow in kilowatts per hour or British thermal units.
8. Operating Instructions: Include complete instructions with each thermal-energy meter system.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install thermowells with socket extending to center of pipe and in vertical position in piping tees.

B. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.

C. Install thermowells with extension on insulated piping.

D. Fill thermowells with heat-transfer medium.

E. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.

F. Install remote-mounted thermometer bulbs in thermowells and install cases on panels; connect cases with tubing and support tubing to prevent kinks. Use minimum tubing length.

G. Install duct-thermometer mounting brackets in walls of ducts. Attach to duct with screws.

H. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.

I. Install remote-mounted pressure gages on panel.

J. Install valve and snubber in piping for each pressure gage for fluids (except steam).

K. Install valve and syphon fitting in piping for each pressure gage for steam.

L. Install test plugs in piping tees.

M. Install flow indicators in piping systems in accessible positions for easy viewing.

N. Assemble and install connections, tubing, and accessories between flow-measuring elements and flowmeters according to manufacturer's written instructions.

O. Install flowmeter elements in accessible positions in piping systems.

P. Install differential-pressure-type flowmeter elements, with at least minimum straight lengths of pipe, upstream and downstream from element according to manufacturer's written instructions.

Q. Install permanent indicators on walls or brackets in accessible and readable positions.

R. Install connection fittings in accessible locations for attachment to portable indicators.

S. Mount thermal-energy meters on wall if accessible; if not, provide brackets to support meters.

T. Install thermometers in the following locations:

1. Inlet and outlet of each hydronic zone.
2. Inlet and outlet of each hydronic boiler.
3. Two inlets and two outlets of each chiller.
4. Inlet and outlet of each hydronic coil in air-handling units.
5. Two inlets and two outlets of each hydronic heat exchanger.
6. Inlet and outlet of each thermal-storage tank.
7. Outside-, return-, supply-, and mixed-air ducts.
8. Other location as indicated.

U. Install pressure gages in the following locations:

1. Discharge of each pressure-reducing valve.
2. Inlet and outlet of each chiller chilled-water and condenser-water connection.
3. Suction and discharge of each pump.
4. Other locations as indicated.

3.2 CONNECTIONS

A. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.

B. Connect flowmeter-system elements to meters.

C. Connect flowmeter transmitters to meters.

D. Connect thermal-energy meter transmitters to meters.

3.3 ADJUSTING

A. After installation, calibrate meters according to manufacturer's written instructions.

B. Adjust faces of meters and gages to proper angle for best visibility.

3.4 THERMOMETER SCHEDULE

A. Thermometers at inlet and outlet of each hydronic zone shall be one of the following:

1. Liquid-filled, bimetallic-actuated type.
2. Compact or Industrial-style, liquid-in-glass type, as indicated.
3. Test plug with chlorosulfonated polyethylene synthetic or EPDM self-sealing rubber inserts, as indicated.

B. Thermometers at inlet and outlet of each hydronic boiler shall be one of the following:

1. Liquid-filled, sealed, bimetallic-actuated type.
2. Industrial-style, liquid-in-glass type.

C. Thermometers at inlets and outlets of each chiller shall be one of the following:

1. Liquid-filled, bimetallic-actuated type.
2. Industrial-style, liquid-in-glass type.

D. Thermometers at inlet and outlet of each hydronic coil in air-handling units and built-up central systems shall be one of the following:

1. Liquid-filled, bimetallic-actuated type.
2. Compact or Industrial-style, liquid-in-glass type.
3. Test plug with chlorosulfonated polyethylene synthetic or EPDM self-sealing rubber inserts, as indicated.

E. Thermometers at inlets and outlets of each hydronic heat exchanger shall be one of the following:

1. Liquid-filled, bimetallic-actuated type.
2. Industrial-style, liquid-in-glass type.

F. Thermometers at inlet and outlet of each hydronic heat-recovery unit shall be one of the following:

1. Liquid-filled, bimetallic-actuated type.
2. Industrial-style, liquid-in-glass type.

G. Thermometers at inlet and outlet of each thermal-storage tank shall be one of the following:

1. Liquid-filled, sealed, bimetallic-actuated type.
2. Industrial-style, liquid-in-glass type.

H. Thermometers at outside-, return-, supply-, and mixed-air ducts shall be one of the following:

1. Liquid-filled, bimetallic-actuated type.
2. Compact or Industrial-style, liquid-in-glass type.

I. Thermometer stems shall be of length to match thermowell insertion length.

3.5 THERMOMETER SCALE-RANGE SCHEDULE

A. Scale Range for Chilled-Water Piping: 0 to 100 deg F.

B. Scale Range for Condenser-Water Piping: 0 to 150 deg F.

C. Scale Range for Heating, Hot-Water Piping: 20 to 240 deg F.

D. Scale Range for Steam and Steam-Condensate Piping: 20 to 240 deg F.

E. Scale Range for Outside-Air Ducts: Minus 40 to plus 110 deg F.

F. Scale Range for Other Air Ducts: 0 to 150 deg F.

3.6 PRESSURE-GAGE SCHEDULE

A. Pressure gages at discharge of each pressure-reducing valve shall be the following:

1. Sealed, direct-mounted, metal case.

B. Pressure gages at inlet and outlet of each chiller chilled-water and condenser-water connection shall be one of the following:

1. Liquid-filled, direct-mounted, metal case.
2. Test plug with chlorosulfonated polyethylene synthetic or EPDM self-sealing rubber inserts, as indicated.

C. Pressure gages at suction and discharge of each pump shall be the following:

1. Liquid-filled, direct-mounted, metal case.

3.7 PRESSURE-GAGE SCALE-RANGE SCHEDULE

A. Scale Range for Chilled-Water Piping: 0 to 100 psi.

B. Scale Range for Condenser-Water Piping: 0 to 100 psi.

C. Scale Range for Heating, Hot-Water Piping: 0 to 160 psi.

D. Scale Range for Steam Piping: 0 to 30 psi.

3.8 FLOWMETER SCHEDULE

A. Flowmeters for Chilled-Water Piping: Venturi or Vortex-shedding type.

B. Flowmeters for Condenser-Water Piping: Venturi or Vortex-shedding type.

C. Flowmeters for Heating, Hot-Water Piping: Venturi or Vortex-shedding type.

D. Flowmeters for Steam and Steam-Condensate Piping: Venturi type.

3.9 THERMAL-ENERGY METER SCHEDULE

A. Thermal-Energy Meters for Chilled-Water Piping: Ultrasonic type.

B. Thermal-Energy Meters for Condenser-Water Piping: Ultrasonic type.

C. Thermal-Energy Meters for Heating, Hot-Water Piping: Ultrasonic type.

D. Thermal-Energy Meters for Steam and Steam-Condensate Piping: Ultrasonic type.

END OF SECTION

SECTION 23 0523

GENERAL-DUTY VALVES FOR HVAC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Bronze ball valves.
2. Iron ball valves.
3. Bronze swing check valves.
4. Iron swing check valves.
5. Bronze gate valves.
6. Iron gate valves.
7. Bronze globe valves.

B. Related Sections:

1. Section "Identification for HVAC Piping and Equipment" for valve tags and schedules.

1.3 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.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of valve indicated.

1.5 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 B31.1 for power piping valves.
3. ASME B31.9 for building services piping valves.

1.6 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

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Refer to HVAC valve schedule articles for applications of valves.

B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

C. Valve Sizes: Same as upstream piping unless otherwise indicated.

D. Valve Actuator Types:
1. Handwheel: For valves other than quarter-turn types.
2. Handlever: For quarter-turn valves NPS 6 and smaller.
3. Wrench: For plug valves with square heads. Furnish Owner with 1 wrench for every 10 plug valves, for each size square plug-valve head.

E. Valves in Insulated Piping: With 2-inch stem extensions and the following features:

1. Gate Valves: With rising stem.

2. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
3. Butterfly Valves: With extended neck.

F. Valve-End Connections:

1. Flanged: With flanges according to ASME B16.1 for iron valves.
2. Grooved: With grooves according to AWWA C606.
3. Solder Joint: With sockets according to ASME B16.18.
4. Threaded: With threads according to ASME B1.20.1.

G. Valve Bypass and Drain Connections: MSS SP-45.

H. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. American Valve, Inc.
2. Crane Co.; Crane Valve Group; Crane Valves.
3. DeZurik Water Controls.
4. Hammond Valve.
5. Kennedy.
6. Milwaukee Valve Company.
7. Mueller.
8. NIBCO INC.
9. Spence.
10. Tyco.
11. Victaulic Company.
12. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2.2 BRONZE BALL VALVES

A. Two-Piece, Full-Port, Bronze Ball Valves with Stainless-Steel Trim:

1. Description:

a. Standard: MSS SP-110.
b. SWP Rating: 150 psig.
c. CWP Rating: 600 psig.
d. Body Design: Two piece.
e. Body Material: Bronze.
f. Ends: Threaded.
g. Seats: PTFE or TFE.
h. Stem: Stainless steel.
i. Ball: Stainless steel, vented.
j. Port: Full.

B. Three-Piece, Full-Port, Bronze Ball Valves with Stainless-Steel Trim:

1. Description:

a. Standard: MSS SP-110.
b. SWP Rating: 150 psig.
c. CWP Rating: 600 psig.

d. Body Design: Three piece.
e. Body Material: Bronze.
f. Ends: Threaded.
g. Seats: PTFE or TFE.
h. Stem: Stainless steel.
i. Ball: Stainless steel, vented.
j. Port: Full.

2.3 IRON BALL VALVES

A. Class 125, Iron Ball Valves:

1. Description:

a. Standard: MSS SP-72.
b. CWP Rating: 200 psig.
c. Body Design: Split body.
d. Body Material: ASTM A 126, gray iron.
e. Ends: Flanged.
f. Seats: PTFE or TFE.
g. Stem: Stainless steel.
h. Ball: Stainless steel.
i. Port: Full.

2.4 BRONZE LIFT CHECK VALVES

A. Class 125, Lift Check Valves with Bronze Disc:

1. Description:

a. Standard: MSS SP-80, Type 1.
b. CWP Rating: 200 psig.
c. Body Design: Vertical flow.
d. Body Material: ASTM B 61 or ASTM B 62, bronze.
e. Ends: Threaded.
f. Disc: Bronze.

2.5 BRONZE SWING CHECK VALVES

A. Class 125, Bronze Swing Check Valves with Bronze Disc:

1. Description:

a. Standard: MSS SP-80, Type 3.
b. CWP Rating: 200 psig.
c. Body Design: Horizontal flow.
d. Body Material: ASTM B 62, bronze.
e. Ends: Threaded.
f. Disc: Bronze.

B. Class 150, Bronze Swing Check Valves with Bronze Disc:

1. Description:

    a. Standard: MSS SP-80, Type 3.
    b. CWP Rating: 300 psig.
    c. Body Design: Horizontal flow.
    d. Body Material: ASTM B 62, bronze.
    e. Ends: Threaded.
    f. Disc: Bronze.

2.6 IRON SWING CHECK VALVES

A. Class 125, Iron Swing Check Valves with Metal Seats:

1. Description:

    a. Standard: MSS SP-71, Type I.
    b. NPS 2-1/2 to NPS 12, CWP Rating: 200 psig.
    c. NPS 14 to NPS 24, CWP Rating: 150 psig.
    d. Body Design: Clear or full waterway.
    e. Body Material: ASTM A 126, gray iron with bolted bonnet.
    f. Ends: Flanged.
    g. Trim: Bronze.
    h. Gasket: Asbestos free.

2.7 IRON SWING CHECK VALVES WITH CLOSURE CONTROL

A. Class 125, Iron Swing Check Valves with Lever- and Spring-Closure Control:

1. Description:

    a. Standard: MSS SP-71, Type I.
    b. NPS 2-1/2 to NPS 12, CWP Rating: 200 psig.
    c. NPS 14 to NPS 24, CWP Rating: 150 psig.
    d. Body Design: Clear or full waterway.
    e. Body Material: ASTM A 126, gray iron with bolted bonnet.
    f. Ends: Flanged.
    g. Trim: Bronze.
    h. Gasket: Asbestos free.
    i. Closure Control: Factory-installed, exterior lever and spring.

B. Class 125, Iron Swing Check Valves with Lever and Weight-Closure Control:

1. Description:

    a. Standard: MSS SP-71, Type I.
    b. NPS 2-1/2 to NPS 12, CWP Rating: 200 psig.
    c. NPS 14 to NPS 24, CWP Rating: 150 psig.
    d. Body Design: Clear or full waterway.
    e. Body Material: ASTM A 126, gray iron with bolted bonnet.
    f. Ends: Flanged.
    g. Trim: Bronze.
    h. Gasket: Asbestos free.
    i. Closure Control: Factory-installed, exterior lever and weight.

2.8 BRONZE GATE VALVES

A. Class 125, NRS Bronze Gate Valves:

1. Description:

a. Standard: MSS SP-80, Type 1.
b. CWP Rating: 200 psig.
c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
d. Ends: Threaded or solder joint.
e. Stem: Bronze.
f. Disc: Solid wedge; bronze.
g. Packing: Asbestos free.
h. Handwheel: Malleable iron, bronze, or aluminum.

B. Class 150, NRS Bronze Gate Valves:

1. Description:

a. Standard: MSS SP-80, Type 1.
b. CWP Rating: 300 psig.
c. Body Material: ASTM B 62, bronze with integral seat and union-ring bonnet.
d. Ends: Threaded.
e. Stem: Bronze.
f. Disc: Solid wedge; bronze.
g. Packing: Asbestos free.
h. Handwheel: Malleable iron, bronze, or aluminum.

2.9 IRON GATE VALVES

A. Class 125, OS&Y, Iron Gate Valves:

1. Description:

a. Standard: MSS SP-70, Type I.
b. NPS 2-1/2 to NPS 12, CWP Rating: 200 psig.
c. NPS 14 to NPS 24, CWP Rating: 150 psig.
d. Body Material: ASTM A 126, gray iron with bolted bonnet.
e. Ends: Flanged.
f. Trim: Bronze.
g. Disc: Solid wedge.
h. Packing and Gasket: Asbestos free.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

E. Install check valves for proper direction of flow and as follows:

1. Swing Check Valves: In horizontal position with hinge pin level.

3.3 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valve applications are not indicated, use the following:

1. Shutoff Service: Ball or gate valves.
2. Pump-Discharge Check Valves:

    a. NPS 2 and Smaller: Bronze swing check valves with bronze disc.
    b. NPS 2-1/2 and Larger: Iron swing check valves with lever and weight or with spring or iron, center-guided, metal or resilient-seat check 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 Steel Piping, NPS 2 and Smaller: Threaded ends.

4. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.

3.5 CHILLED-WATER VALVE SCHEDULE

A. Pipe NPS 2-1/2 and Larger:

1. Iron Valves, NPS 2-1/2 to NPS 4: May be provided with threaded ends instead of flanged ends.
2. Iron Ball Valves, NPS 2-1/2 to NPS 10: Class 125.
3. Iron Swing Check Valves: Class 125, metal seats.
4. Iron Swing Check Valves with Closure Control, NPS 2-1/2 to NPS 12: Class 125, lever and spring or weight.
5. Iron Gate Valves: Class 125 or Class 250, OS&Y.

3.6 HEATING-WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller:

1. Bronze Valves: May be provided with solder-joint ends instead of threaded ends.
2. Ball Valves: Two or Three piece, full port, bronze with bronze or stainless-steel trim.
3. Bronze Swing Check Valves: Class 150, bronze disc.
4. Bronze Gate Valves: Class 150, NRS.

B. Pipe NPS 2-1/2 and Larger:

1. Iron Valves, NPS 2-1/2 to NPS 4: May be provided with threaded ends instead of flanged ends.
2. Iron Ball Valves, NPS 2-1/2 to NPS 10: Class 125.
3. Iron Swing Check Valves: Class 125, metal seats.

END OF SECTION

SECTION 23 0529

HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Metal framing systems.
4. Thermal-hanger shield inserts.
5. Fastener systems.
6. Pipe stands.
7. Equipment supports.

B. Related Sections:

1. Section "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
2. Section "Expansion Fittings and Loops for HVAC Piping" for pipe guides and anchors.
3. Section "Vibration and Seismic Controls for HVAC Piping and Equipment" for vibration isolation devices.
4. Section "Metal Ducts" for duct hangers and supports.

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following; include Product Data for components:

1. Trapeze pipe hangers.
2. Metal framing systems.
3. Pipe stands.
4. Equipment supports.

1.5 QUALITY ASSURANCE

A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pre-galvanized or hot dipped.
3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
4. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel or stainless steel.

B. Copper Pipe Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated or steel stainless steel.

2.2 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.3 METAL FRAMING SYSTEMS

A. MFMA Manufacturer Metal Framing Systems:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Allied Tube & Conduit.
b. Cooper B-Line, Inc.
c. Thomas & Betts Corporation.
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 in-turned 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 or steel stainless steel.
7. Metallic Coating: Electroplated zinc, Hot-dipped galvanized, or Mill galvanized.
8. Paint Coating: Epoxy.
9. Plastic Coating: Polyurethane or Epoxy.

2.4 THERMAL-HANGER SHIELD INSERTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Carpenter & Paterson, Inc.
2. National Pipe Hanger Corporation.
3. Pipe Shields, Inc.; a subsidiary of Piping Technology & Products, Inc.
4. Piping Technology & Products, Inc.

B. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig minimum compressive strength and vapor barrier.

C. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig ASTM C 552 or Type II cellular glass with 100-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.

2.5 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened Portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Expansion Anchors: Insert-wedge-type, stainless steel anchors, for use in hardened Portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.6 PIPE STANDS

A. General Requirements for Pipe Stands: Shop- or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.

B. Curb-Mounted-Type Pipe Stands: Shop- or field-fabricated pipe supports made from structural-steel shapes, continuous-thread rods, and rollers, for mounting on permanent stationary roof curb.

2.7 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.8 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.

D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

E. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

F. Pipe Stand Installation:
1. Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. See Section 077200 "Roof Accessories" for curbs.

G. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

H. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

I. Install hangers and supports to allow controlled thermal movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

J. Install lateral bracing with pipe hangers and supports to prevent swaying.

K. 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.

L. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

M. 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.

N. 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. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:

    a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
    b. NPS 4: 12 inches long and 0.06 inch thick.

5. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.2 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.3 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.4 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.6 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel pipe hangers and supports, metal trapeze pipe hangers, and metal framing systems and attachments for general service applications.

F. Use 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 non-insulated or insulated, stationary pipes NPS 1/2 to NPS 30.
2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F, pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.
3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.
5. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of non-insulated, stationary pipes NPS 3/4 to NPS 8.
7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of non-insulated, stationary pipes NPS 1/2 to NPS 8.
8. Adjustable Band Hangers (MSS Type 9): For suspension of non-insulated, stationary pipes NPS 1/2 to NPS 8.
9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of non-insulated, stationary pipes NPS 1/2 to NPS 8.
10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of non-insulated, stationary pipes NPS 3/8 to NPS 8.
11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of non-insulated, stationary pipes NPS 3/8 to NPS 3.
12. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
14. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.

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 for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

J. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:

    a. Light (MSS Type 31): 750 lb.
    b. Medium (MSS Type 32): 1500 lb.
    c. Heavy (MSS Type 33): 3000 lb.

13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

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. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
3. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
4. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:

    a. Horizontal (MSS Type 54): Mounted horizontally.
    b. Vertical (MSS Type 55): Mounted vertically.
    c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.

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 powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION

SECTION 23 0548

VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Isolation pads.
2. Isolation mounts.
3. Restrained elastomeric isolation mounts.
4. Freestanding and restrained spring isolators.
5. Housed spring mounts.
6. Elastomeric hangers.
7. Restrained vibration isolation roof-curb rails.

1.3 DEFINITIONS

A. IBC: International Building Code.

B. ICC-ES: ICC-Evaluation Service.

C. SMACNA: Sheet Metal and Air-Conditioning Contractors National Association.

D. VISCMA: Vibration Isolation and Seismic Control Manufacturers Association.

1.4 PERFORMANCE REQUIREMENTS

A. Wind-Restraint Loading:

1. Basic Wind Speed: Reference Project Architectural and Structural Design Notes and Information. Use these published values for vibration control components selection.
2. Building Classification Category: Reference Project Architectural and Structural Design Notes and Information. Use these published values for vibration control components selection.
3. Minimum 10 lb/sq. ft. multiplied by the maximum area of the HVAC component projected on a vertical plane that is normal to the wind direction, and 45 degrees either side of normal.

1.5 ACTION SUBMITTALS

A. Product Data: For the following:

1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of restraint component used.

    a. Tabulate types and sizes of restraints, complete with report numbers and rated strength in tension and shear as evaluated by an agency acceptable to authorities having jurisdiction.
    b. Annotate to indicate application of each product submitted and compliance with requirements.

3. Interlocking Snubbers: Include ratings for horizontal, vertical, and combined loads.

B. Delegated-Design Submittal: For vibration isolation details indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Design Calculations: Calculate static and dynamic loading due to equipment weight and operation and wind forces required to select vibration isolators, wind restraints, and for designing vibration isolation bases.

    a. Coordinate design calculations with wind load calculations required for equipment mounted outdoors. Comply with requirements in other Sections for equipment mounted outdoors.

2. Riser Supports: Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure, spring deflection changes, and other loads. Include certification that riser system has been examined for excessive stress and that none will exist.
3. Vibration Isolation Base Details: Detail overall dimensions, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, base weights, equipment static loads, power transmission, component misalignment, and cantilever loads.
4. Wind-Restraint Details:

    a. Design Analysis: To support selection and arrangement of wind restraints. Include calculations of combined tensile and shear loads.
    b. Details: Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure. Indicate association with vibration isolation devices.
    c. Coordinate vibration isolation details with wind-restraint details required for equipment mounted outdoors. Comply with requirements in other Sections for equipment mounted outdoors.
    d. Preapproval and Evaluation Documentation: By an agency acceptable to authorities having jurisdiction, showing maximum ratings of restraint items and the basis for approval (tests or calculations).

1.6 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Show coordination of bracing for HVAC piping and equipment with other systems and equipment in the vicinity, including other supports and restraints.

B. Qualification Data: For professional engineer and testing agency.

C. Welding certificates.

D. Field quality-control test reports.

1.7 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

B. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

C. Manufacturer's Qualifications: Firms regularly engaged in the manufacture of vibration control and wind or seismic restraint products of type, size, and capacity required and whose products have been in satisfactory use in similar service for not less than three years.

D. Vibration isolation and restraint products shall be the product of a single manufacturer unless provided as an integral part of manufactured equipment by the equipment manufacturer.

PART 2 - PRODUCTS

2.1 VIBRATION ISOLATORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Amber/Booth Company, Inc.
2. California Dynamics Corporation.
3. Mason Industries.
4. Vibration Eliminator Co., Inc.
5. Vibro-Acoustics

B. Pads: Arranged in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized-steel baseplates, and factory cut to sizes that match requirements of supported equipment.

1. Resilient Material: Oil- and water-resistant [**neoprene**] [**rubber**].

C. Mounts: Double-deflection type, with molded, oil-resistant rubber or neoprene isolator elements with factory-drilled, encapsulated top plate for bolting to equipment and with baseplate for bolting to structure. Color-code or otherwise identify to indicate capacity range.

1. Materials: Cast-ductile-iron or welded steel housing containing two separate and opposing, oil-resistant rubber or neoprene elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.
2. Neoprene: Shock-absorbing materials compounded according to the standard for bridge-bearing neoprene as defined by AASHTO.

D. Spring Isolators: Freestanding, laterally stable, open-spring isolators.

1. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
2. Minimum Additional Travel: 50 percent of the required deflection at rated load.
3. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
4. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
5. Baseplates: Factory drilled for bolting to structure and bonded to 1/4-inch- thick, rubber isolator pad attached to baseplate underside. Baseplates shall limit floor load to 500 psig.
6. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.

E. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with limit-stop restraint.

1. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to weight being removed; factory-drilled baseplate bonded to 1/4-inch- thick, neoprene or rubber isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation.
2. Restraint: Limit stop as required for equipment and authorities having jurisdiction.
3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

F. Elastomeric Hangers: Single or double-deflection type, fitted with molded, oil-resistant elastomeric isolator elements bonded to steel housings with threaded connections for hanger rods. Color-code or otherwise identify to indicate capacity range.

G. Spring Hangers: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression.

1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
7. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.

2.2 RESTRAINED VIBRATION ISOLATION ROOF-CURB RAILS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Amber/Booth Company, Inc.
2. California Dynamics Corporation.
3. Mason Industries.
4. Thybar Corporation.
5. Vibration Eliminator Co., Inc.
6. Vibro-Acoustics

B. General Requirements for Restrained Vibration Isolation Roof-Curb Rails: Factory-assembled, fully enclosed, insulated, air- and watertight curb rail designed to resiliently support equipment and to withstand wind forces.

C. Lower Support Assembly: Formed sheet-metal section containing adjustable and removable steel springs that support upper frame. Upper frame shall provide continuous support for equipment and shall be captive to resiliently resist wind forces. Lower support assembly shall have a means for attaching to building structure and a wood nailer for attaching roof materials, and shall be insulated with a minimum of 2 inches of rigid, glass-fiber insulation on inside of assembly.

D. Spring Isolators: Adjustable, restrained spring isolators shall be mounted on 1/4-inch- thick, elastomeric vibration isolation pads and shall have access ports, for level adjustment, with removable waterproof covers at all isolator locations. Isolators shall be located so they are accessible for adjustment at any time during the life of the installation without interfering with the integrity of the roof.

1. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with wind restraint.

a. Housing: Steel with resilient vertical-limit stops and adjustable equipment mounting and leveling bolt.
b. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
c. Minimum Additional Travel: 50 percent of the required deflection at rated load.
d. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
e. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

2. Pads: Arranged in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized-steel baseplates, and factory cut to sizes that match requirements of supported equipment.

a. Resilient Material: Oil- and water-resistant standard neoprene or natural rubber.

E. Snubber Bushings: All-directional, elastomeric snubber bushings at least 1/4 inch thick.

F. Water Seal: Galvanized sheet metal with EPDM seals at corners, attached to upper support frame, extending down past wood nailer of lower support assembly, and counterflashed over roof materials.

2.3 FACTORY FINISHES

A. Finish: Manufacturer's standard prime-coat finish ready for field painting.

B. Finish: Manufacturer's standard paint applied to factory-assembled and -tested equipment before shipping.

1. Powder coating on springs and housings.
2. All hardware shall be galvanized. Hot-dip galvanize metal components for exterior use.
3. Baked enamel or powder coat for metal components on isolators for interior use.
4. Color-code or otherwise mark vibration isolation [**- and wind**]-control devices to indicate capacity range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and equipment to receive vibration isolation and wind-control devices for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

A. Multiple Pipe Supports: Secure outdoor pipes to trapeze member with clamps approved for application by an evaluation service member of ICC-ES.

B. Strength of Support and Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and dynamic loads within specified loading limits.

3.3 VIBRATION-CONTROL AND WIND-RESTRAINT DEVICE INSTALLATION

A. Comply with requirements in Section "Roof Accessories" for installation of roof curbs, equipment supports, and roof penetrations.

B. Outdoor Piping Restraints:

1. Comply with requirements in MSS SP-127.
2. Space lateral restraints a maximum of 40 feet o.c., and longitudinal restraints a maximum of 80 feet o.c.
3. Brace a change of direction longer than 12 feet.

C. Install cables so they do not bend across edges of adjacent equipment or building structure.

D. Attachment to Structure: If specific attachment is not indicated, anchor restraints to structure.

E. Drilled-in Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in 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.
5. Set anchors to manufacturer's recommended torque, using a torque wrench.
6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.4 ADJUSTING

A. Adjust isolators after piping system is at operating weight.

B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

C. Adjust active height of spring isolators.

D. Adjust restraints to permit free movement of equipment within normal mode of operation.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain air-mounting systems. Refer to Section 017900 "Demonstration and Training."

END OF SECTION

SECTION 23 0548.13

NOISE AND VIBRATION CONTROLS FOR HVAC SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
1. Neoprene pads.
2. Neoprene mounts.
3. Neoprene hangers.
4. Spring mounts, free-standing.
5. Spring mounts, vertically-restrained.
6. Spring hangers.
7. Flexible pipe connectors.
8. Duct lining.
9. Duct silencers.
10. Duct/pipe wrap (lagging).

B. Related Requirements:
1. Vibration Control Products furnished as integral part of factory-fabricated equipment are specified as part of equipment assembly in other Division 23 sections.
2. Refer to other Division 22, 23, 26 sections for equipment foundations, hangers, sealants, gaskets, requirements of electrical connections to equipment isolated on vibration control products, and requirements of duct connections to air handling equipment isolated on vibration control products.
3. Noise Criteria:
   a. Noise levels due to mechanical equipment, ductwork, grilles, registers, diffusers, terminal devices, etc., shall not exceed sound pressure levels in all 8 octave bands corresponding to dBA levels per ASHRAE Handbook, 2019 HVAC Applications Volume, Chapter 49, Table 1 as indicated. Where noise criteria specified herein differ from the ASHRAE Handbook, the lower noise criteria shall apply.
   b. A-Weighted Noise Level (dBA)

Teleconference Rooms	30
Private Offices	35
Conference Rooms	35
Training Rooms	35
Open Plan Offices	45
Corridors and Lobbies	45

4. Penetrations by ducts, pipes and conduit for partitions, slabs, and gypsum board ceilings within areas designated 35 dBA or less, those rooms with slab-to-slab partitions, and within boiler rooms/plumbing equipment areas shall be packed and sealed airtight with non-hardening sealant as described herein.

1.02 SUBMITTALS

A. See Administrative Requirements for submittal procedures.

B. Contractor shall submit fully coordinated product data and shop drawings for noise control equipment. These submittals shall state the acoustical performance of the products as described below.
1. AHUs, RTUs, Exhaust Fans, Fan Units, and Terminal Units: Submit sound power levels in octave bands from 63 Hz through 8000 Hz inclusive obtained in accordance with accepted standards.
2. Isolators: Submit schedule for all vibration isolators indicating the following:
   a. Manufacturer, type, model number, size.
   b. Static deflection of each isolation element.
   c. Spring constant of each spring-type isolation element.
   d. Estimated imposed load on each isolation element.
   e. Spring o.d., free operating, and solid heights.
   f. Design of supplementary bases.
   g. Seismic restraints.
   h. Catalog datasheets.
   i. Piping isolators.

3. Silencers: Submit sound attenuation and maximum regenerated noise in octave bands.

1.03 QUALITY ASSURANCE

A. All equipment provided for noise control shall be new and manufactured specifically for the purpose intended.

B. The installation of all noise and vibration control systems shall be under the supervision of the manufacturer's representative.

PART 2 PRODUCTS

2.01 COMPONENTS

A. Vibration Isolation Systems:
1. Manufacturers:
a. All vibration isolation equipment and materials shall be provided by a single manufacturer. The following manufacturers are approved, provided systems comply with the specified design and performance requirements:
1) Mason Industries, Inc. – Hauppauge, New York (Basis of Design).
2) Vibration Mountings and Controls – Bloomingdale, New Jersey.
3) Kinetics Noise Control – Dublin, Ohio.
2. General:
a. All vibration isolators shall have either known un-deflected heights or calibration markings so verification can be made after adjustment that loads are within proper range of the device.
b. All isolators shall operate in the linear portion of their load versus deflection curve.
c. The theoretical vertical natural frequency for each support point, based upon load per isolator and isolator stiffness, shall not differ from the design objectives for the equipment by more than ±10%.
d. All neoprene mountings shall be bridge bearing quality and possess Shore A durometer of 50 maximum, or as specified herein, after minimum aging of 20 days or corresponding over-aging.
e. Housed or caged spring isolators are not acceptable.
f. Mounting assemblies for spring isolators shall utilize bare steel springs with the spring diameter not less than 80% of the loaded operating height of the spring. Each spring isolator shall be designed and installed so that the ends of the spring remain parallel during and after the spring installation. All isolators shall operate in the linear portion of their load/deflection curve and have 50% excess capacity without becoming coil bound.
g. All mounting systems exposed to weather and other corrosive environments shall be protected with factory corrosion resistance. All metal parts of mountings (except springs and hardware) shall be hot dip galvanized. Springs shall be cadmium plated and neoprene coated. Nuts and bolts shall be cadmium plated.
3. Isolator Type WP:
a. Type WP (Waffle Pads) shall be 5/16” thick neoprene pads ribbed or waffled on both sides. The pads shall be manufactured with neoprene, and selected for 15% strain maximum. Where required, steel load spreading plates shall be incorporated between the equipment and the neoprene pad.
b. If the isolator is bolted to the structure, a neoprene vibration isolation washer and sleeve (Mason Industries HG or as approved) shall be installed under the bolt head between the steel washer and the base plate.
c. (Type WP: Mason Industries Type W or as approved.).
4. Isolator Type MWP:
a. Type MWP (Metal and Waffle Sandwich Pads) shall consist of two 5/16” thick ribbed or waffle neoprene pads sandwiching a 16-gauge stainless steel shim plate. The pad shall be manufactured with neoprene and selected for 15% strain maximum.
b. If the isolator is bolted to the structure, a neoprene vibration isolation washer and sleeve (Mason Industries HG, or as approved) shall be installed under the bolt head between the steel washer and the base plate.
c. (Type MWP: Mason Industries Type WSW or as approved.).
5. Isolator Type NIS:
a. Type NIS isolators shall be designed with a neoprene element to provide isolation in tension, shear or compression.

b. (Type NIS: Mason Industries Type RBA or as approved).

6. Isolator Type DDNM:
   a. Type DDNM (Double Deflection Neoprene Mounts) shall be laterally stable, double deflecting, molded neoprene isolators. All metal surfaces shall be covered with neoprene. The top and bottom surfaces shall be ribbed, and bolt holes shall be provided in the base. The mounts shall have leveling bolts rigidly secured to the equipment.
   b. The isolator shall be manufactured with neoprene and selected for 15% strain maximum.
   c. (Type DDNM: Mason Industries Type ND or as approved.).
7. Isolator Type DDNH:
   a. Type DDNH (Double Deflection Neoprene Hangers) shall consist of a molded neoprene isolating element in a steel hanger box. A neoprene sleeve shall be provided where the lower hanger rod passes through the steel hanger box, such that the hanger rod cannot contact the steel hanger. The diameter of the clear hole in the hanger box shall be at least 3/4" larger than the diameter of the hanger rod and permit the hanger rod to swing through a 30° arc. When installed, the hanger box shall be allowed to rotate through a full 360° without encountering any obstructions.
   b. The isolator shall be manufactured with neoprene, and selected for 15% strain maximum.
   c. (Type DDNH: Mason Industries Type HD or as approved.).
8. Isolator Type SPNM:
   a. Type SPNM (Spring and Neoprene Mounts) shall have a freestanding and laterally stable steel spring without any housing. Springs shall be designed so that the ratio of the horizontal to vertical spring constant is between one and two. The spring diameter shall be not less than 80% of the compressed height of the spring at rated load. Loaded springs shall have a minimum additional travel to solid equal to 50% of the specified static deflection.
   b. Two Type WP isolation pads sandwiching a 16-gauge stainless or galvanized steel separator plate shall be bonded to the isolator baseplate.
   c. Unless otherwise specified, isolators need not be bolted to the floor for indoor installations. If the base plates are bolted to the structure, a neoprene vibration isolation washer and sleeve (Mason Industries HG or as approved) shall be installed under the bolt head between the steel washer and the base plate.
   d. (Type SPNM: Mason Industries Type SLF or as approved.).
9. Isolator Type SPNH:
   a. Type SPNH (Spring and Neoprene Hangers) shall consist of a steel spring in series with a neoprene isolating element. The spring shall have a minimum additional travel to solid equal to 50% of the specified deflection. The neoprene element shall be selected for 15% strain maximum.
   b. Spring diameter and hanger box hole size shall be large enough to permit the hanger rod to swing through a 30° arc. A neoprene sleeve shall be provided where the lower hanger rod passes through the steel hanger box, such that the hanger rod cannot contact the steel hanger. The diameter of the clear hole in the hanger box shall be at least 3/4" larger than the diameter of the hanger rod. When installed, the spring element shall not be cocked, and the hanger box shall be allowed to rotate through a full 360° arc without encountering any obstructions.
   c. (Type SPNH: Mason Industries Type 30N or as approved.).
10. Isolator Type CSNM:
    a. Type CSNM (Constrained Spring and Neoprene Mounts) shall be a spring and neoprene mount that incorporates a housing which incorporates unrestrained stable springs with built-in leveling device and resilient vertical limit stops to prevent spring elongation when partial load is removed and limits the movement of equipment when it is subjected to wind loading.
    b. A minimum clearance of 1" shall be maintained around restraining bolts and between the housing and the spring so as not to interfere with the spring operation. Limit stops shall provide minimum 1/4" clearance under normal operation, and a neoprene washer shall be installed beneath the bolt head/ washer used to restrain the isolator.
    c. In installations subject to wind load, provide tapped hole in top and bottom plates for bolting to equipment and the roof or supporting structure with a neoprene mounting sleeve.
    d. Provide minimum 1/4" thick neoprene acoustical base pad on underside of mount unless designated otherwise.
    e. Mount shall be capable of supporting equipment at a fixed elevation during equipment erection. Installed and operating heights shall be identical.
    f. (Type CSNM: Mason Industries Type SLR or as approved).
11. Base Type CMB:

a. Base Type CMB (Curb Mounted Base) for roof mounted equipment shall be a structural steel base mounted directly to the structure with an upper floating section on adjustable steel springs. The upper frame shall provide continuous support for the equipment. Steel springs shall rest on 1/4" minimum thickness neoprene pads. All directional snubber bushings shall be 1/4" minimum thickness neoprene. All hardware shall be cadmium or zinc electroplated to provide a rust resistant finish.
b. Weatherproofing shall consist of a continuous galvanized flexible counterflashing nailed over the lower curb's waterproofing and joined at the corners by EPDM bellows. All spring locations shall have access ports with removable waterproof covers to allow for adjustment or replacement of springs. Lower curbs shall have provision for 2" insulation.
c. Duct connections shall be made using a length of flexible duct dimensioned to match the equipment opening, using a foam rubber gasket to seal against the unit bottom.
d. Base Type CMB: Mason Industries Type RSC or as approved.

12. Neoprene Mounting Sleeves:
    a. Neoprene mounting sleeves for hold-down applications of equipment with vibration isolators shall be Mason Industries HG or as approved.
13. Pipe Flexible Connectors:
    a. Flexible connectors for water pipes shall be elastomeric Mason Industries Safeflex SFU, SFDEJ, or SFDCR. Control cables (Mason Industries Type ACC or as approved) may be used to prevent axial elongation in the connector. Rigid control rods shall not be used for this purpose.
    b. Flexible connectors for refrigerant pipes shall be braided stainless-steel Mason Industries ULCPS.

B. Duct Lining:
1. Manufacturers:
    a. The following duct liner manufacturers are approved, provided the product complies with the specified design and performance requirements:
        1) Certainteed.
        2) Owens Corning.
        3) Knauf.
        4) Johns Manville.
2. General:
    a. Duct liner shall comply with all requirements of NFPA 90A and the "Duct Liner Materials Standard" of the Thermal Insulation Manufacturer's Association.
    b. Duct lining shall have a minimum density of 1.5 pcf unless otherwise noted and shall be 1" or 2" in total thickness, as noted on drawings.

C. Duct Silencers:
1. Manufacturers:
    a. The following duct silencer manufacturers are approved, provided the product complies with the specified design and performance requirements:
        1) Price Industries (Basis-of-Design).
        2) Vibro-Acoustics.
        3) Industrial Acoustics.
        4) Kinetics Noise Control.
        5) Pottorff.
2. General:
    a. Rectangular duct silencers shall have outer casings of not less than 22-gauge galvanized steel. Seams shall be lock formed and mastic filled. The internal baffles (splitters) shall be not less than 24-gauge galvanized perforated steel having an open area of about 30%. The nosings shall be full radius or airfoil shape.
    b. The sound absorbing media shall be not less than 4.5 pcf glass/mineral fiber packed under 5% compression. The fiber fill shall be incombustible, mildew resistant and vermin proof. The sound absorbing material shall be protected from erosion.
    c. If the silencer is supplied in modular sections, the silencer shall meet or exceed the specification for single-module silencers with respect to insertion loss, pressure drop, regenerated noise, and air leakage.

D. Duct/Pipe Wrap (Lagging):
1. Manufacturers:

a. Sound Seal – Agawam, Massachusetts (Basis-of-Design).
2. Duct/pipe wrap (or lagging) shall be provided as shown on mechanical drawings. The material shall consist of a layer of reinforced-foil faced mass-loaded vinyl (2 pounds per square foot) bonded to a 2" thick layer of fiberglass (2 pounds per cubic foot).
3. The product shall have a Class A (or 1) flammability rating per ASTM E-84.
4. (Sound Seal B-20 LAG / QFA-9, STC 34, or as approved).

E. Penetrations:
1. Foam Rod:
a. Foam backer rod shall be closed cell polyethylene suitable for use as a backing for non-hardening sealant.
2. Non-Hardening Sealant:
a. Sealant for penetrations shall be permanently non-hardening type and have at least 25% movement capability in both directions of joint width. Reference Section 079200 – Joint Sealants for approved acoustical sealants.
b. Permanently flexible, approved firestop sealant systems may be used for fire-rated penetrations. Reference Section 078400 – Firestopping and Section 079200 – Joint Sealants for approved fire-rated acoustical sealants.
3. Packing Material:
a. Mineral fiber, non-combustible, resistant to water, mildew and vermin. Reference Section 078400 – Firestopping and Section 079200 – Joint Sealants for approved packing materials.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verification of Conditions:
1. Examine areas and conditions under which vibration control units are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Owner or Owner's Representative.
2. Installer of vibration isolation work shall observe installation of other work related to vibration isolation work, including work connected to vibration isolation work.

3.02 APPLICATION

A. General:
1. Except as otherwise indicated, select vibration control products in accordance with ASHRAE Handbook, 2019 HVAC Applications Volume, Chapter 49, "Noise and Vibration Control," Table 47. Where minimum static deflections specified herein differ from the ASHRAE Handbook, the greater static deflections shall apply.
2. Springs shall be sized to be non-resonant with equipment forcing frequencies and/or support structure natural frequencies.

B. Rooftop Units:
1. Internal supply, return, and exhaust fans and associated motors shall be supported from SPNM mounts with a static deflection of 2" under actual load conditions.

C. Chillers:
1. Mount chiller on Type CSNM isolators having a static deflection of 2" under actual load.
2. Number of isolators and location to be provided by isolator manufacturer/vendor based on actual equipment loads.

D. Split (DX) Air Conditioning Units:
1. All condensing units above grade or on roof shall be isolated by means of WP neoprene pads. Units shall be supported off roofing by concrete pavers or suitable concrete blocks.

E. Inline Pumps:
1. Inline pumps 3 HP and over shall be supported on Type SPNM spring isolator mounts or Type SPNH isolation hangers having a static deflection of 1" under actual load. The vertical load shall be carried by the supports, not by the flexible pipe connections.
2. Inline pumps less than 3HP shall be supported as above, with Type DDNM mount or Type DDNH hangers having a static deflection of 0.3" under actual load.

F. End-Suction Pumps:
   1. End-suction pumps shall be mounted on steel and concrete inertia bases, supported by Type SPNM isolators having a static deflection of 2” under actual load. The isolated inertia base shall sit on a 4” thick concrete housekeeping pad.

G. Exhaust Fans:
   1. Large exhaust fans over 1,500 cfm shall be isolated from structure via NIS isolators.

H. Fan Units and Fan-Powered Terminal Units:
   1. Fan units and fan-powered terminal units are to be vibration isolated with Type SPNH hangers having a minimum static deflection of 2” for installations above grade, and 1” on grade under actual load.

I. Flexible Pipe Connectors:
   1. Flexible pipe connectors shall be used to connect piping diameter 2” or greater to equipment requiring isolation supports.

J. Condenser Water, Chilled Water, and Hot Water Piping:
   1. For piping connected to equipment requiring vibration isolation supports, install isolation mounts Type SPNM or isolation hangers Type SPNH, as indicated, for the first three (3) points of support for pipe sizes 2” through 4”, for first four (4) points of support for pipe sizes 6” through 8”, and for first six (6) points of support for pipe sizes 10” and over. Isolator minimum static deflections under actual load conditions shall be equal or greater than that for the isolators supporting the equipment.
   2. Piping 2” or larger in diameter, connected within a 50’-0” pipe length of equipment requiring vibration isolation, shall be vibration isolated from building structure by means of DDNH isolation hangers with a static deflection of 0.3” under actual load conditions, except where SPNM or SPNH isolation supports are specified.

K. Lateral Restraints:
   1. All equipment shall be provided with lateral restraining isolators as required to limit horizontal motion to 1/4” maximum, under all operating conditions. Lateral restraining isolators shall have the same static deflection as equipment being isolated.
   2. Where pipes rise in a vertical chase and are supported from structure with isolation hangers and require lateral bracing, neoprene riser guides shall be mounted around the pipe to limit lateral movement and to prevent direct contact with the supporting structure.

L. Low-Temperature Applications:
   1. Elastomeric isolators that will be exposed to temperatures below 32° F shall be fabricated from natural rubber instead of neoprene.

M. Flexible Conduit:
   1. All wiring connections to equipment on isolators shall be made with flexible conduit fabricated in a slack shape.

3.03 INSTALLATION

A. General:
   1. Except as otherwise indicated, comply with manufacturer's instructions for installation and load application to vibration isolation materials and units.
   2. All equipment, ductwork, piping, etc. shall be mounted on or suspended from approved foundations and supports as specified herein or as shown on the drawings.
   3. Piping, ductwork, conduit, or equipment shall be supported from building structure, not hung from or supported on other equipment, pipes, or ductwork.
   4. Install units between substrate and equipment as required for secure operation and to prevent displacement by normal forces.
   5. Furnish and install neoprene mounting sleeves for hold-down bolts to prevent any metal to metal contact.
   6. Locate isolation hangers as near overhead support structure as possible.

B. Flexible Pipe Connectors:
   1. Install on equipment side of shutoff valves, horizontally and parallel to equipment shafts wherever possible. Flexible connectors shall be installed to prevent metal-to-metal contact across flexible connection.

C. Flexible Duct Connectors:
   1. Ducts shall be connected to fans, fan casings and fan plenums by means of flexible connectors. Flexible connectors shall be installed to prevent metal-to-metal contact across flexible connection.

D. Duct Silencers:
   1. Duct silencers shall be furnished and installed as shown on the mechanical drawings and as called for in the silencer schedule.

E. Duct, Pipe, and Conduit Penetrations:
   1. Where each duct, pipe, or conduit passes through a wall, slab or gypsum board ceiling of a noise-sensitive space (rated 35 dBA or less, those rooms with slab-to-slab partitions, and mechanical/electrical rooms), there shall be a clear annular space of 1/4" – 1/2" between the duct/pipe/conduit and surrounding construction. This also includes all penetrations of roofs and walls from exterior mechanical equipment. After all of the associated ductwork/piping/conduit is installed, the Contractor shall check the clearance and correct it, if necessary. Then the voids shall be packed full depth with mineral fiber batt insulation and sealed both ends with a nonaging, nonhardening sealant backed by a polyethylene foam rod or permanently flexible firestop material. Where there is not sufficient access space to pack around all sides of a duct (for example, at the underside of a slab), place a short stub duct in the wall, pack and caulk around it, and then attach the inlet and outlet ducts to each end.

3.04 SYSTEM STARTUP

A. Do not start-up equipment until inadequacies have been corrected in manner acceptable to vibration isolation installer.

3.05 ADJUSTING

A. Adjust to ensure that units do not exceed rated operating deflections or bottom out under loading and are not short-circuited by other contacts or bearing points. Remove space blocks and similar devices (if any) intended for temporary protection against overloading during installation.

B. Adjust leveling devices as required to distribute loading uniformly onto isolators. Shim units as required where substrate is not level.

3.06 CLEANING

A. Clean each vibration control unit, and verify that each is working freely, and that there is no dirt or debris in immediate vicinity of unit that could possibly short-circuit unit isolation.

END OF SECTION

SECTION 23 0553

IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.
4. Duct labels.
5. Valve tags.
6. Warning tags.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

D. Valve numbering scheme.

E. Valve Schedules: For each piping system to include in maintenance manuals.

1.4 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

2.1 EQUIPMENT LABELS

A. Metal Labels for Equipment:

1. Material and Thickness: Brass, 0.032-inch Stainless steel, 0.025-inch Aluminum, 0.032-inch or anodized aluminum, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
3. 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.
4. Fasteners: Stainless-steel rivets or self-tapping screws.

B. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 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 160 deg F.
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.

C. 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.

2.2 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.

B. Letter Color: White.

C. Background Color: Red.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

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. Label Content: Include caution and warning information, plus emergency notification instructions.

2.3 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: At least 1-1/2 inches high.

2.4 DUCT LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 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 160 deg F.

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. 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.

2.5 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 Stainless steel, 0.025-inch Aluminum, 0.032-inch or anodized aluminum, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Fasteners: Brass wire-link chain or S-hook.

B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch 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.

2.6 WARNING TAGS

A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.

1. Size: Approximately 4 by 7 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

3.1 EQUIPMENT LABEL INSTALLATION

A. Install and permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.2 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 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.

B. Pipe Label Color Schedule:

1. Chilled-Water Piping:

a. Background Color: White.
b. Letter Color: Blue.

2. Heating Water Piping:

a. Background Color: White.
b. Letter Color: Red.

3. Refrigerant Piping:

a. Background Color: Black.
b. Letter Color: White.

3.3 DUCT LABEL INSTALLATION

A. Install plastic-laminated or 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 into concealed spaces and at maximum intervals of 50 feet in each space where ducts are exposed or concealed by removable ceiling system.

3.4 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves; faucets; convenience and lawn-watering hose connections; and HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

B. 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. Chilled Water: 1-1/2 inches, round.
b. Hot Water: 1-1/2 inches, round.
c. Gas: 1-1/2 inches, square.

2. Valve-Tag Color:

a. Chilled Water: Blue.
b. Hot Water: Red.
c. Gas: Yellow.

3. Letter Color:

a. Chilled Water: White.
b. Hot Water: White.
c. Gas: Black.

3.5 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION

SECTION 23 0713

DUCT INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes insulating the following duct services:

1. Indoor, concealed supply and outdoor air.
2. Indoor, exposed supply and outdoor air.
3. Indoor, concealed return located in unconditioned space.
4. Indoor, exposed return located in unconditioned space.

B. Related Sections:
1. Section "HVAC Piping Insulation."
2. Section "Metal Ducts" for duct liners.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied if any).

B. LEED Submittals:

1. Product Data for Credit IEQ 4.1: For adhesives and sealants, documentation including printed statement of VOC content.
2. Product Data for Credit IEQ 4.2: For coatings and paints, documentation including printed statement of VOC content.

1.4 INFORMATIONAL SUBMITTALS

A. 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.

B. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.7 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section "Hangers and Supports for HVAC Piping and 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.

C. Coordinate installation and testing of heat tracing.

1.8 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in "Duct Insulation Schedule, General," "Indoor Duct and Plenum Insulation Schedule," and "Aboveground, Outdoor Duct and Plenum Insulation Schedule" articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type II with factory-applied vinyl jacket, Type III with factory-applied FSK jacket, or Type III with factory-applied FSP jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, provide 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.

G. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. For duct and plenum applications, provide insulation with factory-applied ASJ or with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. CertainTeed Corp.; Commercial Board.
    b. Johns Manville; 800 Series Spin-Glas.
    c. Knauf Insulation; Insulation Board.
    d. Owens Corning; Fiberglas 700 Series.

2.2 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Products: Subject to compliance with requirements, provide 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.

2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. ASJ 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 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; 85-60.
   d. Mon-Eco Industries, Inc.; 22-25.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

D. Vapor-Barrier Coatings: Solvent based; suitable for outdoor use on below ambient services.

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Encacel X/V.
   b. Eagle Bridges - Marathon Industries; 570.
   c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 60-95/60-90.

2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 30-mil dry film thickness.
3. Service Temperature Range: Minus 50 to plus 220 deg F.
4. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.
5. Color: White.

E. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-10/11.
   b. Eagle Bridges - Marathon Industries; 550.
   c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 46-50.
   d. Mon-Eco Industries, Inc.; 55-50.
   e. Vimasco Corporation; WC-1/WC-5.

2. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Solids Content: 60 percent by volume and 66 percent by weight.
5. Color: White.

2.3 SEALANTS

A. FSK and Metal Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 95-44.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: Aluminum or gray.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.4 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.5 TAPES

A. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.

1. Products: Subject to compliance with requirements, provide 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 percent.
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 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 percent.
6. Tensile Strength: 34 lbf/inch in width.

2.6 SECUREMENTS

A. 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 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. 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 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 or Stainless 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.

3. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick, galvanized-steel or stainless-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

    a. Products: Subject to compliance with requirements, provide one of the following:

        1) AGM Industries, Inc.; RC-150.

2) GEMCO; R-150.
3) Midwest Fasteners, Inc.; WA-150.
4) Nelson Stud Welding; Speed Clips.

b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

1. Verify that systems to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.

B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Keep insulation materials dry during application and finishing.

G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

H. Install insulation with least number of joints practical.

I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.

2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.

J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

K. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches o.c.

    a. For below ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct flanges and fittings.

L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.4 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches 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 Section "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

D. Insulation Installation at Floor Penetrations:

1. Duct: For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section "Penetration Firestopping."

3.5 INSTALLATION OF MINERAL-FIBER INSULATION

A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install capacitor-discharge-weld pins and speed washers 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 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.

5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.
6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

B. Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 50 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install capacitor-discharge-weld pins and speed washers 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 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.

5. 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.

3.6 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Inspect ductwork, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location for each duct system defined in the "Duct Insulation Schedule, General" Article.

C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.7 DUCT INSULATION SCHEDULE, GENERAL

A. Plenums and Ducts Requiring Insulation:

1. Indoor, concealed supply and outdoor air.
2. Indoor, exposed supply and outdoor air.
3. Indoor, concealed return located in unconditioned space.
4. Indoor, exposed return located in unconditioned space.
5. Indoor, concealed exhaust between isolation damper and penetration of building exterior.

B. Items Not Insulated:

1. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
2. Factory-insulated flexible ducts.
3. Factory-insulated plenums and casings.
4. Flexible connectors.
5. Vibration-control devices.
6. Factory-insulated access panels and doors.

3.8 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Concealed, round and flat-oval duct insulation shall be one of the following:

1. Mineral-Fiber Blanket: 1-1/2 inches thick and 1.5-lb/cu. ft. nominal density.
2. Mineral-Fiber Board: 1-1/2 inches thick and 2-lb/cu. ft. nominal density.

B. Concealed, rectangular duct insulation shall be one of the following:

1. Mineral-Fiber Blanket: 1-1/2 inches thick and 1.5-lb/cu. ft. nominal density.
2. Mineral-Fiber Board: 1-1/2 inches thick and 2-lb/cu. ft. nominal density.

C. Exposed, round and flat-oval duct insulation shall be one of the following:

1. Mineral-Fiber Blanket: 1-1/2 inches thick and 1.5-lb/cu. ft. nominal density.
2. Mineral-Fiber Board: 1-1/2 inches thick and 2-lb/cu. ft. nominal density.

D. Concealed, rectangular, exhaust-air duct insulation shall be one of the following:

1. Mineral-Fiber Blanket: 1-1/2 inches thick and 1.5-lb/cu. ft. nominal density.
2. Mineral-Fiber Board: 1-1/2 inches thick and 2-lb/cu. ft. nominal density.

E. Exposed, rectangular, supply-air duct insulation shall be one of the following:

1. Mineral-Fiber Blanket: 1-1/2 inches thick and 1.5-lb/cu. ft. nominal density.
2. Mineral-Fiber Board: 1-1/2 inches thick and 2-lb/cu. ft. nominal density.

END OF SECTION

SECTION 23 0719

HVAC PIPING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes insulating the following HVAC piping systems:

1. Condensate drain piping, indoors and outdoors.
2. Chilled-water and brine piping, indoors and outdoors.
3. Heating hot-water piping, indoors and outdoors.
4. Refrigerant suction and hot-gas piping, indoors and outdoors.

B. Related Sections:

1. Section "Duct Insulation."
2. Section "HVAC Equipment Insulation."

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory and field applied if any).

B. LEED Submittals:

1. Product Data for Credit IEQ 4.1: For adhesives and sealants, documentation including printed statement of VOC content.
2. Product Data for Credit IEQ 4.2: For coatings and paints, documentation including printed statement of VOC content.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

C. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.7 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section "Hangers and Supports for HVAC Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

C. Coordinate installation and testing of heat tracing.

1.8 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.

1. Products: Subject to compliance with requirements, provide 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.

G. Mineral-Fiber, Preformed Pipe Insulation:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Johns Manville; Micro-Lok.
b. Knauf Insulation; 1000-Degree Pipe Insulation.
c. Owens Corning; Fiberglas Pipe Insulation.

2. Type I, 850 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ-SSL. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
3. Type II, 1200 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type II, Grade A, with factory-applied ASJ-SSL. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.2 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class I.

1. Products: Subject to compliance with requirements, provide 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. Childers CP-82.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127.
   b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70.
   c. Mon-Eco Industries, Inc.; 22-25.

2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

D. ASJ Adhesive, FSK, and PVDC 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 one of the following:

   a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.
   b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60 or 85-70.
   c. Mon-Eco Industries, Inc.; 22-25.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

E. PVC Jacket Adhesive: Compatible with PVC jacket.

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Dow Corning Corporation; 739, Dow Silicone.
   b. Johns Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
   c. Speedline Corporation; Polyco VP Adhesive.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.3 COATINGS AND MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Vapor-Barrier Coatings: Water based; suitable for indoor or outdoor use on below-ambient services.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-80/30-90.
b. Childers CP-38.
c. Vimasco Corporation; 749.

2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
5. Color: White.

NOTE: Coordinate below paragraph with LEED requirements. Products in Paragraph C do not comply with LEED. Delete paragraph if project has LEED requirements. Paragraph may be retained at specifier's option if project does not have LEED requirements. As part of editing this Section, remove this note.

C. [Vapor-Barrier Coatings: Solvent based; suitable for indoor use on below-ambient services.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-30LO.
b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-35.
c. Mon-Eco Industries, Inc.; 55-10.

2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 35-mil dry film thickness.
3. Service Temperature Range: 0 to 180 deg F.
4. Solids Content: ASTM D 1644, 44 percent by volume and 62 percent by weight.
5. **Color: White.]**

D. Vapor-Barrier Coatings: Solvent based; suitable for outdoor use on below-ambient services.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Encacel X/V.
b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 60-95/60-90.

2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 30-mil dry film thickness.
3. Service Temperature Range: Minus 50 to plus 220 deg F.

4. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.
5. Color: White.

E. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-10/11.
b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 46-50.
c. Vimasco Corporation; WC-1/WC-5.

2. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Solids Content: 60 percent by volume and 66 percent by weight.
5. Color: White.

2.4 SEALANTS

A. Joint Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Permanently flexible sealant.
3. Service Temperature Range: Minus 100 to plus 200 deg F.
4. Color: White, tan, or gray.
5. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
6. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

B. FSK and Metal Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 95-44.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: Aluminum or gray.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. ASJ Flashing Sealants, Vinyl, PVDC, and PVC Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, provide the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: White.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.5 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.

3. PVDC Jacket for Outdoor Applications: 6-mil- thick, white PVDC biaxially oriented barrier film with a permeance at 0.01 perm when tested according to ASTM E 96/E 96M and with a flame-spread index of 5 and a smoke-developed index of 25 when tested according to ASTM E 84.

a. Products: Subject to compliance with requirements, provide the following:

1) Dow Chemical Company (The); Saran 540 Vapor Retarder Film and Saran 560 Vapor Retarder Film.

4. PVDC-SSL Jacket: PVDC jacket with a self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip.

2.6 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. Metal Jacket:

1. Products: Subject to compliance with requirements, provide one of the following:

a. ITW Insulation Systems; Aluminum and Stainless Steel Jacketing.
b. RPR Products, Inc.; Insul-Mate.

2. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.

a. Sheet and roll stock ready for shop or field sizing.
b. Finish and thickness are indicated in field-applied jacket schedules.

c. Moisture Barrier for Indoor Applications: 3-mil- thick, heat-bonded polyethylene and kraft paper.
d. Moisture Barrier for Outdoor Applications: 3-mil- thick, heat-bonded polyethylene and kraft paper.
e. Factory-Fabricated Fitting Covers:

1) Same material, finish, and thickness as jacket.
2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
3) Tee covers.
4) Flange and union covers.
5) End caps.
6) Beveled collars.
7) Valve covers.
8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

C. Self-Adhesive Outdoor Jacket: 60-mil- thick, laminated vapor barrier and waterproofing membrane for installation over insulation located aboveground outdoors; consisting of a rubberized bituminous resin on a cross laminated polyethylene film covered with white aluminum-foil facing.

1. Products: Subject to compliance with requirements, provide the following:

a. Polyguard Products, Inc.; Alumaguard 60.

2.7 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. Products: Subject to compliance with requirements, provide one of the following:

a. ABI, Ideal Tape Division; 428 AWF ASJ.
b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0836.
c. Compac Corporation; 104 and 105.
d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.

2. Width: 3 inches.
3. Thickness: 11.5 mils.
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

1. Products: Subject to compliance with requirements, provide 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 percent.
6. Tensile Strength: 34 lbf/inch in width.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

1. Verify that systems to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.

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 4 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 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches 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.

3.4 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
4. Seal jacket to wall flashing with flashing sealant.

C. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

D. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.

1. Comply with requirements in Section "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

E. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section "Penetration Firestopping."

3.5 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular

surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.

3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and 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. 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.
7. For services not specified to receive a field-applied jacket except for flexible elastomeric, 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.
8. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

3.6 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe 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.

C. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.7 INSTALLATION OF MINERAL-FIBER INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward-clinched staples at 6 inches 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 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.

C. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.8 FIELD-APPLIED JACKET INSTALLATION

A. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

B. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.9 FINISHES

A. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

3.10 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, two locations of threaded valves, and two locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.11 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Drainage piping located in crawl spaces.
2. Underground piping.
3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.12 INDOOR PIPING INSULATION SCHEDULE

A. Condensate and Equipment Drain Water below 60 Deg F:

1. All Pipe Sizes: Insulation shall be one of the following:
   a. Flexible Elastomeric: 1 inch Insert dimension thick.
   b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

B. Chilled Water and Brine, above 40 Deg F:

1. NPS 12 and Smaller: Insulation shall be one of the following:
   a. Mineral-Fiber, Pipe Insulation Wicking System: 1-1/2 inches thick.

C. Heating-Hot-Water Supply and Return, 200 Deg F and Below:

1. NPS 12 and Smaller: Insulation shall be one of the following:
   a. Mineral-Fiber, Preformed Pipe, Type I: 1 inch thick.

D. Refrigerant Suction and Hot-Gas Flexible Tubing:

1. All Pipe Sizes: Insulation shall be the following:

a. Flexible Elastomeric: 1 inch thick.

3.13 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

A. Chilled Water and Brine:

1. All Pipe Sizes: Insulation shall be one of the following:
a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 3 inches thick.

B. Refrigerant Suction and Hot-Gas Piping:

1. All Pipe Sizes: Insulation shall be the following:

a. Flexible Elastomeric: 2 inches thick.

C. Refrigerant Suction and Hot-Gas Flexible Tubing:

1. All Pipe Sizes: Insulation shall be the following:

a. Flexible Elastomeric: 2 inches thick.

3.14 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Piping, Concealed:

1. None.

B. Piping, Exposed:

1. None.

3.15 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Piping, Concealed:

1. PVC: 30 mils thick.
2. Aluminum, Smooth: 0.020 inch thick.

D. Piping, Exposed:

1. PVC: 30 mils thick.
2. Aluminum, Smooth: 0.024 inch thick.

END OF SECTION

SECTION 23 0800

HVAC COMMISSIONING REQUIREMENTS

PART 1 - GENERAL

1.2 DESCRIPTION

B. The purpose of this section is to specify Division 23 responsibilities in the commissioning process.

C. The systems to be commissioned are listed in Section 019113.

D. Commissioning requires the participation of Division 23 contractors to ensure that all systems are operating in a manner consistent with the Contract Documents. The general commissioning requirements and coordination are detailed in Section 019113. Division 23 contractors shall be familiar with all parts of Section 019113 and the commissioning plan issued by the CA and shall execute all commissioning responsibilities assigned to them in the Contract Documents.

1.3 RESPONSIBILITIES

A. Mechanical, Controls and TAB Contractors. The commissioning responsibilities applicable to each of the mechanical, controls and TAB contractors of Division 23 are as follows (all references apply to commissioned equipment only):

1. Construction and Acceptance Phases
    a. Include and itemize the cost of commissioning in the contract price.
    b. In each purchase order or subcontract written, include requirements for submittal data, commissioning documentation, O&M data and training.
    c. Attend a commissioning scoping meeting and other meetings necessary to facilitate the Cx process.
    d. Contractors shall provide the CA with normal cut sheets and shop drawing submittals of commissioned equipment.
    e. Provide additional requested documentation, prior to normal O&M manual submittals, to the CA for development of start-up and functional testing procedures.
        1) Typically this will include detailed manufacturer installation and start-up, operating, troubleshooting and maintenance procedures, full details of any owner-contracted tests, fan and pump curves, full factory testing reports, if any, and full warranty information, including all responsibilities of the Owner to keep the warranty in force clearly identified. In addition, the installation, start-up and checkout materials that are actually shipped inside the equipment and the actual field checkout sheet forms to be used by the factory or field technicians shall be submitted to the Commissioning Agent.
        2) The Commissioning Agent may request further documentation necessary for the commissioning process.
        3) This data request may be made prior to normal submittals.
    f. Provide a copy of the O&M manuals and submittals of commissioned equipment, through normal channels, to the CA for review and approval.
    g. Contractors shall assist (along with the design engineers) in clarifying the operation and control of commissioned equipment in areas where the specifications, control drawings or equipment documentation is not sufficient for writing detailed testing procedures.
    h. Provide limited assistance to the CA in preparing the specific functional performance test procedures as specified. Subs shall review test procedures to ensure feasibility, safety and equipment protection and provide necessary written alarm limits to be used during the tests.

i. Develop a full start-up and initial checkout plan using manufacturer's start-up procedures and the prefunctional checklists from the CA for all commissioned equipment. Submit to CA for review and approval prior to startup. Refer to Section 01 9113 for further details on start-up plan preparation.
j. During the startup and initial checkout process, execute the mechanical-related portions of the prefunctional checklists for all commissioned equipment.
k. Perform and clearly document all completed startup and system operational checkout procedures, providing a copy to the CA.
l. Address current A/E punch list items before functional testing. Air and water TAB shall be completed with discrepancies and problems remedied before functional testing of the respective air- or water-related systems.
m. Provide skilled technicians to execute starting of equipment and to execute the functional performance tests. Ensure that they are available and present during the agreed upon schedules and for sufficient duration to complete the necessary tests, adjustments and problem-solving.
n. Provide skilled technicians to perform functional performance testing under the direction of the CA for specified equipment in Section 019113. Assist the CA in interpreting the monitoring data, as necessary.
o. Correct deficiencies (differences between specified and observed performance) as interpreted by the CA, PM and A/E and retest the equipment.
p. Prepare O&M manuals according to the Contract Documents, including clarifying and updating the original sequences of operation to as-built conditions.
q. During construction, maintain as-built red-line drawings for all drawings and final CAD as-builts for contractor-generated coordination drawings. Update after completion of commissioning (excluding deferred testing).
r. Provide training of the Owner's operating staff using expert qualified personnel, as specified.
s. Coordinate with equipment manufacturers to determine specific requirements to maintain the validity of the warranty.

2. Warranty Period
   a. Execute seasonal or deferred functional performance testing, witnessed by the CA, according to the specifications.
   b. Correct deficiencies and make necessary adjustments to O&M manuals and as-built drawings for applicable issues identified in any seasonal testing.

B. Mechanical Contractor. The responsibilities of the HVAC mechanical contractor, during construction and acceptance phases in addition to those listed in (A) are:
1. Provide startup for all HVAC equipment, except for the building automation control system.
2. Assist and cooperate with the TAB contractor and CA by:
   a. Putting all HVAC equipment and systems into operation and continuing the operation during each working day of TAB and commissioning, as required.
   b. Including cost of sheaves and belts that may be required by TAB.
   c. Providing test holes in ducts and plenums where directed by TAB to allow air measurements and air balancing. Providing an approved plug.
   d. Providing temperature and pressure taps according to the Construction Documents for TAB and commissioning testing.
3. Install a P/T plug (or well) at each water sensor, as shown in the HVAC Details, that is required for an input point to the control system. Coordinate with CC for sensor size and type.
4. List and clearly identify on the as-built drawings the locations of all air-flow stations.
5. Prepare a preliminary schedule for Division 23 pipe and duct system testing, flushing and cleaning, equipment start-up and TAB start and completion for use by the CA. Update the schedule as appropriate.

6. Notify the PM or CA depending on protocol, when pipe and duct system testing, flushing, cleaning, startup of each piece of equipment and TAB will occur. Be responsible to notify the PM or CA, ahead of time, when commissioning activities not yet performed or not yet scheduled will delay construction. Be proactive in seeing that commissioning processes are executed and that the CA has the scheduling information needed to efficiently execute the commissioning process.

C. Controls Contractor. The commissioning responsibilities of the controls contractor, during construction and acceptance phases in addition to those listed in (A) are:
   1. Sequences of Operation Submittals. The Controls Contractor's submittals of control drawings shall include complete detailed sequences of operation for each piece of equipment. Refer to Section 230593 for Sequences of Operation and Control Submittal details.
   2. Control Drawings Submittal: Refer to Section 230593 for Sequences of Operation and Control Submittal details.
   3. An updated as-built version of the control drawings and sequences of operation shall be included in the final controls O&M manual submittal.
   4. Assist and cooperate with the TAB contractor in the following manner:
      a. Meet with the TAB contractor prior to beginning TAB and review the TAB plan to determine the capabilities of the control system toward completing TAB. Provide the TAB any needed unique instruments for setting terminal unit boxes and instruct TAB in their use (handheld control system interface for use around the building during TAB, etc.).
      b. For a given area, have all required prefunctional checklists, calibrations, startup and selected functional tests of the system completed and approved by the CA prior to TAB.
      c. Provide a qualified technician to operate the controls to assist the TAB contractor in performing TAB, or provide sufficient training for TAB to operate the system without assistance.
   5. Assist and cooperate with the CA in the following manner:
      a. Using a skilled technician who is familiar with this building, execute the functional testing of the controls system as specified for the controls contractor and assist in the functional testing of all equipment specified. Provide two-way radios during the testing.
      b. Execute all control system trend logs as listed below in item number 10 and as directed by the owner and CA.
   6. The controls contractor shall prepare a written plan indicating in a step-by-step manner, the procedures that will be followed to test, checkout and adjust the control system prior to functional performance testing, according to the process in Section 019113. At minimum, the plan shall include for each type of equipment controlled by the automatic controls:
      a. System name.
      b. List of devices.
      c. Step-by-step procedures for testing each controller after installation, including:
         1) Process of verifying proper hardware and wiring installation.
         2) Process of downloading programs to local controllers and verifying that they are addressed correctly.
         3) Process of performing operational checks of each controlled component.
         4) Plan and process for calibrating valve and damper actuators and all sensors.
         5) A description of the expected field adjustments for transmitters, controllers and control actuators should control responses fall outside of expected values.
      d. A copy of the log and field checkout sheets that will document the process. This log must include a place for initial and final read values during calibration of each

point and clearly indicate when a sensor or controller has "passed" and is operating within the contract parameters.

e. A description of the instrumentation required for testing.

f. Indicate what tests on what systems should be completed prior to TAB using the control system for TAB work. Coordinate with the CA and TAB contractor for this determination.

7. Provide a signed and dated certification to the CA and PM upon completion of the checkout of each controlled device, equipment and system prior to functional testing for each piece of equipment or system, that all system programming is complete as to all respects of the Contract Documents, except functional testing requirements.
8. Beyond the control points necessary to execute all documented control sequences, provide monitoring, control and virtual points as specified in Section 230900.
9. List and clearly identify on the as-built duct and piping drawings the locations of all static and differential pressure sensors (air, water and building pressure).
10. Trending. Set up trending for all system inputs, outputs, and controlling virtual points (temperature setpoints, pressure setpoints, etc.). Data shall automatically be periodically downloaded from the controllers to the DDC system server and be stored for at least two years. Charts shall be generated to show proper PID function with proper response times and no hunting or oscillating of controlled equipment. The following table includes some of the primary data points that shall be trended for this project as applicable to the installed equipment. Additional or fewer points may be required based on final project design and sequences. Trend Intervals are based on the Cx period only and are shorter than standard intervals to verify proper PID control. After Cx, intervals will be lengthened to reduce database size.

TREND POINT	**TREND INTERVAL**
AHUs/ERVs/RTUs	
Occupancy Status	Change of State
SF S/S	Change of State
SF Status	Change of State
SF Speed	1 min
SF Power (from VFD)	15 min
RF or EF S/S	Change of State
RF or EF Status	Change of State
RF or EF Speed	1 min
RF or EF Power (from VFD)	15 min
DAT Setpoint	15 min
DAT	1 min
RAT	15 min
MAT Setpoint	15 min
MAT	1 min
EAT	1 min
LWT (Leaving Wheel Temp)	1 min
Heating Enable	Change of State
Cooling Enable	Change of State
HW Valve Position (%)	1 min
CHW Valve Position (%)	1 min
Gas Furnace Firing Rate (%)	1 min
Duct Static Setpoint	15 min
Duct Static Pressure	1 min
Bldg Static Setpoint	1 hour
Bldg Static Pressure	1 min
Heat Wheel S/S	Change of State
Heat Wheel Status	Change of State

TREND POINT	TREND INTERVAL
Heat Wheel Speed	1 min
OA Flow	1 min
Outdoor Air Damper	1 min
Outdoor Air Bypass Damper	1 min
Return Air Damper	1 min
Exhaust Air Damper	1 min
Exhaust Air Bypass Damper	1 min
DX System	
Compressor Stages S/S	Change of State
Compressor Status	Change of State
Condensor Fan S/S	Change of State
Condensor Fan Status	Change of State
Cooling %	1 min
Compressor Current	1 min
Sump Fill/Drain Valves	Change of State
Evap Pump S/S	Change of State
Evap Pump Status	Change of State
Boilers	
Heating System Enable	Change of State
HW Supply Temp Setpoint	5 min
HW Supply Temp (Old Building)	5 min
HW Return Temp (Old Building)	5 min
HW Supply Temp (New Building)	5 min
HW Return Temp (New Building)	5 min
HW Flow	5 min
Boiler 1 Status	Change of State
Boiler 2 Status	Change of State
Boiler 1 Firing Rate	1 min
Boiler 2 Firing Rate	1 min
Boiler 1 Iso Valve	Change of State
Boiler 2 Iso Valve	Change of State
Boiler 1 Circ Pump	Change of State
Boiler 2 Circ Pump	Change of State
All Alarms	Change of State
Pumps	
Pump S/S	Change of State
Pump Status	Change of State
Pump Speed	1 min
Pump Power (from VFD) (Pump Current if no VFD)	15 min
Diff Pressure Setpoint	1 min (demand based reset) 15 min (constant setpoint)
Diff Pressure	1 min
Terminal Units	
Occupancy Status	Change of State
Override	Change of State
Fan S/S (for FPBs and CUHs)	Change of State
Fan Status (for FPBs and CUHs)	Change of State
Space Temp Setpoint	15 min
Space Temp	5 min

TREND POINT	TREND INTERVAL
DAT Setpoint	1 min
DAT	1 min
Reheat Valve Position	1 min
CFM Setpoint	1 min
CFM	1 min
Domestic Hot Water	
DHW Heater Status	Change of State
DHW Heater Firing Rate	5 min
DHW Supply Temp	5 min
DHW Pump S/S	Change of State
DHW Pump Status	Change of State
Exhaust Fans	
EF S/S	Change of State
EF Status	Change of State
Universal Points	
Outdoor Air Temp	15 min
Electric Meter Pulse	Per pulse (or BACnet)
Gas Meter Pulse	Per pulse (or BACnet)
Electric Panel Sub-meters	Per pulse (or BACnet)
DHW Gas Sub-meter	Per pulse (or BACnet)

D. TAB Contractor. The duties of the TAB contractor, in addition to those listed in (A) are:
   1. Six weeks prior to starting TAB, submit to the PM the qualifications of the site technician for the project, including the name of the contractors and facility managers of recent projects the technician on which was lead. The Owner will approve the site technician's qualifications for this project.
   2. Submit the outline of the TAB plan and approach for each system and component to the CA, PM and the controls contractor six weeks prior to starting the TAB. This plan will be developed after the TAB has some familiarity with the control system.
   3. The submitted plan will include:
      a. Certification that the TAB contractor has reviewed the construction documents and the systems with the design engineers and contractors to sufficiently understand the design intent for each system.
      b. An explanation of the intended use of the building control system. The controls contractor will comment on feasibility of the plan.
      c. All field checkout sheets and logs to be used that list each piece of equipment to be tested, adjusted and balanced with the data cells to be gathered for each.
      d. Discussion of what notations and markings will be made on the duct and piping drawings during the process.
      e. Final test report forms to be used.
      f. Detailed step-by-step procedures for TAB work for each system and issue: terminal flow calibration (for each terminal type), diffuser proportioning, branch / submain proportioning, total flow calculations, rechecking, diversity issues, expected problems and solutions, etc. Criteria for using air flow straighteners or relocating flow stations and sensors will be discussed. Provide the analogous explanations for the water side.
      g. List of all air flow, water flow, sound level, system capacity and efficiency measurements to be performed and a description of specific test procedures, parameters, formulas to be used.
      h. Details of how *total* flow will be determined (Air: sum of terminal flows via BAS calibrated readings or via hood readings of all terminals, supply (SA) and return air

(RA) pitot traverse, SA or RA flow stations. Water: pump curves, circuit setter, flow station, ultrasonic, etc.).

i. The identification and types of measurement instruments to be used and their most recent calibration date.
j. Specific procedures that will ensure that both air and water side are operating at the lowest possible pressures and provide methods to verify this.
k. Confirmation that TAB understands the outside air ventilation criteria under all conditions.
l. Details of whether and how minimum outside air cfm will be verified and set, and for what level (total building, zone, etc.).
m. Details of how building static and exhaust fan / relief damper capacity will be checked.
n. Proposed selection points for sound measurements and sound measurement methods.
o. Details of methods for making any specified coil or other system plant capacity measurements.
p. Details of any TAB work to be done in phases (by floor, etc.), or of areas to be built out later.
q. Details regarding specified deferred or seasonal TAB work.
r. Details of any specified false loading of systems to complete TAB work.
s. Details of all exhaust fan balancing and capacity verifications, including any required room pressure differentials.
t. Details of any required interstitial cavity differential pressure measurements and calculations.
u. Plan for hand-written field technician logs of discrepancies, deficient or uncompleted work by others, contract interpretation requests and lists of completed tests (scope and frequency).
v. Plan for formal progress reports (scope and frequency).
w. Plan for formal deficiency reports (scope, frequency and distribution).

4. A running log of events and issues shall be kept by the TAB field technicians. Submit hand-written reports of discrepancies, deficient or uncompleted work by others, contract interpretation requests and lists of completed tests to the CA and PM at least twice a week.
5. Communicate in writing to the controls contractor all setpoint and parameter changes made or problems and discrepancies identified during TAB which affect the control system setup and operation.
6. Provide a draft TAB report within two weeks of completion. A copy will be provided to the CA. The report will contain a full explanation of the methodology, assumptions and the results in a clear format with designations of all uncommon abbreviations and column headings. The report should follow the latest and most rigorous reporting recommendations by AABC, NEBB or ASHRAE Standard 111.
7. Provide the CA with any requested data, gathered, but not shown on the draft reports.
8. Provide a final TAB report for the CA with details, as in the draft.
9. Conduct functional performance tests and checks on the original TAB as specified by the CA.

E. Mechanical Designer. Refer to Section 019113 for the responsibilities of the mechanical designer.

1.4 RELATED WORK

A. Refer to Section 01 9113 for a listing of all sections where commissioning requirements are found.

B. Refer to Section 01 9113 for systems to be commissioned and for functional testing requirements.

PART 2 - PRODUCTS

2.2 TEST EQUIPMENT

A. Division 23 contractors shall provide all test equipment necessary to fulfill the testing requirements of this Division.

B. Refer to Section 01 9113 Part 2.1 for additional Division 23 testing requirements.

PART 3 - EXECUTION

3.2 SUBMITTALS

A. Division 23 contractors shall provide submittal documentation relative to commissioning as required in this Section, Section 01 1001, and Section 01 9113.

3.3 STARTUP

A. The HVAC mechanical and controls contractors shall follow the start-up and initial checkout procedures listed in the Responsibilities list in this section and in 019113. Division 23 has start-up responsibility and is required to complete systems and sub-systems so they are fully functional, meeting the design objectives of the Contract Documents. The commissioning procedures and functional testing do not relieve or lessen this responsibility or shift that responsibility partially to the commissioning agent or Owner.

B. Functional testing is intended to begin upon completion of a system. Functional testing may proceed prior to the completion of systems or sub-systems at the discretion of the CA and PM. Beginning system testing before full completion does not relieve the Contractor from fully completing the system, including all prefunctional checklists as soon as possible.

3.4 TAB

A. Refer to the TAB responsibilities in Part 1.2 above.

3.5 FUNCTIONAL PERFORMANCE TESTS

A. Refer to Section 01 9113 for a list of systems to be commissioned and to Part 3.6 for a description of the process.

3.6 TESTING DOCUMENTATION, NON-CONFORMANCE AND APPROVALS

A. Refer to Section 01 9113 Part 3.4 for specific details on non-conformance issues relating to prefunctional checklists and tests.

B. Refer to Section 01 9113 Part 3.7 for issues relating to functional performance tests.

3.7 OPERATION AND MAINTENANCE (O&M) MANUALS

A. The following O&M manual requirements do not replace O&M manual documentation requirements elsewhere in these specifications.

B. The CA shall receive a copy of the O&M manuals for review.

C. Special Control System O&M Manual Requirements. In addition to documentation that may be specified elsewhere, the controls contractor shall compile and organize at minimum the following data on the control system in labeled 3-ring binders with indexed tabs.
   1. Three copies of the controls training manuals in a separate manual from the O&M manuals.
   2. Operation and Maintenance Manuals containing:
      a. Specific instructions on how to perform and apply all functions, features, modes, etc. mentioned in the controls training sections of this specification and other

features of this system. These instructions shall be step-by-step. Indexes and clear tables of contents shall be included. The detailed technical manual for programming and customizing control loops and algorithms shall be included.

b. Full as-built set of control drawings (refer to Submittal section above for details).
c. Full as-built sequence of operations for each piece of equipment.
d. Full points list. In addition to the updated points list required in the original submittals (Part 1 of this section), a listing of all rooms shall be provided with the following information for each room:
    1) Floor
    2) Room number
    3) Room name
    4) Air handler unit ID
    5) Reference drawing number
    6) Air terminal unit tag ID
    7) Heating and/or cooling valve tag ID
    8) Minimum cfm
    9) Maximum cfm
e. Full print out of all schedules and set points after testing and acceptance of the system.
f. Full as-built print out of software program.
g. Electronic copy on disk of the entire program for this facility.
h. Marking of all system sensors and thermostats on the as-built floor plan and mechanical drawings with their control system designations.
i. Maintenance instructions, including sensor calibration requirements and methods by sensor type, etc.
j. Control equipment component submittals, parts lists, etc.
k. Warranty requirements.
l. Copies of all checkout tests and calibrations performed by the Contractor (not commissioning tests).

3. The manual shall be organized and subdivided with permanently labeled tabs for each of the following data in the given order:
    a. Sequences of operation
    b. Control drawings
    c. Points lists
    d. Controller / module data
    e. Thermostats and timers
    f. Sensors and DP switches
    g. Valves and valve actuators
    h. Dampers and damper actuators
    i. Program setups (software program printouts)
4. Field checkout sheets and trend logs should be provided to the CA for inclusion in the Commissioning Report and Facilities Manual.

D. Review and Approvals. Review of the commissioning related sections of the O&M manuals shall be made by the A/E and by the CA. Refer to Section 019113, Part 3.8 for details.

3.8 TRAINING OF OWNER PERSONNEL

A. The GC shall be responsible for training coordination and scheduling and ultimately to ensure that training is completed. Refer to Section 019113 for additional details.

B. The CA shall be responsible for overseeing and approving the content and adequacy of the training of Owner personnel for commissioned equipment. Refer to Section 019113 for additional details.

C. Mechanical Contractor. The mechanical contractor shall have the following training responsibilities:
   1. Provide the CA with a training plan two weeks before the planned training according to the outline described in Section 019113, Part 3.9.
   2. Provide designated Owner personnel with comprehensive orientation and training in the understanding of the systems and the operation and maintenance of each piece of HVAC equipment including, but not limited to, pumps, boilers, furnaces, chillers, heat rejection equipment, air conditioning units, air handling units, fans, terminal units, controls and water treatment systems, etc.
   3. Training shall normally start with classroom sessions followed by hands-on training on each piece of equipment, which shall illustrate the various modes of operation, including startup, shutdown, fire/smoke alarm, power failure, etc.
   4. During any demonstration, should the system fail to perform in accordance with the requirements of the O&M manual or sequence of operations, the system will be repaired or adjusted as necessary and the demonstration repeated.
   5. The appropriate trade or manufacturer's representative shall provide the instructions on each major piece of equipment. This person may be the start-up technician for the piece of equipment, the installing contractor or manufacturer's representative. Practical building operating expertise as well as in-depth knowledge of all modes of operation of the specific piece of equipment is required. More than one party may be required to execute the training.
   6. The controls contractor shall attend sessions other than the controls training, as requested, to discuss the interaction of the controls system as it relates to the equipment being discussed.
   7. The training sessions shall follow the outline in the Table of Contents of the operation and maintenance manual and illustrate whenever possible the use of the O&M manuals for reference.
   8. Training shall include:
      a. Use of the printed installation, operation and maintenance instruction material included in the O&M manuals.
      b. A review of the written O&M instructions emphasizing safe and proper operating requirements, preventative maintenance, special tools needed and spare parts inventory suggestions. The training shall include start-up, operation in all modes possible, shut-down, seasonal changeover and any emergency procedures.
      c. Discussion of relevant health and safety issues and concerns.
      d. Discussion of warranties and guarantees.
      e. Common troubleshooting problems and solutions.
      f. Explanatory information included in the O&M manuals and the location of all plans and manuals in the facility.
      g. Discussion of any peculiarities of equipment installation or operation.
      h. The format and training agenda in ASHRAE's *Guidelines for Commissioning HVAC Systems* is recommended.
      i. Classroom sessions shall include the use of overhead projections, slides, video/audio-taped material as might be appropriate.
   9. Hands-on training shall include start-up, operation in all modes possible, including manual, shut-down and any emergency procedures and preventative maintenance for all pieces of equipment.
   10. The mechanical contractor shall fully explain and demonstrate the operation, function and overrides of any local packaged controls, not *controlled* by the central control system.
   11. Training shall occur after functional testing is complete, unless approved otherwise by the Project Manager.

D. Controls Contractor. The controls contractor shall have the following training responsibilities:
   1. Provide the CA with a training plan two weeks before the planned training according to the outline described in Section 019113, Part 3.9.

2. The controls contractor shall provide designated Owner personnel training on the control system in this facility. The intent is to clearly and completely instruct the Owner on all the capabilities of the control system.
3. Training manuals. The standard operating manual for the system and any special training manuals will be provided for each trainee, with two extra copies left for the O&M manuals. In addition, copies of the system technical manual will be demonstrated during training and three copies submitted with the O&M manuals. Manuals shall include detailed description of the subject matter for each session. The manuals will cover all control sequences and have a definitions section that fully describes all relevant words used in the manuals *and* in all software displays. Manuals will be approved by the CA. Copies of audiovisuals shall be delivered to the Owner.
4. The trainings will be tailored to the needs and skill-level of the trainees.
5. The trainers will be knowledgeable on the system and its use in buildings. For the on-site sessions, the most qualified trainer(s) will be used. The Owner shall approve the instructor prior to scheduling the training.
6. During any demonstration, should the system fail to perform in accordance with the requirements of the O&M manual or sequence of operations, the system will be repaired or adjusted as necessary and the demonstration repeated.
7. The controls contractor shall attend sessions other than the controls training, as requested, to discuss the interaction of the controls system as it relates to the equipment being discussed.

3.9 DEFERRED TESTING

A. Refer to Section 019113, Part 3.10 for requirements of deferred testing.

3.10 WRITTEN WORK PRODUCTS

A. Written work products of Contractors will consist of the start-up and initial checkout plan described in Section 01 9113 and the filled-out start-up, initial checkout and prefunctional checklists.

END OF SECTION

SECTION 23 0900

INSTRUMENTATION AND CONTROL FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes control equipment for HVAC systems and components, including control components for terminal heating and cooling units not supplied with factory-wired controls.

B. Related Sections include the following:

1. Section "Meters and Gages for HVAC Piping" for measuring equipment that relates to this Section.

1.3 DEFINITIONS

A. BMS: Building Management System.

B. BACnet: Data communication protocol for Building Management and Control networks.

C. DDC: Direct digital control.

D. I/O: Input/output.

E. BACnet: the ASHRAE building automation and central networking protocol standard 135. The BACnet protocol communicates via Ethernet, MS/TP, BACnet IP and PTP.

F. BTL: BACnet Testing Laboratory. An international consortium that tests and certifies the compliance of BACnet devices for interoperability.

G. LonWorks: A control network technology platform for designing and implementing interoperable control devices and networks.

H. Modbus: Data communication protocol and control network technology platform for implementing interoperable control devices and networks.

I. Ethernet: Computer networking technology for local area networks following the standard IEEE 802.3.

J. TCP/IP: Transmission control protocol and internet protocol.

K. UDP/IP: User datagram protocol and internet protocol.

L. MS/TP: Master slave/token passing.

M. OWS: Operator Workstation.

N. PC: Personal computer.

O. PID: Proportional plus integral plus derivative.

P. RTD: Resistance temperature detector.

Q. WES: Web enabled server. A server that performs data collection and user interface functions by serving up graphics and control dialogs in web-page format.

1.4 SYSTEM PERFORMANCE

A. Comply with the following performance requirements:

1. Graphic Display: Display graphic with minimum 20 dynamic points with current data within 10 seconds.
2. Graphic Refresh: Update graphic with minimum 20 dynamic points with current data within 8 seconds.
3. Object Command: Reaction time of less than two seconds between operator command of a binary object and device reaction.
4. Object Scan: Transmit change of state and change of analog values to control units or workstation within six seconds.
5. Alarm Response Time: Annunciate alarm at workstation within 45 seconds. Multiple workstations must receive alarms within five seconds of each other.
6. Program Execution Frequency: Run capability of applications as often as five seconds, but selected consistent with mechanical process under control.
7. Performance: Programmable controllers shall execute DDC PID control loops, and scan and update process values and outputs at least once per second.
8. Reporting Accuracy and Stability of Control: Report values and maintain measured variables within tolerances as follows:

    a. Water Temperature: Plus or minus 1 deg F.
    b. Water Flow: Plus or minus 5 percent of full scale.
    c. Water Pressure: Plus or minus 2 percent of full scale.
    d. Space Temperature: Plus or minus 1 deg F.
    e. Ducted Air Temperature: Plus or minus 1 deg F.
    f. Outside Air Temperature: Plus or minus 2 deg F.
    g. Dew Point Temperature: Plus or minus 3 deg F.
    h. Temperature Differential: Plus or minus 0.25 deg F.
    i. Relative Humidity: Plus or minus 5 percent.
    j. Airflow (Pressurized Spaces): Plus or minus 3 percent of full scale.
    k. Airflow (Measuring Stations): Plus or minus 5 percent of full scale.
    l. Airflow (Terminal): Plus or minus 10 percent of full scale.
    m. Air Pressure (Space): Plus or minus 0.01-inch wg.
    n. Air Pressure (Ducts): Plus or minus 0.1-inch wg.
    o. Carbon Dioxide: Plus or minus 50 ppm.
    p. Electrical: Plus or minus 5 percent of reading.
    q. Wet Bulb Temperature: Plus or minus 1 deg F.

1.5 ACTION SUBMITTALS

A. Product Data: Include manufacturer's technical literature for each control device. Indicate dimensions, capacities, performance characteristics, electrical characteristics, finishes for materials, and installation and startup instructions for each type of product indicated.

1. DDC System Hardware: Product data sheets or marked catalog pages including part number, photo, and description for products including BMS database server, operator workstation equipment, control units, transducers/transmitters, sensors, actuators, valves, dampers, relays/switches, control panels, and operator interface equipment.
2. Control System Software: Include technical data for operating system software, operator interface, color graphics, and other third-party applications.
3. Controlled Systems: Instrumentation list with element name, type of device, manufacturer, model number, and product data. Include written description of sequence of operation including schematic diagram.

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. Bill of materials of equipment indicating quantity, manufacturer, and model number.
2. Schematic flow diagrams showing fans, pumps, coils, dampers, valves, and control devices.
3. Wiring Diagrams: Power, signal, and control wiring.
4. Details of control panel faces, including controls, instruments, and labeling.
5. Written description of sequence of operation.
6. Schedule of dampers including size, leakage, and flow characteristics.
7. Schedule of valves including flow characteristics.
8. DDC System Hardware:

    a. Wiring diagrams for control units with termination numbers.
    b. Schematic diagrams and floor plans for field sensors and control hardware.
    c. Schematic diagrams for control, communication, and power wiring, showing trunk data conductors and wiring between operator workstation and control unit locations.

9. Control System Software: List of color graphics indicating monitored systems, data (connected and calculated) point addresses, output schedule, and operator notations.
10. Controlled Systems:

    a. Schematic diagrams of each controlled system with control points labeled and control elements graphically shown, with wiring.
    b. Scaled drawings showing mounting, routing, and wiring of elements including bases and special construction.
    c. Written description of sequence of operation including schematic diagram.
    d. Points list.

1.6 INFORMATIONAL SUBMITTALS

A. Data Communications Protocol Certificates: Certify that each proposed DDC system component complies with ASHRAE 135.

B. BACnet PICS: BACnet Protocol Implementation Conformance Statement (PICS) for each controller or device (master or slave) that communicates on BACnet MS/TP bus.

C. Qualification Data: For Installer and manufacturer.

D. Software Upgrade Kit: For Owner to use in modifying software to suit future systems revisions or monitoring and control revisions.

E. Field quality-control test reports.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For HVAC instrumentation and control system to include in emergency, operation, and maintenance manuals. The Operation and Maintenance Manual shall be furnished on Compact Disc media. In addition to items specified in Section "Operation and Maintenance Data," include the following:

1. Table of Contents.
2. As-Built Record Drawings. Record Drawings shall represent the as-built conditions of the BMS and incorporate information supplied with approved submittals.
3. Manufacturer's product data sheets or catalog pages for BMS products, including software.
4. System Operator's Manual.
5. Archive copy on Compact Disk (or equivalent media) of site-specific databases and sequences of operation.
6. BMS network diagrams.
7. Interfaces to third-party products and work by other trades.
8. Maintenance Instructions and lists of spare parts for each type of control device or BMS component.
9. Maintenance instructions and lists of spare parts for each type of control device.
10. Inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances.
11. Calibration records and list of set points.

B. Software and Firmware Operational Documentation: Include the following:

1. Software operating and upgrade manuals.
2. Program Software Backup: On a magnetic media or compact disc, complete with data files.
3. Device address list.
4. Printout of software application and graphic screens.
5. Software license required by and installed for DDC workstations and control systems.

1.8 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Replacement Materials: One replacement kit or relay mechanism for each unique damper motor, valve motor, controller, sensor, and thermostat.
2. Maintenance Materials: Three thermostat adjusting keys.

1.9 QUALITY ASSURANCE

A. Installer Qualifications: Automatic control system manufacturer's authorized representative who is trained and approved for installation of system components required for this Project.

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 ASHRAE BACnet Standard 135-2008 for DDC system components.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Factory-Mounted Components: Where control devices specified in this Section are indicated to be factory mounted on equipment, arrange for shipping of control devices to equipment manufacturer.

B. System Software: Update to latest version of software at Project completion.

1.11 COORDINATION

A. Coordinate location of thermostats, humidistats, and other exposed control sensors with plans and room details before installation.

B. Coordinate equipment with Section "Addressable-Fixture Lighting Controls" and Section "Relay-Based Lighting Controls" to achieve compatibility with equipment that interfaces with that system.

C. Coordinate equipment with Section "Digital, Addressable Fire-Alarm System" to achieve compatibility with equipment that interfaces with that system.

D. Coordinate supply of conditioned electrical branch circuits for control units and operator workstation.

E. Coordinate equipment with Section "Electrical Power Monitoring and Control" to achieve compatibility of communication interfaces.

F. Coordinate equipment with Section "Panelboards" to achieve compatibility with starter coils and annunciation devices.

G. Coordinate equipment with Section "Motor-Control Centers" to achieve compatibility with motor starters and annunciation devices.

1.12 WARRANTY

A. Provide manufacturer’s standard material and labor warranty in compliance with Division 23 Section “Basic Mechanical Requirements,” and as follows:

1. One year labor and material warranty on BMS.
2. Warranty period: from date of substantial completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 CONTROL SYSTEM

A. Manufacturers:

1. Andover Controls, Inc.
2. Automated Logic Corporation.
3. Delta Controls.
4. Johnson Controls, Inc. – Metasys® Systems
5. Trane Company.
6. Reliable Controls by Pritchett Controls, Inc.

B. The BMS shall use open architecture and support a multi-vendor environment. To accomplish this effectively, the BMS shall support open communications protocol standards (BACnet, LonWorks, and Modbus) and integrate third-party devices and applications. The system shall be designed for use on the Internet (or intranets) using industry standard technology compatible with other Owner-provided networks.

C. The BMS shall consist of sensors, indicators, actuators, control elements, interface equipment, apparatus, accessories, and software connected to distributed controllers operating in a multiuser, multitasking environment on BACnet Ethernet or BACnet MS/TP token-passing network and programmed to control the equipment indicated. An OWS permits interface with the network via dynamic color graphics with each connected system or piece of equipment, building floor plan, or control device depicted by point-and-click graphics.

D. The BMS shall be modular in nature and shall permit expansion through the addition of sensors, actuators, controllers, operator devices, and software modules while re-using existing BMS equipment.

E. BMS architecture shall eliminate dependence on any single device for alarm reporting or control execution. Failure of any single component or network connection shall not interrupt the execution of control strategies at other system devices. The BMS shall maintain settings and overrides through a system reboot.

F. Control system shall include the following:

1. Building lighting control system specified in Section "Addressable-Fixture Lighting Controls" and Section "Relay-Based Lighting Controls."
2. Fire alarm system specified in Section "Digital, Addressable Fire-Alarm System."

2.3 BMS ARCHITECTURE

A. Building Level (Level 1) Network:

1. The Level 1 network shall be based on PC industry standard Ethernet TCP/IP or UDP connectivity.
2. The BMS shall network multiple user interface clients, automation controllers, system controllers, and application specific/unitary controllers. Provide application and data servers as required for system operations.
3. Level 1 network shall operate at minimum communication speed of 100 Mbps with full peer-to-peer network communications.
4. The Level 1 network shall be compatible with other enterprise-wide networks. If indicated, the BMS Level 1 network shall be connected to the Owner's enterprise network and share resources with it using industry standard networking devices and practices.

B. Application Level (Level 2) Network:

1. The Level 2 network shall be based on one of the following industry standard building automation protocols: BACnet Ethernet, BACnet IP, BACnet MS/TP or BACnet ARCnet.
2. The Level 2 network shall run at a minimum communication speed of 100 Mbps for IEEE 802.3 (Ethernet) networks and 76.8 kbps for RS/EIA-485 networks.
3. The Level 2 network shall be peer-to-peer and any disruption of another controller on this network, or the Building Controller connecting it to the Level 1 network shall not affect the normal operation of any other controller on the network.

C. Integration:

1. Direct Protocol (Integrator Panel): The BMS shall include appropriate hardware and software to allow bi-directional data communication between the BMS and third-party manufacturer's control panels or equipment. The BMS shall receive from, react to, and transmit information to multiple building systems, including (but not limited to) chillers, boilers, variable frequency drives, power monitoring systems, and packaged equipment.

    a. All data required by the application shall be mapped into the BMS database and shall be transparent to the operator.
    b. Point inputs and outputs from the third-party controllers shall have real-time interoperability with BMS software features, such as: control software, energy management, alarm management, trend analysis, totalization routines, and custom programming.

2. BACnet Protocol Integration:

    a. Neutral protocol used between systems shall be BACnet over Ethernet; comply with ASHRAE Standard 135-2008, or LonWorks, or Modbus.
    b. Provide PICS for system devices.
    c. Provide ability to command, share point object data, change of state data, and schedule between BMS and other systems.

D. BMS Network Security:

1. All controls software, web appliances, and user interfaces shall be configured to remove default usernames and passwords or blank usernames and passwords. Project or customer specific usernames and passwords shall be set before servers, software, or web appliances are connected to the network.
2. The controls system shall reside on a private class IP network and only be accessible through the private network or a Virtual Private Network (VPN) connection.
3. For all systems connected to the internet, the controls system shall have an integral firewall. By default all ports on the firewall in the range 0xBAC0 through 0xBACF shall be blocked.

4. Verify all unused ports are disabled on any switches within the end-user space.
5. The BMS network shall be physically separated from the Enterprise IT network unless project requirements dictate otherwise. The following security shall be employed as a minimum:

    a. A separate BMS network shall be provided which has a single point of connection to the Enterprise IT network: Webserver will use separate network interface card (NIC) for BMS and internet. For the firewall between webserver and internet, utilize SSL connections and force passwords of at least eight characters.
    b. There shall be no network infrastructure shared between the BMS network and the Enterprise IT network (no shared switches, etc.)
    c. The single point of connection shall be protected by a firewall (provided by the controls vendor). The only device on the BMS network that shall be allowed to communicate through the firewall is the BMS webserver.

6. As an alternative, and only upon specific needs of the client/end user, the BMS network can run through the Enterprise network if it is using a VLAN for connecting disparate disjoint BMS networks. Regardless, a single point of connection between the “logical” BMS network and the Enterprise or Internet network shall exist as above. Coordinate with client IT staff and submit a network plan as part of the controls submittal to be reviewed and commented on by the client/end-user.

2.4 DDC EQUIPMENT

A. Server: The primary control, graphical user interface and information gathering and storage for the DDC system shall be server based in the form of a Web Server (WES). The server shall permit connection by simultaneous users either from the OWS or other enterprise network PC-based computers or portable devices using only industry standard web browsers. The server minimum configuration is as follows:

1. Motherboard: With at least 3 integrated USB 3.0 ports, 2 integrated Intel Pro 10/100/1000 (Ethernet) interface cards (NIC), bios, and hardware monitoring.
2. Processor: Intel 4th generation i7 Quad-core or better.
3. Radom-Access memory (RAM): 8 GB or better.
4. Graphics: Video adapter, minimum 1600 x 1200 pixels, 256 MB video memory, with HDMI out.
5. Monitor: 21 inches, LCD color.
6. Keyboard: 104-key US English QWERTY in standard shape.
7. Hard-Disk drive: 500 GB minimum with RAID 5 array.
8. Optical drive: CD/DVD-ROM Read/Write drive 48x24x48.
9. Uninterruptible power supply: 2kVA.
10. Operating System:

    a. Small to medium systems of 2,500 points or less: Microsoft Windows 7 Professional or Windows 8.1 may be acceptable;
    b. Large systems of greater than 2,500 points anticipated at full build-out: Microsoft Server 2003 or 2008 R2 with ten (10) simultaneous user licenses (CALs).

11. Application Software:

    a. Shall be BACnet/ASHRAE 135 compliant for B-AWS: Server shall use ASHRAE 135 protocol and communicate using IEEE 802.3 (Ethernet) datalink/physical layer protocol. The Server communication stack shall be BTL listed as a BACnet Advanced Operator Workstation (B-AWS).

b. System security for each operator via software password and access levels.
c. Automatic system diagnostics; monitor system and report failures.
d. Database save and restore.
e. Internet Information Services (IIS) web support.
f. Support for Microsoft Internet Explorer, Google Chrome and Firefox web browsers, at a minimum.
g. Alarm processing, messages, and reactions, including email reporting actions.
h. Trend logs retrievable in spreadsheets and database programs.
i. Trend Archiving: Store all critical point trends in an archive file for up to one year.
j. BACnet Event processing.
k. BACnet object and property status and control.
l. Data collection, reports, and logs. Include standard reports for the following:

1) Current values of all objects
2) Current alarm summary
3) Disabled objects
4) Audit and operator logs
5) Energy consumption and comparison reports

m. Custom report development
n. Utility and weather reports
o. Server application editors for controllers and schedules
p. Maintenance management

12. Custom Application Software:

a. English language oriented
b. Full-screen character editor/programming environment
c. Allow development of independently executing program modules with debugging/simulation capability
d. Support conditional statements
e. Support floating-point arithmetic with mathematic functions
f. Contains predefined time variables

B. Operator Workstation: One PC-based microcomputers to be used as Operator Workstations (OWS) with minimum configuration as follows:

1. Motherboard: With 3 integrated USB 2.0 ports, integrated Intel Pro 10/100/1000 (Ethernet), integrated audio, bios, and hardware monitoring.
2. Processor: Intel Pentium i7 or equivalent.
3. Random-Access Memory: 6 GB.
4. Graphics: Video adapter, minimum 1600 x 1200 pixels, 512-MB video memory, with HDMI.
5. Monitor: 21 inches, LCD color.
6. Keyboard: QWERTY, 105 keys in standard shape.
7. Hard-Disk Drive: 500 GB.
8. CD/DVD-ROM Read/Write Drive: 48x24x48.
9. Mouse: Three button, optical.
10. Uninterruptible Power Supply: Sized by the manufacturer to provide minimum 30 minutes uninterrupted operation of the Operator Workstation.
11. Operating System: Microsoft Windows

a. ASHRAE 135 Compliance: All operational functions of the control system GUI shall be performed via the web browser on the OWS through the web server. If the OWS is to be used as an engineering station with software from the control system manufacturer loaded onto it, then the software shall comply with ASHRAE 135 for

the BACnet Advanced Operator Workstation device profile (B-AWS). See "Application Software" specification below for this case.

12. Application Software:

    a. I/O capability from operator workstation.
    b. System security for each operator via software password and access levels.
    c. Automatic system diagnostics; monitor system and report failures.
    d. Database creation and support.
    e. Automatic and manual database save and restore.
    f. Dynamic color graphic displays with up to 10 screen displays at once.
    g. Custom graphics generation and graphics library of HVAC equipment and symbols.
    h. Alarm processing, messages, and reactions.
    i. Trend logs retrievable in spreadsheets and database programs.
    j. Alarm and event processing.
    k. Object and property status and control.
    l. Automatic restart of field equipment on restoration of power.
    m. Data collection, reports, and logs. Include standard reports for the following:

        1) Current values of all objects.
        2) Current alarm summary.
        3) Disabled objects.
        4) Alarm lockout objects.
        5) Logs.

    n. Custom report development.
    o. Utility and weather reports.
    p. Workstation application editors for controllers and schedules.
    q. Maintenance management.

13. Custom Application Software:

    a. English language oriented.
    b. Full-screen character editor/programming environment.
    c. Allow development of independently executing program modules with debugging/simulation capability.
    d. Support conditional statements.
    e. Support floating-point arithmetic with mathematic functions.
    f. Contains predefined time variables.

C. Diagnostic Terminal Unit: Portable notebook-style, PC-based microcomputer terminal capable of accessing system data by connecting to system network with minimum configuration as follows:

1. System: With 3 integrated USB 2.0 port, integrated Intel Pro 10/100 (Ethernet), integrated audio, bios, and hardware monitoring.
2. Processor: Intel Pentium i5 or equivalent.
3. Random-Access Memory: 4 MB.
4. Graphics: Video adapter, minimum 1024 x 768 pixels, 64-MB video memory.
5. Monitor: 15 inches, LCD color.
6. Keyboard: QWERTY 105 keys in standard shape.
7. Hard-Disk Drive: 200 GB.
8. CD-ROM Read/Write Drive: 48x24x48.
9. Pointing Device: Touch pad or other internal device.

D. Level 1 Network Controllers: Modular, comprising processor board with programmable, nonvolatile, random-access memory; local operator access and display panel; integral interface equipment; and backup power source.

1. Level 1 Network Controllers shall provide supervisory control over the BMS control network and shall support the following:

    a. BACnet Ethernet or IP Protocol – ASHRAE SSPC-135, Annex J.
    b. LonWorks enabled devices using Free Topology Transceiver (FFT-10a).
    c. Modbus Communications Protocol.

2. Level 1 Network Controllers shall meet all requirements of the BACnet Building Controller (B-BC) application Device Profile and shall be BTL listed for the B-BC device profile.
3. Level 1 Network Controllers shall be capable of supporting at least one BACnet MS/TP subnet consisting of Level 2 Controllers.
4. Provide PICS for each device that communicates on either the Level 1 or Level 2 network.
5. Units monitor or control each I/O point; process information; execute commands from other control units, devices, and operator stations; and download from or upload to operator workstation or diagnostic terminal unit.
6. Stand-alone mode control functions operate regardless of network status. Functions include the following:

    a. Global communications.
    b. Discrete/digital, analog, and pulse I/O.
    c. Monitoring, controlling, or addressing data points.
    d. Software applications, scheduling, and alarm processing.
    e. Testing and developing control algorithms without disrupting field hardware and controlled environment.

7. Standard Application Programs:

    a. Electric Control Programs: Demand limiting, duty cycling, automatic time scheduling, start/stop time optimization, night setback/setup, on-off control with differential sequencing, staggered start, anti-short cycling, PID control, DDC with fine tuning, and trend logging.
    b. HVAC Control Programs: Optimal run time, supply-air reset, and enthalpy switchover.
    c. Chiller Control Programs: Control function of condenser-water reset, chilled-water reset, and equipment sequencing.
    d. Programming Application Features: Include trend point; alarm processing and messaging; weekly, monthly, and annual scheduling; energy calculations; run-time totalization; and security access.
    e. Remote communications.
    f. Maintenance management.
    g. Units of Measure: Inch-pound and SI (metric).

8. Local operator interface provides for download from or upload to operator workstation or diagnostic terminal unit.
9. ASHRAE 135 Compliance: Control units shall use ASHRAE 135 protocol and communicate using ISO 8802-3 (Ethernet) datalink/physical layer protocol at the required application level and shall be BTL listed.
10. LonWorks/Modbus Compliance: Control units shall use LonTalk protocol and communicate using EIA/CEA 709.1 datalink/physical layer protocol, or equivalent Modbus protocol.

E. Level 2 Network Controllers – Advanced Application Controllers: Modular, comprising processor board with electronically programmable, nonvolatile, read-only memory; or a backup power source.

1. Advanced Application Level controllers shall provide stand-alone custom programmable controls operations for applications requiring 16 total I/O points or less. Controllers shall support at a minimum:

    a. BACnet MS/TP Protocol at 76.8 kbps
    b. LonWorks enabled devices using Free Topology Transceiver (FFT-10a).
    c. Modbus RTU Communications Protocol.

2. The Advanced Application Controller at a minimum shall be BTL listed at the BACnet Advanced Application Controller (B-AAC) device profile.
3. Units monitor or control each I/O point, process information, and download from or upload to operator workstation or diagnostic terminal unit.
4. Stand-alone mode control functions operate regardless of network status. Functions include the following:

    a. Global communications.
    b. Discrete/digital, analog, and pulse I/O.
    c. Monitoring, controlling, or addressing data points.

5. Local operator interface provides for download from or upload to operator workstation or diagnostic terminal unit.
6. ASHRAE 135 Compliance: Control units shall use ASHRAE 135 protocol and communicate using ISO 8802-3 (Ethernet) datalink/physical layer protocol at the required application level and shall be BTL listed.
7. LonWorks/Modbus Compliance: Control units shall use LonTalk protocol and communicate using EIA/CEA 709.1 datalink/physical layer protocol, or equivalent Modbus protocol.

F. Level 2 Network Controllers – Application Specific Controllers: Modular, comprising processor board with electronically programmable, nonvolatile, read-only memory; or a backup power source.

1. Application Specific level controllers shall provide stand-alone configurable controls solutions for small packaged or other equipment not requiring custom sequences and limited pre-configured I/O capabilities. Controllers shall support at a minimum:

    a. BACnet MS/TP Protocol at 76.8 kbps
    b. LonWorks enabled devices using Free Topology Transceiver (FFT-10a).
    c. Modbus RTU Communications Protocol.

2. The Application Specific Controller at a minimum shall be BTL listed at the BACnet Advanced Application Controller (B-ASC) device profile.
3. Units monitor or control each I/O point, process information, and download from or upload to operator workstation or diagnostic terminal unit.
4. Stand-alone mode control functions operate regardless of network status. Functions include the following:

    a. Global communications.
    b. Discrete/digital, analog, and pulse I/O.
    c. Monitoring, controlling, or addressing data points.

5. Local operator interface provides for download from or upload to operator workstation or diagnostic terminal unit.
6. ASHRAE 135 Compliance: Control units shall use ASHRAE 135 protocol and communicate using ISO 8802-3 (Ethernet) datalink/physical layer protocol at the required application level and shall be BTL listed.
7. LonWorks/Modbus Compliance: Control units shall use LonTalk protocol and communicate using EIA/CEA 709.1 datalink/physical layer protocol, or equivalent Modbus protocol.

G. I/O Interface: Hardwired inputs and outputs may tie into system through controllers. Protect points so that shorting will cause no damage to controllers.

1. Binary Inputs: Allow monitoring of on-off signals without external power.
2. Pulse Accumulation Inputs: Accept up to 10 pulses per second.
3. Analog Inputs: Allow monitoring of low-voltage (0- to 10-V dc), current (4 to 20 mA), or resistance signals.
4. Binary Outputs: Provide on-off or pulsed low-voltage signal, selectable for normally open or normally closed operation with three-position (on-off-auto) override switches and status lights.
5. Analog Outputs: Provide modulating signal, either low voltage (0- to 10-V dc) or current (4 to 20 mA) with status lights, two-position (auto-manual) switch, and manually adjustable potentiometer.
6. Tri-State Outputs: Provide two coordinated binary outputs for control of three-point, floating-type electronic actuators.
7. Universal I/Os: Provide software selectable binary or analog outputs.

H. Power Supplies: Transformers with Class 2 current-limiting type or overcurrent protection; limit connected loads to 80 percent of rated capacity. Supply separate DC power supplies for half-wave and full-wave applications. DC power supply shall match output current and voltage requirements with the following:

1. Output ripple of 5.0 mV maximum peak to peak.
2. Combined 1 percent line and load regulation with 100-mic.sec. response time for 50 percent load changes.
3. Built-in overvoltage and overcurrent protection and be able to withstand 150 percent overload for at least 3 seconds without failure.

I. Power Line Filtering: Internal or external transient voltage and surge suppression for workstations or controllers with the following:

1. Minimum dielectric strength of 1000 V.
2. Maximum response time of 10 nanoseconds.
3. Minimum transverse-mode noise attenuation of 65 dB.
4. Minimum common-mode noise attenuation of 150 dB at 40 to 100 Hz.

2.5 ELECTRONIC SENSORS

A. Description: Vibration and corrosion resistant; for wall, immersion, or duct mounting as required.

B. Thermistor Temperature Sensors and Transmitters:

1. Manufacturers:

a. Building Automation Products, Inc. (BAPI)
b. Ebtron, Inc.
c. Johnson Controls, Inc.
d. MAMAC Systems, Inc.
e. RDF Corporation.

2. Accuracy: Plus or minus 0.5 deg F at calibration point.
3. Wire: Twisted, shielded-pair cable.
4. Insertion Elements in Ducts: Single point, 18 inches long; use where not affected by temperature stratification or where ducts are smaller than 9 sq. ft.
5. Averaging Elements in Ducts: 72 inches long, flexible; use where prone to temperature stratification or where ducts are larger than 10 sq. ft.
6. Insertion Elements for Liquids: Brass or stainless-steel socket with minimum insertion length of 2-1/2 inches.
7. Room Sensor Cover Construction: Manufacturer's standard locking covers.

a. Set-Point Adjustment: Exposed.
b. Set-Point Indication: Concealed.
c. Temperature Display: Exposed.
d. Color: Selected by Architect from manufacturer’s standard selections.
e. Orientation: Vertical.

8. Outside-Air Sensors: Watertight inlet fitting, shielded from direct sunlight.
9. Room Security Sensors: Stainless-steel cover plate with insulated back and security screws.

C. RTDs and Transmitters:

1. Manufacturers:

a. Building Automation Products, Inc. (BAPI)
b. BEC Controls Corporation.
c. Johnson Controls, Inc.
d. MAMAC Systems, Inc.
e. RDF Corporation.

2. Accuracy: Plus or minus 0.2 percent at calibration point.
3. Wire: Twisted, shielded-pair cable.
4. Insertion Elements in Ducts: Single point, 18 inches long; use where not affected by temperature stratification or where ducts are smaller than 9 sq. ft.
5. Averaging Elements in Ducts: 48 inches long, rigid; use where prone to temperature stratification or where ducts are larger than 9 sq. ft.; length as required.
6. Insertion Elements for Liquids: Brass socket with minimum insertion length of 2-1/2 inches.
7. Room Sensor Cover Construction: Manufacturer's standard locking covers.

a. Set-Point Adjustment: Exposed.
b. Set-Point Indication: Concealed.
c. Temperature Display: Exposed.
d. Color: Selected by Architect from manufacturer’s standard selections.
e. Orientation: Vertical.

8. Outside-Air Sensors: Watertight inlet fitting, shielded from direct sunlight.
9. Room Security Sensors: Stainless-steel cover plate with insulated back and security screws.

10. Thermo Wells:

    a. When required, provide thermo wells and sensors supplied as a complete assembly including wellhead and conduit fitting.
    b. Pressure test and construct thermo wells in accordance with hydronic or fluid system working pressure.
    c. Mount thermo wells in threadolet or saddle, NPS 1/2, to provide access to the sensor.
    d. Construct thermo wells of brass or stainless steel.

D. Humidity Sensors: Bulk polymer sensor element.

1. Manufacturers:

    a. Building Automation Products, Inc. (BAPI)
    b. BEC Controls Corporation.
    c. Johnson Controls, Inc.
    d. MAMAC Systems, Inc.
    e. Vaisala.

2. Accuracy: 2 percent full range with linear output.
3. Room Sensor Range: 20 to 80 percent relative humidity.
4. Room Sensor Cover Construction: Manufacturer's standard locking covers.

    a. Set-Point Adjustment: Concealed.
    b. Set-Point Indication: Concealed.
    c. Color: Selected by Architect from manufacturer’s standard selections.
    d. Orientation: Vertical.

5. Duct Sensor: 20 to 80 percent relative humidity range with element guard and mounting plate.
6. Outside-Air Sensor: 20 to 80 percent relative humidity range with mounting enclosure, suitable for operation at outdoor temperatures of 32 to 120 deg F.
7. Duct and Sensors: With element guard and mounting plate, range of 0 to 100 percent relative humidity.

E. Pressure Transmitters/Transducers:

1. Manufacturers:

    a. BEC Controls Corporation.
    b. Johnson Controls, Inc.
    c. MAMAC Systems, Inc.
    d. Setra.
    e. Vaisala.

2. Static-Pressure Transmitter: Non-directional sensor with suitable range for expected input, and temperature compensated.

    a. Accuracy: 1 percent of full scale with repeatability of 0.5 percent.
    b. Output: 4 to 20 mA.
    c. Building Static-Pressure Range: 0- to 0.25-inch wg.
    d. Duct Static-Pressure Range: 0- to 5-inch wg.

3. Water Pressure Transducers: Stainless-steel diaphragm construction, suitable for service; minimum 150-psig operating pressure; linear output 4 to 20 mA.
4. Water Differential-Pressure Transducers: Stainless-steel diaphragm construction, suitable for service; minimum 150-psig operating pressure and tested to 300-psig; linear output 4 to 20 mA.
5. Differential-Pressure Switch (Air or Water): Snap acting, with pilot-duty rating and with suitable scale range and differential.
6. Pressure Transmitters: Direct acting for gas or liquid service; range suitable for system; linear output 4 to 20 mA.

F. Room Sensor Cover Construction: Manufacturer's standard locking covers.

1. Set-Point Adjustment: Concealed.
2. Set-Point Indication: Concealed.
3. Color: Selected by Architect from manufacturer’s standard selections.
4. Orientation: Vertical.

G. Room sensor accessories include the following:

1. Insulating Bases: For sensors located on exterior walls.
2. Guards: [**Locking; heavy-duty, transparent plastic; mounted on separate base**] [**Metal wire, tamperproof**] [**Locking, solid metal, ventilated**].
3. Adjusting Key: As required for calibration and cover screws.

2.6 STATUS SENSORS

A. Status Inputs for Fans: Differential-pressure switch with pilot-duty rating and with adjustable range of 0- to 5-inch wg.

B. Status Inputs for Pumps: Differential-pressure switch with pilot-duty rating and with adjustable pressure-differential range of 8 to 60 psig, piped across pump.

C. Status Inputs for Electric Motors: Comply with ISA 50.00.01, current-sensing fixed- or split-core transformers with self-powered transmitter, adjustable and suitable for 175 percent of rated motor current.

D. Voltage Transmitter (100- to 600-V ac): Comply with ISA 50.00.01, single-loop, self-powered transmitter, adjustable, with suitable range and 1 percent full-scale accuracy.

E. Power Monitor: 3-phase type with disconnect/shorting switch assembly, listed voltage and current transformers, with pulse kilowatt hour output and 4- to 20-mA kW output, with maximum 2 percent error at 1.0 power factor and 2.5 percent error at 0.5 power factor.

F. Current Switches: Self-powered, solid-state with adjustable trip current, selected to match current and system output requirements.

G. Electronic Valve/Damper Position Indicator: Visual scale indicating percent of travel and 2- to 10-V dc, feedback signal.

H. Water-Flow Switches: Bellows-actuated mercury or snap-acting type with pilot-duty rating, stainless-steel or bronze paddle, with appropriate range and differential adjustment, in NEMA 250, Type 1 enclosure.

1. Manufacturers:

a. BEC Controls Corporation.
b. I.T.M. Instruments Inc.
c. Johnson Controls, Inc.

2.7 GAS DETECTION EQUIPMENT

A. Manufacturers:

1. Building Automation Products, Inc. (BAPI)
2. Ebtron, Inc.
3. Greystone Energy Systems Inc.
4. INTEC Controls, Inc.
5. Johnson Controls, Inc.
6. Mine Safety Apparatus (MSA)
7. QEL/Quatrosense Environmental Limited.
8. Sensidyne, Inc.
9. Vaisala.

B. Carbon Monoxide Detectors: Single or multichannel, dual-level detectors using solid-state plug-in sensors with a 3-year minimum life; suitable over a temperature range of 32 to 104 deg F; with 2 factory-calibrated alarm levels at 50 and 100 ppm.

C. Carbon Dioxide Sensor and Transmitter: Single detectors using solid-state infrared sensors; suitable over a temperature range of 23 to 130 deg F and calibrated for 0 to 2 percent, with continuous or averaged reading, 4- to 20-mA output;, for wall mounting.

D. Oxygen Sensor and Transmitter: Single detectors using solid-state zircon cell sensing; suitable over a temperature range of minus 32 to plus 1100 deg F and calibrated for 0 to 5 percent, with continuous or averaged reading, 4- to 20-mA output; for wall mounting.

E. Occupancy Sensor: Passive infrared, with time delay, daylight sensor lockout, sensitivity control, and 180-degree field of view with vertical sensing adjustment; for flush mounting.

2.8 FLOW MEASURING STATIONS

A. Duct Airflow Station: Combination of air straightener and multiport, self-averaging pitot tube station.

1. Manufacturers:

a. Air Monitor Corporation.
b. Ebtron, Inc.
c. Johnson Controls, Inc.
d. Wetmaster Co., Ltd.

2. Casing: Galvanized-steel frame.
3. Flow Straightener: Aluminum honeycomb, 3/4-inch parallel cell, 3 inches deep.
4. Sensing Manifold: Copper manifold with bullet-nosed static pressure sensors positioned on equal area basis; or equivalent vortex shedding or hot wire technology – manufacturer’s standard.

2.9 THERMOSTATS

A. Manufacturers:

1. Erie Controls.
2. Danfoss Inc.; Air-Conditioning and Refrigeration Div.
3. Heat-Timer Corporation.
4. Johnson Controls, Inc.
5. Sauter Controls Corporation.

B. Electric, solid-state, microcomputer-based room thermostat with remote sensor.

1. Automatic switching from heating to cooling.
2. Preferential rate control to minimize overshoot and deviation from set point.
3. Set up for four separate temperatures per day.
4. Instant override of set point for continuous or timed period from 1 hour to 31 days.
5. Short-cycle protection.
6. Programming based on weekday, Saturday, and Sunday.
7. Selection features include degree F or degree C display, 12- or 24-hour clock, keyboard disable, remote sensor, and fan on-auto.
8. Battery replacement without program loss.
9. Thermostat display features include the following:

    a. Time of day.
    b. Actual room temperature.
    c. Programmed temperature.
    d. Programmed time.
    e. Duration of timed override.
    f. Day of week.
    g. System mode indications include "heating," "off," "fan auto," and "fan on."

C. Low-Voltage, On-Off Thermostats: NEMA DC 3, 24-V, bimetal-operated, mercury-switch type, with adjustable or fixed anticipation heater, concealed set-point adjustment, 55 to 85 deg F set-point range, and 2 deg F maximum differential.

D. Line-Voltage, On-Off Thermostats: Bimetal-actuated, open contact or bellows-actuated, enclosed, snap-switch or equivalent solid-state type, with heat anticipator; listed for electrical rating; with concealed set-point adjustment, 55 to 85 deg F set-point range, and 2 deg F maximum differential.

1. Electric Heating Thermostats: Equip with off position on dial wired to break ungrounded conductors.
2. Selector Switch: Integral, manual on-off-auto.

E. Fire-Protection Thermostats: Listed and labeled by an NRTL acceptable to authorities having jurisdiction; with fixed or adjustable settings to operate at not less than 75 deg F above normal maximum operating temperature, and the following:

1. Reset: Manual.
2. Reset: Automatic, with control circuit arranged to require manual reset at central control panel; with pilot light and reset switch on panel labeled to indicate operation.

F. Electric, Low-Limit Duct Thermostat: Snap-acting, single-pole, single-throw, manual-reset switch that trips if temperature sensed across any 12 inches of bulb length is equal to or below set point.

1. Bulb Length: Minimum 20 feet.
2. Quantity: One thermostat for every 20 sq. ft. of coil surface.

2.10 HUMIDISTATS

A. Manufacturers:

1. MAMAC Systems, Inc.
2. ROTRONIC Instrument Corp.
3. Schneider Electric.

B. Duct-Mounting Humidistats: Electric insertion, 2-position type with adjustable, 2 percent throttling range, 20 to 80 percent operating range, and single- or double-pole contacts.

2.11 ACTUATORS

A. Electric Motors: Size to operate with sufficient reserve power to provide smooth modulating action or two-position action.

1. Comply with requirements in Section "Common Motor Requirements for HVAC Equipment."
2. Permanent Split-Capacitor or Shaded-Pole Type: Gear trains completely oil immersed and sealed. Equip spring-return motors with integral spiral-spring mechanism in housings designed for easy removal for service or adjustment of limit switches, auxiliary switches, or feedback potentiometer.
3. Nonspring-Return Motors for Valves Larger Than NPS 2-1/2: Size for running torque of 150 in. x lbf and breakaway torque of 300 in. x lbf.
4. Spring-Return Motors for Valves Larger Than NPS 2-1/2: Size for running and breakaway torque of 150 in. x lbf.
5. Nonspring-Return Motors for Dampers Larger Than 25 Sq. Ft.: Size for running torque of 150 in. x lbf and breakaway torque of 300 in. x lbf.
6. Spring-Return Motors for Dampers Larger Than 25 Sq. Ft.: Size for running and breakaway torque of 150 in. x lbf.
7. Provide each motor actuator with end switches to indicate travel limits for both open and closed positions of the actuator.

B. Electronic Actuators: Direct-coupled type designed for minimum 60,000 full-stroke cycles at rated torque.

1. Manufacturers:

   a. Belimo Aircontrols (USA), Inc.
   b. Johnson Controls, Inc.

2. Valves: Size for torque required for valve close off at maximum pump differential pressure.
3. Dampers: Size for running torque calculated as follows:

   a. Parallel-Blade Damper with Edge Seals: 7 inch-lb/sq. ft. of damper.
   b. Opposed-Blade Damper with Edge Seals: 5 inch-lb/sq. ft. of damper.
   c. Parallel-Blade Damper without Edge Seals: 4 inch-lb/sq. ft. of damper.
   d. Opposed-Blade Damper without Edge Seals: 3 inch-lb/sq. ft. of damper.

e. Dampers with 2- to 3-Inch wg of Pressure Drop or Face Velocities of 1000 to 2500 fpm: Increase running torque by 1.5.
f. Dampers with 3- to 4-Inch wg of Pressure Drop or Face Velocities of 2500 to 3000 fpm: Increase running torque by 2.0.

4. Coupling: V-bolt and V-shaped, toothed cradle.
5. Overload Protection: Electronic overload or digital rotation-sensing circuitry.
6. Fail-Safe Operation: Mechanical, spring-return mechanism. Provide external, manual gear release on nonspring-return actuators.
7. Power Requirements (Two-Position Spring Return): 24 or 120-V ac.
8. Power Requirements (Modulating): Maximum 10 VA at 24-V ac or 8 W at 24-V dc.
9. Proportional Signal: 2- to 10-V dc or 4 to 20 mA, and 2- to 10-V dc position feedback signal.
10. Temperature Rating: Minus 22 to plus 122 deg F.
11. Temperature Rating (Smoke Dampers): Minus 22 to plus 250 deg F.
12. Run Time: 30 seconds.
13. Provide each actuator with end switches to indicate travel limits for both open and closed positions of the actuator.

2.12 CONTROL VALVES

A. Manufacturers:

1. Belimo.
2. Bray International.
3. Erie Controls.
4. Johnson Controls, Inc.
5. Parker Hannifin Corporation; Skinner Valve Division.

B. Control Valves: Factory fabricated, of type, body material, and pressure class based on maximum pressure and temperature rating of piping system, unless otherwise indicated.

C. Hydronic system control valves shall have the following characteristics:

1. NPS 2 and Smaller:

a. Class 125 bronze body, bronze trim, rising stem, renewable composition disc, and screwed ends with backseating capacity repackable under pressure.
b. Class 125 bronze body, stainless-steel trim, characterized ball valves, and screwed ends.

2. NPS 2-1/2 and Larger:

a. Class 125 iron body, bronze trim, rising stem, plug-type disc, flanged ends, and renewable seat and disc.
b. Class 125 iron body, stainless-steel trim, disk-characterized ball valves, and flanged ends.
c. Class 125 iron body, stainless-steel trim, v-notch style characterized ball valves, and flanged ends.

3. Internal Construction for globe valves: Replaceable plugs and stainless-steel or brass seats.

a. Single-Seated Valves: Cage trim provides seating and guiding surfaces for plug on top and bottom.
b. Double-Seated Valves: Balanced plug; cage trim provides seating and guiding surfaces for plugs on top and bottom.

4. Sizing: 5-psig maximum pressure drop at design flow rate or the following:

a. Two Position: Line size.
b. Two-Way Modulating: Either the value specified above or twice the load pressure drop, whichever is more.
c. Three-Way Modulating: Twice the load pressure drop, but not more than value specified above.

5. Flow Characteristics: Two-way valves shall have equal percentage characteristics; three-way valves shall have linear characteristics.
6. Close-Off (Differential) Pressure Rating: Combination of actuator and trim shall provide minimum close-off pressure rating of 150 percent of total system (pump) head for two-way valves and 100 percent of pressure differential across valve or 100 percent of total system (pump) head for three-way valves.

D. Butterfly Valves: 200-psig, 150-psig maximum pressure differential, ASTM A 126 cast-iron or ASTM A 536 ductile-iron body and bonnet, extended neck, stainless-steel stem, field-replaceable EPDM or Buna N sleeve and stem seals.

1. Body Style: Wafer, Lug, or Grooved.
2. Disc Type: Nickel-plated ductile iron or Aluminum bronze.
3. Sizing: 1-psig maximum pressure drop at design flow rate.

E. Terminal Unit Control Valves: Bronze body, bronze trim, two or three ports as indicated, replaceable plugs and seats if globe style, characterized disk if CCV style, and union and threaded ends.

1. Rating: Class 125 for service at 125 psig and 250 deg F operating conditions.
2. Sizing: 5-psig maximum pressure drop at design flow rate, to close against pump shutoff head.
3. Flow Characteristics: Two-way valves shall have equal percentage characteristics; three-way valves shall have linear characteristics.

F. Actuators: Comply with paragraph for Electric Motor actuators or Electronic Actuators unless indicated otherwise.

2.13 PRESSURE INDEPENDENT CONTROL VALVES (PICV)

A. Manufacturers:

1. Belimo.
2. Bray International.
3. Flow Control, Inc.
4. Griswold.
5. Flow Con International.
6. Johnson Controls, Inc.

B. Control Valves: Factory fabricated, of type, body material, and pressure class based on maximum pressure and temperature rating of piping system, unless otherwise indicated.

C. Hydronic system control valves shall have the following characteristics:

1. NPS 2 and Smaller: Class 125 brass or bronze body, brass, bronze, or stainless-steel trim, renewable flow control cartridge, and solder or screwed ends with backseating capacity repackable under pressure.
2. NPS 2-1/2 and Larger: Class 125 iron body, brass, bronze, or stainless-steel trim, renewable flow control cartridge, flanged ends, and renewable seat or disc.
3. Internal Construction: Replaceable flow control elements, components, and seats.
4. Sizing: Provide flow control of the specified flow or indicated flow rate at plus –or-minus 5% over a differential pressure range of 5-psig to 55-psig.

    a. Two-Way Modulating: Line size unless indicated otherwise smaller size is indicated by manufacturer's published literature or written instructions.
    b. Three-Way Modulating: Line size unless indicated otherwise smaller size is indicated by manufacturer's published literature or written instructions.

5. Close-Off (Differential) Pressure Rating: Combination of actuator and trim shall provide minimum close-off pressure rating of 150 percent of total system (pump) head for two-way valves and 100 percent of pressure differential across valve or 100 percent of total system (pump) head for three-way valves.

D. Terminal Unit Control Valves: Brass or bronze body, brass, bronze, or stainless-steel trim, two or three ports as indicated, replaceable cartridges and seats or disks, and union with solder or threaded ends.

1. Rating: Class 125 for service at 125 psig and 250 deg F operating conditions.
2. Sizing: Provide flow control of the specified flow or indicated flow rate at plus –or-minus 5% over a differential pressure range of 5-psig to 55-psig.

E. Actuators: Comply with paragraph for Electric Motor actuators or Electronic Actuators unless indicated otherwise.

2.14 DAMPERS

A. Manufacturers:

1. Air Balance Inc.
2. Johnson Controls, Inc.
3. Ruskin.
4. Vent Products Company, Inc.

B. Dampers: AMCA-rated, parallel or opposed-blade design; 0.108-inch- minimum thick, galvanized-steel or 0.125-inch- minimum thick, extruded-aluminum frames with holes for duct mounting; damper blades shall not be less than 0.064-inch- thick galvanized steel with maximum blade width of 8 inches and length of 48 inches.

1. Secure blades to 1/2-inch- diameter, zinc-plated axles using zinc-plated hardware, with oil-impregnated sintered bronze blade bearings, blade-linkage hardware of zinc-plated steel and brass, ends sealed against spring-stainless-steel blade bearings, and thrust bearings at each end of every blade.
2. Operating Temperature Range: From minus 40 to plus 200 deg F.
3. Edge Seals, Standard Pressure Applications: Closed-cell neoprene.
4. Edge Seals, Low-Leakage Applications: Use inflatable blade edging or replaceable rubber blade seals and spring-loaded stainless-steel side seals, leakage class 1: rated for

leakage at less than 10 cfm per sq. ft. of damper area, at differential pressure of 4-inch wg when damper is held by torque of 50 in. x lbf; when tested according to AMCA publication 500D.

C. Actuators: Comply with paragraph for Electric Motor actuators or Electronic Actuators unless indicated otherwise.

2.15 CONTROL CABLE

A. Electronic and fiber-optic cables for control wiring are specified in Section "Communications Horizontal Cabling."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that conditioned power supply is available to control units and operator workstation.

3.2 INSTALLATION

A. Install software in control units and operator workstation**[s]**. Implement all features of programs to specified requirements and as appropriate to sequence of operation.

B. Connect and configure equipment and software to achieve sequence of operation specified.

C. Verify location of thermostats, humidistats, and other exposed control sensors with Drawings and room details before installation. Install devices 48 inches above the floor.

1. Install averaging elements in ducts and plenums in crossing or zigzag pattern.

D. Install guards on thermostats in the following locations:

1. Entrances.
2. Public areas.

E. Install automatic dampers according to Section "Air Duct Accessories."

F. Install damper motors on outside of duct in warm areas, not in locations exposed to outdoor temperatures.

G. Install labels and nameplates to identify control components according to Section "Identification for HVAC Piping and Equipment."

H. Install hydronic instrument wells, valves, and other accessories according to Section “Hydronic Piping Specialties."

I. Install duct volume-control dampers according to Section "Metal Ducts" and Section "Nonmetal Ducts."

3.3 VALVE APPLICATIONS

A. Two-way modulating control: Use globe valves or characterized flow ball valves for NPS 2 and Smaller. Use globe valves or v-notch characterized ball valves for sizes Larger than NPS 2. Provide equal percentage flow characteristics.

B. Three-way modulating control: Use globe valves or characterized ball valves for all sizes. Provide linear flow characteristics.

C. Two-way two-position control: Use globe valves, butterfly valves, or ball valves for NPS 2 and Smaller. Use globe valves or butterfly valves for sizes Larger than NPS 2. Provide line size valves for two-position applications.

D. Pressure Independent Control Valves (PICV): Use where indicated; provide valve line size unless indicated otherwise, or in accordance with manufacturer’s published data that meets flow and maximum pressure drop requirements specified.

3.4 ELECTRICAL WIRING AND CONNECTION INSTALLATION

A. Install raceways, boxes, and cabinets according to Section "Raceways and Boxes for Electrical Systems."

B. Install building wire and cable according to Section "Low-Voltage Electrical Power Conductors and Cables."

C. Install signal and communication cable according to Section "Communications Horizontal Cabling."

1. Conceal cable, except in mechanical rooms and areas where other conduit and piping are exposed.
2. Install exposed cable in raceway.
3. Install concealed cable in raceway.
4. Bundle and harness multi-conductor instrument cable in place of single cables where several cables follow a common path.
5. Fasten flexible conductors, bridging cabinets and doors, along hinge side; protect against abrasion. Tie and support conductors.
6. Number-code or color-code conductors for future identification and service of control system, except local individual room control cables.
7. Install wire and cable with sufficient slack and flexible connections to allow for vibration of piping and equipment.

D. Connect manual-reset limit controls independent of manual-control switch positions. Automatic duct heater resets may be connected in interlock circuit of power controllers.

E. Connect hand-off-auto selector switches to override automatic interlock controls when switch is in hand position.

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.

B. DDC Loop Tuning:

1. For each DDC loop or algorithm in the system, field tune and calibrate the loop for the specific, applied field conditions.
2. Tune each loop for stable operation and for fast and appropriate recovery from deviations from setpoint; provide graphic output printouts upon request from Owner or Architect/Engineer for each loop.
3. Provide necessary system software features, timers, and lockouts (manufacturer's choice of methodology) to prevent controller windup when applying PI or PID algorithms to control loops. If the system demonstrates symptoms of controller windup, take necessary steps to correct the problem for each algorithm in the system.

C. 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 unit operation. Remove and replace malfunctioning units and retest.
2. Test and adjust controls and safeties.
3. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
4. Test calibration of electronic controllers by disconnecting input sensors and stimulating operation with compatible signal generator.
5. Test each point through its full operating range to verify that safety and operating control set points are as required.
6. Test each control loop to verify stable mode of operation and compliance with sequence of operation. Adjust PID actions.
7. Test each system for compliance with sequence of operation.
8. Test software and hardware interlocks.

D. DDC Verification:

1. Verify that instruments are installed before calibration, testing, and loop or leak checks.
2. Check instruments for proper location and accessibility.
3. Check instrument installation for direction of flow, elevation, orientation, insertion depth, and other applicable considerations.
4. Check instrument tubing for proper fittings, slope, material, and support.
5. Check installation of air supply for each instrument.
6. Check flow instruments. Inspect tag number and line and bore size, and verify that inlet side is identified and that meters are installed correctly.
7. Check pressure instruments, piping slope, installation of valve manifold, and self-contained pressure regulators.
8. Check temperature instruments and material and length of sensing elements.
9. Check control valves. Verify that they are in correct direction.
10. Check air-operated dampers. Verify that pressure gages are provided and that proper blade alignment, either parallel or opposed, has been provided.
11. Check DDC system as follows:

    a. Verify that DDC controller power supply is from emergency power supply, if applicable.
    b. Verify that wires at control panels are tagged with their service designation and approved tagging system.
    c. Verify that spare I/O capacity has been provided.
    d. Verify that DDC controllers are protected from power supply surges.

E. Replace damaged or malfunctioning controls and equipment and repeat testing procedures.

3.6 ADJUSTING

A. Calibrating and Adjusting:

1. Calibrate instruments.
2. Make three-point calibration test for both linearity and accuracy for each analog instrument.
3. Calibrate equipment and procedures using manufacturer's written recommendations and instruction manuals. Use test equipment with accuracy at least double that of instrument being calibrated.
4. Control System Inputs and Outputs:

    a. Check analog inputs at 0, 50, and 100 percent of span.
    b. Check analog outputs using milliampere meter at 0, 50, and 100 percent output.
    c. Check digital inputs using jumper wire.
    d. Check digital outputs using ohmmeter to test for contact making or breaking.
    e. Check resistance temperature inputs at 0, 50, and 100 percent of span using a precision-resistant source.

5. Flow:

    a. Set differential pressure flow transmitters for 0 and 100 percent values with 3-point calibration accomplished at 50, 90, and 100 percent of span.
    b. Manually operate flow switches to verify that they make or break contact.

6. Pressure:

    a. Calibrate pressure transmitters at 0, 50, and 100 percent of span.
    b. Calibrate pressure switches to make or break contacts, with adjustable differential set at minimum.

7. Temperature:

    a. Calibrate resistance temperature transmitters at 0, 50, and 100 percent of span using a precision-resistance source.
    b. Calibrate temperature switches to make or break contacts.

8. Stroke and adjust control valves and dampers without positioners, following the manufacturer's recommended procedure, so that valve or damper is 100 percent open and closed.
9. Stroke and adjust control valves and dampers with positioners, following manufacturer's recommended procedure, so that valve and damper is 0, 50, and 100 percent closed.
10. Provide diagnostic and test instruments for calibration and adjustment of system.
11. Provide written description of procedures and equipment for calibrating each type of instrument. Submit procedures review and approval before initiating startup procedures.

B. Adjust initial temperature and humidity set points.

C. 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 three visits to Project during other than normal occupancy hours for this purpose.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain HVAC instrumentation and controls. Refer to Section "Demonstration and Training."

END OF SECTION

SECTION 23 1123

FACILITY NATURAL-GAS PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Pipes, tubes, and fittings.
2. Piping specialties.
3. Piping and tubing joining materials.
4. Valves.
5. Pressure regulators.
6. Service meters.
7. Concrete bases.

1.3 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

1.4 PERFORMANCE REQUIREMENTS

A. Minimum Operating-Pressure Ratings:

1. Piping and Valves: 100 psig minimum unless otherwise indicated.

B. Natural-Gas System Pressure within Buildings: More than 0.5 psig but not more than 2 psig.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of the following:

1. Piping specialties.
2. Valves. Include pressure rating, capacity, settings, and electrical connection data of selected models.

B. Shop Drawings: For facility natural-gas piping layout. Include plans, piping layout and elevations, sections, and details for fabrication of pipe anchors, hangers, supports for multiple pipes, alignment guides, expansion joints and loops, and attachments of the same to building structure. Detail location of anchors, alignment guides, and expansion joints and loops.

1. Shop Drawing Scale: 1/4 inch per foot.
2. Detail mounting, supports, and valve arrangements for service meter assembly and pressure regulator assembly.

1.6 INFORMATIONAL SUBMITTALS

A. Site Survey: Plans, drawn to scale, on which natural-gas piping is shown and coordinated with other services and utilities.

B. Qualification Data: For qualified professional engineer.

C. Welding certificates.

D. Field quality-control reports.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For motorized gas valves, pressure regulators, and service meters to include in emergency, operation, and maintenance manuals.

1.8 QUALITY ASSURANCE

A. Steel Support Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Handling Flammable Liquids: Remove and dispose of liquids from existing natural-gas piping according to requirements of authorities having jurisdiction.

B. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

C. Store and handle pipes and tubes having factory-applied protective coatings to avoid damaging coating, and protect from direct sunlight.

1.10 PROJECT CONDITIONS

A. Perform site survey, research public utility records, and verify existing utility locations. Contact utility-locating service for area where Project is located.

B. Interruption of Existing Natural-Gas Service: Do not interrupt natural-gas service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide purging and startup of natural-gas supply according to requirements indicated:

1. Notify Architect/Owner no fewer than seven days in advance of proposed interruption of natural-gas service.
2. Do not proceed with interruption of natural-gas service without Architect's/Owner's written permission.

PART 2 - PRODUCTS

2.1 PIPES, TUBES, AND FITTINGS

A. Steel Pipe: ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.

1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
2. Wrought-Steel Welding Fittings: ASTM A 234/A 234M for butt welding and socket welding.
3. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.

4. Mechanical Couplings:

a. Buna-nitrile seals.
b. Stainless-steel bolts, washers, and nuts.
c. Coupling shall be capable of joining PE pipe to PE pipe, steel pipe to PE pipe, or steel pipe to steel pipe.
d. Steel body couplings installed underground on plastic pipe shall be factory equipped with anode.

B. Drawn-Temper Copper Tube: Comply with ASTM B 88, Type L.

1. Copper Fittings: ASME B16.22, wrought copper, and streamlined pattern.
2. Bronze Flanges and Flanged Fittings: ASME B16.24, Class 150.

a. Gasket Material: ASME B16.20, metallic, flat, asbestos free, aluminum o-rings, and spiral-wound metal gaskets.
b. Bolts and Nuts: ASME B18.2.1, carbon steel or stainless steel.

3. Protective Coating for Underground Tubing: Factory-applied, extruded PE a minimum of 0.022 inch thick.

C. Annealed-Temper Copper Tube: Comply with ASTM B 88, Type L.

1. Copper Fittings: ASME B16.22, wrought copper, and streamlined pattern.
2. Flare Fittings: Comply with ASME B16.26 and SAE J513.

a. Copper fittings with long nuts.
b. Metal-to-metal compression seal without gasket.
c. Dryseal threads complying with ASME B1.20.3.

3. Protective Coating for Underground Tubing: Factory-applied, extruded PE a minimum of 0.022 inch thick.

2.2 PIPING SPECIALTIES

A. Appliance Flexible Connectors:

1. Indoor, Fixed-Appliance Flexible Connectors: Comply with ANSI Z21.24.
2. Indoor, Movable-Appliance Flexible Connectors: Comply with ANSI Z21.69.
3. Outdoor, Appliance Flexible Connectors: Comply with ANSI Z21.75.
4. Corrugated stainless-steel tubing with polymer coating.
5. Operating-Pressure Rating: 0.5 psig.
6. End Fittings: Zinc-coated steel.
7. Threaded Ends: Comply with ASME B1.20.1.
8. Maximum Length: 72 inches

B. Weatherproof Vent Cap: Cast- or malleable-iron increaser fitting with corrosion-resistant wire screen, with free area at least equal to cross-sectional area of connecting pipe and threaded-end connection.

2.3 JOINING MATERIALS

A. Joint Compound and Tape: Suitable for natural gas.

B. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

C. Brazing Filler Metals: Alloy with melting point greater than 1000 deg F complying with AWS A5.8/A5.8M. Brazing alloys containing more than 0.05 percent phosphorus are prohibited.

2.4 MANUAL GAS SHUTOFF VALVES

A. See "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles for where each valve type is applied in various services.

B. General Requirements for Metallic Valves, NPS 2 and Smaller: Comply with ASME B16.33.

1. CWP Rating: 125 psig.
2. Threaded Ends: Comply with ASME B1.20.1.
3. Dryseal Threads on Flare Ends: Comply with ASME B1.20.3.
4. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
5. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction for valves 1 inch and smaller.
6. Service Mark: Valves 1-1/4 inches to NPS 2 shall have initials "WOG" permanently marked on valve body.

C. General Requirements for Metallic Valves, NPS 2-1/2 and Larger: Comply with ASME B16.38.

1. CWP Rating: 125 psig.
2. Flanged Ends: Comply with ASME B16.5 for steel flanges.
3. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
4. Service Mark: Initials "WOG" shall be permanently marked on valve body.

D. One-Piece, Bronze Ball Valve with Bronze Trim: MSS SP-110.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. BrassCraft Manufacturing Company; a Masco company.
    b. Conbraco Industries, Inc.; Apollo Div.
    c. McDonald, A. Y. Mfg. Co.
    d. Perfection Corporation; a subsidiary of American Meter Company.

2. Body: Bronze, complying with ASTM B 584.
3. Ball: Chrome-plated brass.
4. Stem: Bronze; blowout proof.
5. Seats: Reinforced TFE; blowout proof.
6. Packing: Separate packnut with adjustable-stem packing threaded ends.
7. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
8. CWP Rating: 600 psig.
9. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

E. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim: MSS SP-110.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. BrassCraft Manufacturing Company; a Masco company.
    b. Conbraco Industries, Inc.; Apollo Div.
    c. McDonald, A. Y. Mfg. Co.
    d. Perfection Corporation; a subsidiary of American Meter Company.

2. Body: Bronze, complying with ASTM B 584.
3. Ball: Chrome-plated bronze.
4. Stem: Bronze; blowout proof.
5. Seats: Reinforced TFE; blowout proof.
6. Packing: Threaded-body packnut design with adjustable-stem packing.
7. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
8. CWP Rating: 600 psig.
9. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

F. Bronze Plug Valves: MSS SP-78.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Lee Brass Company.
    b. McDonald, A. Y. Mfg. Co.

2. Body: Bronze, complying with ASTM B 584.
3. Plug: Bronze.
4. Ends: Threaded, socket, or flanged as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
5. Operator: Square head or lug type with tamperproof feature where indicated.
6. Pressure Class: 125 psig.
7. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
8. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for natural-gas piping system to verify actual locations of piping connections before equipment installation.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Close equipment shutoff valves before turning off natural gas to premises or piping section.

B. Inspect natural-gas piping according to NFPA 54 and the International Fuel Gas Code to determine that natural-gas utilization devices are turned off in piping section affected.

C. Comply with NFPA 54 and the International Fuel Gas Code requirements for prevention of accidental ignition.

3.3 INDOOR PIPING INSTALLATION

A. Comply with NFPA 54 and the International Fuel Gas Code for installation and purging of natural-gas piping.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Arrange for pipe spaces, chases, slots, sleeves, and openings in building structure during progress of construction, to allow for mechanical installations.

D. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

E. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

G. Locate valves for easy access.

H. Install natural-gas piping at uniform grade of 2 percent down toward drip and sediment traps.

I. Install piping free of sags and bends.

J. Install fittings for changes in direction and branch connections.

K. Verify final equipment locations for roughing-in.

L. Comply with requirements in Sections specifying gas-fired appliances and equipment for roughing-in requirements.

M. Drips and Sediment Traps: Install drips at points where condensate may collect, including service-meter outlets. Locate where accessible to permit cleaning and emptying. Do not install where condensate is subject to freezing.

1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use nipple a minimum length of 3 pipe diameters, but not less than 3 inches long and same size as connected pipe. Install with space below bottom of drip to remove plug or cap.

N. Extend relief vent connections for service regulators, line regulators, and overpressure protection devices to outdoors and terminate with weatherproof vent cap.

O. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings, below grade or floors, and in floor channels unless indicated to be exposed to view.

P. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.

Q. Connect branch piping from top or side of horizontal piping.

R. Install unions in pipes NPS 2 and smaller, adjacent to each valve, at final connection to each piece of equipment. Unions are not required at flanged connections.

S. Do not use natural-gas piping as grounding electrode.

T. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section "Sleeves and Sleeve Seals for HVAC Piping."

U. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section "Sleeves and Sleeve Seals for HVAC Piping."

V. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section "Escutcheons for HVAC Piping."

3.4 VALVE INSTALLATION

A. Install manual gas shutoff valve for each gas appliance ahead of corrugated stainless-steel tubing, aluminum, or copper connector.

3.5 PIPING JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Threaded Joints:

1. Thread pipe with tapered pipe threads complying with ASME B1.20.1.
2. Cut threads full and clean using sharp dies.
3. Ream threaded pipe ends to remove burrs and restore full inside diameter of pipe.
4. Apply appropriate tape or thread compound to external pipe threads unless dryseal threading is specified.
5. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

D. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter.

3.6 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for pipe hangers and supports specified in Section "Hangers and Supports for HVAC Piping and Equipment."

B. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:

1. NPS 1 and Smaller: Maximum span, 96 inches; minimum rod size, 3/8 inch.
2. NPS 1-1/4: Maximum span, 108 inches; minimum rod size, 3/8 inch.
3. NPS 1-1/2 and NPS 2: Maximum span, 108 inches; minimum rod size, 3/8 inch.
4. NPS 2-1/2 to NPS 3-1/2: Maximum span, 10 feet; minimum rod size, 1/2 inch.

C. Install hangers for horizontal drawn-temper copper tubing with the following maximum spacing and minimum rod sizes:

1. NPS 3/8: Maximum span, 48 inches; minimum rod size, 3/8 inch.
2. NPS 1/2 and NPS 5/8: Maximum span, 72 inches; minimum rod size, 3/8 inch.
3. NPS 3/4 and NPS 7/8: Maximum span, 84 inches; minimum rod size, 3/8 inch.
4. NPS 1: Maximum span, 96 inches; minimum rod size, 3/8 inch.

3.7 CONNECTIONS

A. Connect to utility's gas main according to utility's procedures and requirements.

B. Install natural-gas piping electrically continuous and bonded to gas appliance equipment grounding conductor of the circuit powering the appliance according to NFPA 70.

C. Install piping adjacent to appliances to allow service and maintenance of appliances.

D. Connect piping to appliances using manual gas shutoff valves and unions. Install valve within 72 inches of each gas-fired appliance and equipment. Install union between valve and appliances or equipment.

E. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance.

3.8 LABELING AND IDENTIFYING

A. Comply with requirements in Section "Identification for HVAC Piping and Equipment" for piping and valve identification.

3.9 PAINTING

A. Comply with requirements in Section "Exterior Painting" and Section "Interior Painting" for painting interior and exterior natural-gas piping.

B. Paint exposed, interior metal piping, valves, service regulators, service meters and meter bars, earthquake valves, and piping specialties, except components, with factory-applied paint or protective coating.

1. Latex Over Alkyd Primer System: MPI INT 5.1Q.

    a. Prime Coat: Quick-drying alkyd metal primer.
    b. Intermediate Coat: Interior latex matching topcoat.
    c. Topcoat: Interior latex (semigloss).
    d. Color: Gray.

2. Alkyd System: MPI INT 5.1E.

    a. Prime Coat: Quick-drying alkyd metal primer.
    b. Intermediate Coat: Interior alkyd matching topcoat.
    c. Topcoat: Interior alkyd (semigloss).
    d. Color: Gray.

C. Damage and Touchup: Repair marred and damaged factory-applied finishes with materials and by procedures to match original factory finish.

3.10 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Test, inspect, and purge natural gas according to the International Fuel Gas Code and authorities having jurisdiction.

C. Natural-gas piping will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.11 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain earthquake valves.

3.12 INDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES LESS THAN 0.5 PSIG

A. Aboveground, branch piping NPS 1 and smaller shall be one of the following:

1. Annealed-temper, copper tube with wrought-copper fittings and brazed or flared joints.
2. Steel pipe with malleable-iron fittings and threaded joints.

B. Aboveground, distribution piping shall be one of the following:

1. Steel pipe with malleable-iron fittings and threaded joints.
2. Steel pipe with wrought-steel fittings and welded joints.
3. Drawn-temper copper tube with wrought-copper fittings and brazed joints.

3.13 ABOVEGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE

A. Distribution piping valves for pipe sizes NPS 2 and smaller shall be one of the following:

1. One-piece, bronze ball valve with bronze trim.
2. Two-piece, full-port, bronze ball valves with bronze trim.
3. Bronze plug valve.

B. Distribution piping valves for pipe sizes NPS 2-1/2 and larger shall be one of the following:

1. Two-piece, full-port, bronze ball valves with bronze trim.
2. Bronze plug valve.
3. Cast-iron, lubricated plug valve.

C. Valves in branch piping for single appliance shall be one of the following:

1. One-piece, bronze ball valve with bronze trim.
2. Two-piece, full-port, bronze ball valves with bronze trim.
3. Bronze plug valve.

END OF SECTION

SECTION 23 2113

HYDRONIC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes pipe and fitting materials and joining methods for the following:

1. Hot-water heating piping.
2. Chilled-water piping.
3. Makeup-water piping.
4. Condensate-drain piping.
5. Air-vent piping.
6. Safety-valve-inlet and -outlet piping.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of the following:

1. Pressure-seal fittings.
2. Chemical treatment.

B. LEED Submittals:

1. Product Data for Credit IEQ 4.1: For solvent cements and adhesive primers, documentation including printed statement of VOC content.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Welding certificates.

C. Field quality-control reports.

D. Water Analysis: Submit a copy of the water analysis to illustrate water quality available at Project site.

1.5 QUALITY ASSURANCE

A. Steel Support Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code: Section IX.

1. Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation.
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Hydronic piping components and installation shall be capable of withstanding the following minimum working pressure and temperature unless otherwise indicated:

1. Hot-Water Heating Piping: 150 psig at 200 deg F.
2. Chilled-Water Piping: 150 psig at 200 deg F.
3. Makeup-Water Piping: 80 psig at 150 deg F.
4. Condensate-Drain Piping: 150 deg F.
5. Air-Vent Piping: 200 deg F.
6. Safety-Valve-Inlet and -Outlet Piping: Equal to the pressure of the piping system to which it is attached.

2.2 COPPER TUBE AND FITTINGS

A. Drawn-Temper Copper Tubing: ASTM B 88, Type L.

B. Annealed-Temper Copper Tubing: ASTM B 88, Type K.

C. DWV Copper Tubing: ASTM B 306, Type DWV.

D. Wrought-Copper Unions: ASME B16.22.

2.3 STEEL PIPE AND FITTINGS

A. Steel Pipe: ASTM A 53/A 53M, black steel with plain ends; welded and seamless, Grade B, and wall thickness as indicated in "Piping Applications" Article.

B. Cast-Iron Threaded Fittings: ASME B16.4; Classes 125 and 250 as indicated in "Piping Applications" Article.

C. Malleable-Iron Threaded Fittings: ASME B16.3, Classes 150 and 300 as indicated in "Piping Applications" Article.

D. Malleable-Iron Unions: ASME B16.39; Classes 150, 250, and 300 as indicated in "Piping Applications" Article.

E. Cast-Iron Pipe Flanges and Flanged Fittings: ASME B16.1, Classes 25, 125, and 250; raised ground face, and bolt holes spot faced as indicated in "Piping Applications" Article.

F. Wrought-Steel Fittings: ASTM A 234/A 234M, wall thickness to match adjoining pipe.

G. Wrought Cast- and Forged-Steel Flanges and Flanged Fittings: ASME B16.5, including bolts, nuts, and gaskets of the following material group, end connections, and facings:

1. Material Group: 1.1.
2. End Connections: Butt welding.
3. Facings: Raised face.

H. Steel Pipe Nipples: ASTM A 733, made of same materials and wall thicknesses as pipe in which they are installed.

2.4 JOINING MATERIALS

A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch maximum thickness unless otherwise indicated.

a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

C. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

D. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for joining copper with copper; or BAg-1, silver alloy for joining copper with bronze or steel.

E. Welding Filler Metals: Comply with AWS D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.5 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 the following:

a. Capitol Manufacturing Company.
b. Hart Industries International, Inc.
c. Watts Regulator Co.
d. Zurn Industries, LLC.

2. Description:

a. Standard: ASSE 1079.
b. Pressure Rating: 150 psig.
c. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric Flanges:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Capitol Manufacturing Company.
b. Watts Regulator Co.
c. Zurn Industries, LLC.

2. Description:

a. Standard: ASSE 1079.
b. Factory-fabricated, bolted, companion-flange assembly.
c. Pressure Rating: 150 psig.
d. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric-Flange Insulating Kits:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Advance Products & Systems, Inc.
b. Calpico, Inc.
c. Pipeline Seal and Insulator, Inc.

2. Description:

a. Non-conducting materials for field assembly of companion flanges.
b. Pressure Rating: 150 psig.
c. Gasket: Neoprene or phenolic.
d. Bolt Sleeves: Phenolic or polyethylene.
e. Washers: Phenolic with steel backing washers.

E. Dielectric Nipples:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Grinnell Mechanical Products.
b. Precision Plumbing Products, Inc.
c. Victaulic Company.

2. Description:

a. Standard: IAPMO PS 66.
b. Electroplated steel nipple, complying with ASTM F 1545.
c. Pressure Rating: 300 psig at 225 deg F.
d. End Connections: Male threaded or grooved.
e. Lining: Inert and noncorrosive, propylene.

2.6 BYPASS CHEMICAL FEEDER

A. Description: Welded steel construction; 125-psig working pressure; 5-gal. capacity; with fill funnel and inlet, outlet, and drain valves.

1. Chemicals: Specially formulated, based on analysis of makeup water, to prevent accumulation of scale and corrosion in piping and connected equipment.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Hot-water heating piping, aboveground, NPS 2 and smaller, shall be any of the following:

1. Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered or brazed joints.
2. Schedule 40, Grade B, Type 96 steel pipe; Class 150, malleable-iron fittings; cast-iron flanges and flange fittings; and threaded joints.

B. Hot-water heating piping, aboveground, NPS 2-1/2 and larger, shall be any of the following:

1. Schedule 40 steel pipe, wrought-steel fittings and wrought-cast or forged-steel flanges and flange fittings, and welded and flanged joints.
2. Schedule 40 steel pipe; grooved, mechanical joint coupling and fittings; and grooved, mechanical joints.

C. Chilled-water piping, aboveground, NPS 2 and smaller, shall be any of the following:

1. Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered or brazed joints.
2. Schedule 40 steel pipe; Class 150, malleable-iron fittings; cast-iron flanges and flange fittings; and threaded joints.

D. Chilled-water piping, aboveground, NPS 2-1/2 and larger, shall be any of the following:

1. Schedule 40 steel pipe, wrought-steel fittings and wrought-cast or forged-steel flanges and flange fittings, and welded and flanged joints.
2. Schedule 40 steel pipe; grooved, mechanical joint coupling and fittings; and grooved, mechanical joints.

E. Makeup-water piping installed aboveground shall be the following:

1. Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered or brazed joints.

F. Condensate-Drain Piping: Type M or Type DWV, drawn-temper copper tubing, wrought-copper fittings, and soldered joints.

G. Air-Vent Piping:

1. Inlet: Same as service where installed.
2. Outlet: Type K, annealed-temper copper tubing with soldered or flared joints.

H. Safety-Valve-Inlet and -Outlet Piping for Hot-Water Piping: Same materials and joining methods as for piping specified for the service in which safety valve is installed.

3.2 PIPING INSTALLATIONS

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. 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. Select system components with pressure rating equal to or greater than system operating pressure.

K. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.

L. Install drains, consisting of a tee fitting, NPS 3/4 ball valve, and short NPS 3/4 threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.

M. Install piping at a uniform grade of 0.2 percent upward in direction of flow.

N. Reduce pipe sizes using eccentric reducer fitting installed with level side up.

O. Install branch connections to mains using mechanically formed tee fittings in main pipe, with the branch connected to the bottom of the main pipe. For up-feed risers, connect the branch to the top of the main pipe.

P. Install valves according to Section "General-Duty Valves for HVAC Piping."

Q. Install unions in piping, NPS 2 and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated.

R. Install flanges in piping, NPS 2-1/2 and larger, at final connections of equipment and elsewhere as indicated.

S. Install shutoff valve immediately upstream of each dielectric fitting.

T. Comply with requirements in Section "Expansion Fittings and Loops for HVAC Piping" for installation of expansion loops, expansion joints, anchors, and pipe alignment guides.

U. Comply with requirements in Section "Identification for HVAC Piping and Equipment" for identifying piping.

V. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section "Sleeves and Sleeve Seals for HVAC Piping."

W. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section "Sleeves and Sleeve Seals for HVAC Piping."

3.3 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 unions.

C. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flanges.

D. Dielectric Fittings for NPS 5 and Larger: Use dielectric flange kits.

3.4 HANGERS AND SUPPORTS

A. Comply with requirements in Section "Hangers and Supports for HVAC Piping and Equipment" for hanger, support, and anchor devices. Comply with the following requirements for maximum spacing of supports.

B. Comply with requirements in Section "Vibration and Seismic Controls for HVAC Piping and Equipment" for vibration isolation and restraints.

C. Install the following pipe attachments:

1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet long.
2. Adjustable roller hangers and spring hangers for individual horizontal piping 20 feet or longer.
3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
4. Spring hangers to support vertical runs.
5. Provide copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.
6. On plastic pipe, install pads or cushions on bearing surfaces to prevent hanger from scratching pipe.

D. Install hangers for steel piping with the following maximum spacing and minimum rod sizes:

1. NPS 3/4: Maximum span, 7 feet.
2. NPS 1: Maximum span, 7 feet.
3. NPS 1-1/2: Maximum span, 9 feet.
4. NPS 2: Maximum span, 10 feet.
5. NPS 2-1/2: Maximum span, 11 feet.
6. NPS 3 and Larger: Maximum span, 12 feet.

E. Install hangers for drawn-temper copper piping with the following maximum spacing and minimum rod sizes:

1. NPS 3/4: Maximum span, 5 feet; minimum rod size, 1/4 inch.
2. NPS 1: Maximum span, 6 feet; minimum rod size, 1/4 inch.
3. NPS 1-1/4: Maximum span, 7 feet; minimum rod size, 3/8 inch.
4. NPS 1-1/2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
5. NPS 2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
6. NPS 2-1/2: Maximum span, 9 feet; minimum rod size, 3/8 inch.
7. NPS 3 and Larger: Maximum span, 10 feet; minimum rod size, 3/8 inch.

F. Support vertical runs at roof, at each floor, and at 10-foot intervals between floors.

3.5 PIPE JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

D. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8/A5.8M.

E. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

F. Welded Joints: Construct joints according to AWS D10.12M/D10.12, using qualified processes and welding operators according to "Quality Assurance" Article.

G. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

3.6 TERMINAL EQUIPMENT CONNECTIONS

A. Sizes for supply and return piping connections shall be the same as or larger than equipment connections.

B. Install control valves in accessible locations close to connected equipment.

C. Install bypass piping with ball valve around control valve. If parallel control valves are installed, only one bypass is required.

D. Install ports for pressure gages and thermometers at coil inlet and outlet connections. Comply with requirements in Section "Meters and Gages for HVAC Piping."

3.7 CHEMICAL TREATMENT

A. Perform an analysis of makeup water to determine type and quantities of chemical treatment needed to keep system free of scale, corrosion, and fouling, and to sustain the following water characteristics:

1. pH: 9.0 to 10.5.
2. "P" Alkalinity: 100 to 500 ppm.
3. Boron: 100 to 200 ppm.
4. Chemical Oxygen Demand: Maximum of 100 ppm. Revise this value if closed system contains glycol.
5. Corrosion Inhibitor:

    a. Sodium Nitrate: 1000 to 1500 ppm.
    b. Molybdate: 200 to 300 ppm.
    c. Chromate: 200 to 300 ppm.
    d. Sodium Nitrate Plus Molybdate: 100 to 200 ppm each.
    e. Chromate Plus Molybdate: 50 to 100 ppm each.

6. Soluble Copper: Maximum of 0.20 ppm.
7. Tolyiriazole Copper and Yellow Metal Corrosion Inhibitor: Minimum of 10 ppm.
8. Total Suspended Solids: Maximum of 10 ppm.
9. Ammonia: Maximum of 20 ppm.
10. Free Caustic Alkalinity: Maximum of 20 ppm.
11. Microbiological Limits:

    a. Total Aerobic Plate Count: Maximum of 1000 organisms/mL.
    b. Total Anaerobic Plate Count: Maximum of 100 organisms/mL.
    c. Nitrate Reducers: 100 organisms/mL.
    d. Sulfate Reducers: Maximum of zero organisms/mL.
    e. Iron Bacteria: Maximum of zero organisms/mL.

B. Install bypass chemical feeders in each hydronic system where indicated.

1. Install in upright position with top of funnel not more than 48 inches above the floor.
2. Install feeder in minimum NPS 3/4 bypass line, from main with full-size, full-port, ball valve in the main between bypass connections.
3. Install NPS 3/4 pipe from chemical feeder drain to nearest equipment drain and include a full-size, full-port, ball valve.

C. Fill system with fresh water and add liquid alkaline compound with emulsifying agents and detergents to remove grease and petroleum products from piping. Circulate solution for a minimum of 24 hours, drain, clean strainer screens, and refill with fresh water.

D. Add initial chemical treatment and maintain water quality in ranges noted above for the first year of operation.

E. Fill systems that have antifreeze or glycol solutions with the following concentrations:

1. Glycol Heat-Water Piping: Minimum of 30 percent propylene glycol.

3.8 FIELD QUALITY CONTROL

A. Prepare hydronic piping according to ASME B31.9 and as follows:

1. Leave joints, including welds, uninsulated and exposed for examination during test.
2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
3. Flush hydronic piping systems with clean water; then remove and clean or replace strainer screens.
4. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.
5. Install safety valve, set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.

B. Perform the following tests on hydronic piping:

1. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
2. While filling system, use vents installed at high points of system to release air. Use drains installed at low points for complete draining of test liquid.
3. Isolate expansion tanks and determine that hydronic system is full of water.
4. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the system's working pressure. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed 90 percent of specified minimum yield strength or 1.7 times the "SE" value in Appendix A in ASME B31.9, "Building Services Piping."
5. After hydrostatic test pressure has been applied for at least 10 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.
6. Prepare written report of testing.

C. Perform the following before operating the system:

1. Open manual valves fully.
2. Inspect pumps for proper rotation.
3. Set makeup pressure-reducing valves for required system pressure.
4. Inspect air vents at high points of system and determine if all are installed and operating freely (automatic type), or bleed air completely (manual type).
5. Set temperature controls so all coils are calling for full flow.
6. Inspect and set operating temperatures of hydronic equipment, such as boilers, chillers, cooling towers, to specified values.
7. Verify lubrication of motors and bearings.

END OF SECTION

SECTION 23 2116

HYDRONIC PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes special-duty valves and specialties for the following:

1. Hot-water heating piping.
2. Chilled-water piping.
3. Makeup-water piping.
4. Condensate-drain piping.
5. Air-vent piping.
6. Safety-valve-inlet and -outlet piping.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of the following:

1. Valves: Include flow and pressure drop curves based on manufacturer's testing for calibrated-orifice balancing valves and automatic flow-control valves.
2. Air-control devices.
3. Hydronic specialties.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air-control devices, hydronic specialties, and special-duty valves to include in emergency, operation, and maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Differential Pressure Meter: For each type of balancing valve and automatic flow control valve, include flowmeter, probes, hoses, flow charts, and carrying case.

1.6 QUALITY ASSURANCE

A. Pipe Welding: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code: Section IX.

1. Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Hydronic piping components and installation shall be capable of withstanding the following minimum working pressure and temperature unless otherwise indicated:

1. Hot-Water Heating Piping: 150 psig at 200 deg F.
2. Chilled-Water Piping: 150 psig at 200 deg F.
3. Makeup-Water Piping: 80 psig at 150 deg F.
4. Condensate-Drain Piping: 150 deg F.
5. Air-Vent Piping: 200 deg F.
6. Safety-Valve-Inlet and -Outlet Piping: Equal to the pressure of the piping system to which it is attached.

2.2 VALVES

A. Gate, Globe, Check, Ball, and Butterfly Valves: Comply with requirements specified in Section "General-Duty Valves for HVAC Piping."

B. Automatic Temperature-Control Valves, Actuators, and Sensors: Comply with requirements specified in Section "Instrumentation and Control for HVAC."

C. Bronze, Calibrated-Orifice, Balancing Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Armstrong Pumps, Inc.
b. Bell & Gossett Domestic Pump.
c. Gerand Engineering Co.
d. Griswold Controls.
e. Pro Hydronic Specialties.
f. Taco.
g. Tour & Andersson; available through Victaulic Company.

2. Body: Bronze, ball or plug type with calibrated orifice or venturi.
3. Ball: Brass or stainless steel.
4. Plug: Resin.
5. Seat: PTFE.
6. End Connections: Threaded or socket.
7. Pressure Gage Connections: Integral seals for portable differential pressure meter.
8. Handle Style: Lever, with memory stop to retain set position.
9. CWP Rating: Minimum 125 psig.
10. Maximum Operating Temperature: 250 deg F.

D. Cast-Iron or Steel, Calibrated-Orifice, Balancing Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

    a. Armstrong Pumps, Inc.
    b. Bell & Gossett Domestic Pump.
    c. Gerand Engineering Co.
    d. Griswold Controls.
    e. Pro Hydronic Specialties.
    f. Taco.
    g. Tour & Andersson; available through Victaulic Company.

2. Body: Cast-iron or steel body, ball, plug, or globe pattern with calibrated orifice or venturi.
3. Ball: Brass or stainless steel.
4. Stem Seals: EPDM O-rings.
5. Disc: Glass and carbon-filled PTFE.
6. Seat: PTFE.
7. End Connections: Flanged or grooved.
8. Pressure Gage Connections: Integral seals for portable differential pressure meter.
9. Handle Style: Lever, with memory stop to retain set position.
10. CWP Rating: Minimum 125 psig.
11. Maximum Operating Temperature: 250 deg F.

E. Diaphragm-Operated, Pressure-Reducing Valves: ASME labeled.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

    a. Amtrol, Inc.
    b. Armstrong Pumps, Inc.
    c. Bell & Gossett Domestic Pump.
    d. Spence Engineering Company, Inc.
    e. Watts Regulator Co.

2. Body: Bronze or brass.
3. Disc: Glass and carbon-filled PTFE.
4. Seat: Brass.
5. Stem Seals: EPDM O-rings.
6. Diaphragm: EPT.
7. Low inlet-pressure check valve.
8. Inlet Strainer: Stainless steel, removable without system shutdown.
9. Valve Seat and Stem: Noncorrosive.
10. Valve Size, Capacity, and Operating Pressure: Selected to suit system in which installed, with operating pressure and capacity factory set and field adjustable.

F. Diaphragm-Operated Safety Valves: ASME labeled.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

    a. Amtrol, Inc.
    b. Armstrong Pumps, Inc.
    c. Bell & Gossett Domestic Pump.
    d. Spence Engineering Company, Inc.
    e. Watts Regulator Co.

2. Body: Bronze or brass.
3. Disc: Glass and carbon-filled PTFE.
4. Seat: Brass.
5. Stem Seals: EPDM O-rings.
6. Diaphragm: EPT.
7. Wetted, Internal Work Parts: Brass and rubber.
8. Inlet Strainer: Stainless steel, removable without system shutdown.
9. Valve Seat and Stem: Noncorrosive.
10. Valve Size, Capacity, and Operating Pressure: Comply with ASME Boiler and Pressure Vessel Code: Section IV, and selected to suit system in which installed, with operating pressure and capacity factory set and field adjustable.

G. Automatic Flow-Control Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

    a. Flow Design Inc.
    b. Griswold Controls.
    c. Flow Con International.
    d. Pro Hydronic Specialties.

2. Body: Brass or ferrous metal.
3. Piston and Spring Assembly: Stainless steel, tamper proof, self-cleaning, and removable.
4. Combination Assemblies: Include bronze or brass-alloy ball valve.
5. Identification Tag: Marked with zone identification, valve number, and flow rate.
6. Size: Same as pipe in which installed.
7. Performance: Maintain constant flow, plus or minus 5 percent over system pressure fluctuations.
8. Minimum CWP Rating: 175 psig.
9. Maximum Operating Temperature: 200 deg F.

2.3 AIR-CONTROL DEVICES

A. Manual Air Vents:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

    a. Amtrol, Inc.
    b. Armstrong Pumps, Inc.
    c. Bell & Gossett Domestic Pump.
    d. Taco, Inc.

2. Body: Bronze.
3. Internal Parts: Nonferrous.
4. Operator: Screwdriver or thumbscrew.
5. Inlet Connection: NPS 1/2.
6. Discharge Connection: NPS 1/8.
7. CWP Rating: 150 psig.
8. Maximum Operating Temperature: 225 deg F.

B. Automatic Air Vents:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

    a. Amtrol, Inc.
    b. Armstrong Pumps, Inc.
    c. Bell & Gossett Domestic Pump.
    d. Taco, Inc.

2. Body: Bronze or cast iron.
3. Internal Parts: Nonferrous.
4. Operator: Noncorrosive metal float.
5. Inlet Connection: NPS 1/2.
6. Discharge Connection: NPS 1/4.
7. CWP Rating: 150 psig.
8. Maximum Operating Temperature: 240 deg F.

C. Diaphragm-Type Expansion Tanks:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

    a. Amtrol, Inc.
    b. Armstrong Pumps, Inc.
    c. Bell & Gossett Domestic Pump.
    d. Taco, Inc.

2. Tank: Welded steel, rated for 125-psig working pressure and 375 deg F maximum operating temperature. Factory test after taps are fabricated and supports installed and are labeled according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
3. Diaphragm: Securely sealed into tank to separate air charge from system water to maintain required expansion capacity.
4. Air-Charge Fittings: Schrader valve, stainless steel with EPDM seats.

D. Tangential-Type Air Separators:

1. Manufacturers: Subject to compliance with requirements, provide products by the following provide products by one of the following:

    a. Amtrol, Inc.
    b. Armstrong Pumps, Inc.
    c. Bell & Gossett Domestic Pump.
    d. Taco, Inc.

2. Tank: Welded steel; ASME constructed and labeled for 125-psig minimum working pressure and 375 deg F maximum operating temperature.
3. Air Collector Tube: Perforated stainless steel, constructed to direct released air into expansion tank.
4. Tangential Inlet and Outlet Connections: Threaded for NPS 2 and smaller; flanged connections for NPS 2-1/2 and larger.
5. Blowdown Connection: Threaded.
6. Size: Match system flow capacity.

E. In-Line Air Separators:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

    a. Amtrol, Inc.
    b. Armstrong Products, Inc.
    c. Bell & Gossett Domestic Pump.
    d. Taco, Inc.

2. Tank: One-piece cast iron with an integral weir constructed to decelerate system flow to maximize air separation.
3. Maximum Working Pressure: Up to 175 psig.
4. Maximum Operating Temperature: Up to 300 deg F.

2.4 HYDRONIC PIPING SPECIALTIES

A. Y-Pattern Strainers:

1. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.
3. Strainer Screen: Stainless-steel, 40-mesh strainer, or perforated stainless-steel basket.
4. CWP Rating: 125 psig.

B. Stainless-Steel Bellow, Flexible Connectors:

1. Body: Stainless-steel bellows with woven, flexible, bronze, wire-reinforcing protective jacket.
2. End Connections: Threaded or flanged to match equipment connected.
3. Performance: Capable of 3/4-inch misalignment.
4. CWP Rating: 150 psig.
5. Maximum Operating Temperature: 250 deg F.

C. Spherical, Rubber, Flexible Connectors:

1. Body: Fiber-reinforced rubber body.
2. End Connections: Steel flanges drilled to align with Classes 150 and 300 steel flanges.
3. Performance: Capable of misalignment.
4. CWP Rating: 150 psig.
5. Maximum Operating Temperature: 250 deg F.

D. Expansion Fittings: Comply with requirements in Section "Expansion Fittings and Loops for HVAC Piping."

PART 3 - B

3.1 VALVE APPLICATIONS

A. Install shutoff-duty valves at each branch connection to supply mains and at supply connection to each piece of equipment.

B. Install throttling-duty or calibrated-orifice, balancing valves at each branch connection to return main.

C. Install calibrated-orifice, balancing valves in the return pipe of each heating or cooling terminal.

D. Install check valves at each pump discharge and elsewhere as required to control flow direction.

E. Install safety valves at hot-water generators and elsewhere as required by ASME Boiler and Pressure Vessel Code. Install drip-pan elbow on safety-valve outlet and pipe without valves to the outdoors; pipe drain to nearest floor drain or as indicated on Drawings. Comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1, for installation requirements.

F. Install pressure-reducing valves at makeup-water connection to regulate system fill pressure.

3.2 HYDRONIC SPECIALTIES INSTALLATION

A. Install manual air vents at high points in piping, at heat-transfer coils, and elsewhere as required for system air venting.

B. Install automatic air vents at high points of system piping in mechanical equipment rooms only. Install manual vents at heat-transfer coils and elsewhere as required for air venting.

C. Install piping from boiler air outlet or air separator to expansion tank with a 2 percent upward slope toward tank.

D. Install in-line air separators in pump suction. Install drain valve on air separators NPS 2 and larger.

E. Install tangential air separator in pump suction. Install blowdown piping with gate or full-port ball valve; extend full size to nearest floor drain.

F. Install expansion tanks suspended or on the floor, as indicated. Vent and purge air from hydronic system, and ensure that tank is properly charged with air to suit system Project requirements.

END OF SECTION

SECTION 23 2123

HYDRONIC PUMPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Close-coupled, in-line centrifugal pumps.
2. Wet-rotor pumps.

1.3 DEFINITIONS

A. Buna-N: Nitrile rubber.

B. EPT: Ethylene propylene terpolymer.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of pump. Include certified performance curves and rated capacities, operating characteristics, furnished specialties, final impeller dimensions, and accessories for each type of product indicated. Indicate pump's operating point on curves.

B. Shop Drawings: For each pump.

1. Show pump layout and connections.
2. Include setting drawings with templates for installing foundation and anchor bolts and other anchorages.
3. Include diagrams for power, signal, and control wiring.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For pumps to include in emergency, operation, and maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Mechanical Seals: Two mechanical seals for each pump.

PART 2 - PRODUCTS

2.1 CLOSE-COUPLED, IN-LINE CENTRIFUGAL PUMPS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Armstrong Pumps Inc.
2. Aurora Pump; Division of Pentair Pump Group.
3. Grundfos Pumps Corporation.
4. ITT Corporation; Bell & Gossett.
5. PACO Pumps.
6. Patterson Pump Co.; a subsidiary of the Gorman-Rupp Co.
7. Peerless Pump Company.
8. TACO Incorporated.

B. Description: Factory-assembled and -tested, centrifugal, overhung-impeller, close-coupled, in-line pump as defined in HI 1.1-1.2 and HI 1.3; designed for installation with pump and motor shafts mounted horizontally or vertically.

C. Pump Construction:

1. Casing: Radially split, cast iron, with threaded gage tappings at inlet and outlet, replaceable bronze wear rings, and threaded, companion-flange, or union-end connections.
2. Impeller: ASTM B 584, cast bronze; statically and dynamically balanced, keyed to shaft, and secured with a locking cap screw. For constant-speed pumps, trim impeller to match specified performance.
3. Pump Shaft: Stainless steel.
4. Seal: Mechanical seal consisting of carbon rotating ring against a ceramic seat held by a stainless-steel spring, and Buna-N or EPT bellows and gasket. Include water slinger on shaft between motor and seal.
5. Pump Bearings: Permanently lubricated ball bearings.

D. Motor: Single speed and rigidly mounted to pump casing.

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section "Common Motor Requirements for HVAC Equipment."

a. Enclosure: Open, dripproof.
b. Enclosure Materials: Cast iron.
c. Motor Bearings: Permanently lubricated ball bearings.
d. Unusual Service Conditions:

1) Ambient Temperature: 40 C.
2) Altitude: 3,300 feet above sea level.
3) High humidity.

e. Efficiency: Premium efficient.
f. Service Factor: 1.15.

E. Capacities and Characteristics: As Scheduled.

2.2 WET-ROTOR PUMPS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Armstrong Pumps Inc.
2. Grundfos Pumps Corporation.
3. ITT Corporation; Bell & Gossett.
4. TACO Incorporated.

B. Description: Factory-assembled and -tested, wet-rotor pump.

C. Pump Construction:

1. Body: 100 percent lead-free bronze or Stainless steel.
2. Impeller: Polypropylene or Noryl.
3. Pump Shaft: Ceramic.
4. Bearings. Double-sintered carbon.

D. Motor: Single speed.

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section "Common Motor Requirements for HVAC Equipment."

a. Efficiency: Premium efficient.
b. Service Factor: 1.0.

E. Capacities and Characteristics: As Scheduled.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine equipment foundations and anchor-bolt locations for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for piping systems to verify actual locations of piping connections before pump installation.

C. Examine foundations and inertia bases for suitable conditions where pumps are to be installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PUMP INSTALLATION

A. Comply with HI 1.4 and HI 2.4.

B. Install pumps to provide access for periodic maintenance including removing motors, impellers, couplings, and accessories.

C. Independently support pumps and piping so weight of piping is not supported by pumps and weight of pumps is not supported by piping.

D. Equipment Mounting: Install in-line pumps with continuous-thread hanger rods and spring hangers of size required to support weight of in-line pumps.

1. Comply with requirements for restraint devices specified in Section "Vibration and Seismic Controls for HVAC Piping and Equipment."
2. Comply with requirements for hangers and supports specified in Section "Hangers and Supports for HVAC Piping and Equipment."

3.3 CONNECTIONS

A. Where installing piping adjacent to pump, allow space for service and maintenance.

B. Connect piping to pumps. Install valves that are same size as piping connected to pumps.

C. Install suction and discharge pipe sizes equal to or greater than diameter of pump nozzles.

D. Install check, shutoff, and throttling valves on discharge side of pumps.

E. Install flexible connectors on suction and discharge sides of base-mounted pumps between pump casing and valves.

F. Install pressure gages on pump suction and discharge or at integral pressure-gage tapping, or install single gage with multiple-input selector valve.

G. Install check valve and gate or ball valve on each condensate pump unit discharge.

H. Ground equipment according to Section "Grounding and Bonding for Electrical Systems."

I. Connect wiring according to Section "Low-Voltage Electrical Power Conductors and Cables."

END OF SECTION

SECTION 23 2300

REFRIGERANT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes refrigerant piping used for air-conditioning applications.

1.3 PERFORMANCE REQUIREMENTS

A. Line Test Pressure for Refrigerant R-410A:

1. Suction Lines for Air-Conditioning Applications: 300 psig.
2. Suction Lines for Heat-Pump Applications: 535 psig.
3. Hot-Gas and Liquid Lines: 535 psig.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control test reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For refrigerant valves and piping specialties to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

B. Comply with ASHRAE 15, "Safety Code for Refrigeration Systems."

C. Comply with ASME B31.5, "Refrigeration Piping and Heat Transfer Components."

1.7 PRODUCT STORAGE AND HANDLING

A. Store piping in a clean and protected area with end caps in place to ensure that piping interior and exterior are clean when installed.

1.8 COORDINATION

A. Coordinate size and location of roof curbs, equipment supports, and roof penetrations. These items are specified in Section "Roof Accessories."

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

A. Copper Tube: ASTM B 280, Type ACR.

B. Wrought-Copper Fittings: ASME B16.22.

C. Wrought-Copper Unions: ASME B16.22.

D. Solder Filler Metals: ASTM B 32. Use 95-5 tin antimony or alloy HB solder to join copper socket fittings on copper pipe.

E. Brazing Filler Metals: AWS A5.8.

2.2 VALVES AND SPECIALTIES

A. Moisture/Liquid Indicators:

1. Body: Forged brass.
2. Window: Replaceable, clear, fused glass window with indicating element protected by filter screen.
3. Indicator: Color coded to show moisture content in ppm.
4. Minimum Moisture Indicator Sensitivity: Indicate moisture above 60 ppm.
5. End Connections: Socket or flare.
6. Working Pressure Rating: 500 psig.
7. Maximum Operating Temperature: 240 deg F.

B. Replaceable-Core Filter Dryers: Comply with ARI 730.

1. Body and Cover: Painted-steel shell with ductile-iron cover, stainless-steel screws, and neoprene gaskets.
2. Filter Media: 10 micron, pleated with integral end rings; stainless-steel support.
3. Desiccant Media: Activated alumina or charcoal.
4. Designed for reverse flow (for heat-pump applications).
5. End Connections: Socket.
6. Access Ports: NPS 1/4 connections at entering and leaving sides for pressure differential measurement.
7. Maximum Pressure Loss: 2 psig.
8. Rated Flow: Per system design.
9. Working Pressure Rating: 500 psig.
10. Maximum Operating Temperature: 240 deg F.

C. Permanent Filter Dryers: Comply with ARI 730.

1. Body and Cover: Painted-steel shell.
2. Filter Media: 10 micron, pleated with integral end rings; stainless-steel support.

3. Desiccant Media: Activated alumina or charcoal.
4. Designed for reverse flow (for heat-pump applications).
5. End Connections: Socket.
6. Access Ports: NPS 1/4 connections at entering and leaving sides for pressure differential measurement.
7. Maximum Pressure Loss: 2 psig.
8. Rated Flow: Per system design.
9. Working Pressure Rating: 500 psig.
10. Maximum Operating Temperature: 240 deg F.

2.3 REFRIGERANTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Atofina Chemicals, Inc.
2. DuPont Company; Fluorochemicals Div.
3. Honeywell, Inc.; Genetron Refrigerants.
4. INEOS Fluor Americas LLC.

B. ASHRAE 34, R-410A: Pentafluoroethane/Difluoromethane.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS FOR REFRIGERANT R-134a, R-407C, AND R-410A

A. Suction Lines NPS 1-1/2 and Smaller for Conventional Air-Conditioning Applications: Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with brazed joints.

B. Suction Lines NPS 2 to NPS 4 for Conventional Air-Conditioning Applications: Copper, Type ACR, drawn-temper tubing and wrought-copper fittings with brazed joints.

C. Hot-Gas and Liquid Lines, and Suction Lines for Heat-Pump Applications: Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with brazed joints.

D. Safety-Relief-Valve Discharge Piping: Copper, Type ACR, drawn-temper tubing and wrought-copper fittings with soldered joints.

3.2 VALVE AND SPECIALTY APPLICATIONS

A. Install moisture/liquid indicators in liquid line at the inlet of the thermostatic expansion valve or at the inlet of the evaporator coil capillary tube.

B. Install filter dryers in liquid line between compressor and thermostatic expansion valve.

3.3 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 Shop Drawings.

B. Install refrigerant piping according to ASHRAE 15.

C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

D. 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.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping adjacent to machines to allow service and maintenance.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Select system components with pressure rating equal to or greater than system operating pressure.

J. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.

K. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or panels as specified in Section "Access Doors and Frames" if valves or equipment requiring maintenance is concealed behind finished surfaces.

L. Install refrigerant piping in protective conduit where installed belowground.

M. Slope refrigerant piping as follows:

1. Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.
2. Install horizontal suction lines with a uniform slope downward to compressor.
3. Install traps and double risers to entrain oil in vertical runs.
4. Liquid lines may be installed level.

N. When brazing or soldering, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.

O. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.

P. Identify refrigerant piping and valves according to Section "Identification for HVAC Piping and Equipment."

Q. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section "Sleeves and Sleeve Seals for HVAC Piping."

3.4 PIPE JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Fill pipe and fittings with an inert gas (nitrogen or carbon dioxide), during brazing or welding, to prevent scale formation.

D. Soldered Joints: Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook."

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."

1. Use Type BcuP, copper-phosphorus alloy for joining copper socket fittings with copper pipe.
2. Use Type BAg, cadmium-free silver alloy for joining copper with bronze or steel.

3.5 HANGERS AND SUPPORTS

A. Hanger, support, and anchor products are specified in Section "Hangers and Supports for HVAC Piping and Equipment."

B. Install the following pipe attachments:

1. Copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.

C. Install hangers for copper tubing with the following maximum spacing and minimum rod sizes:

1. NPS 1/2: Maximum span, 60 inches; minimum rod size, 1/4 inch.
2. NPS 5/8: Maximum span, 60 inches; minimum rod size, 1/4 inch.
3. NPS 1: Maximum span, 72 inches; minimum rod size, 1/4 inch.

D. Support multifloor vertical runs at least at each floor.

3.6 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

B. Tests and Inspections:

1. Comply with ASME B31.5, Chapter VI.
2. Test refrigerant piping, specialties, and receivers. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure.
3. Test high- and low-pressure side piping of each system separately at not less than the pressures indicated in Part 1 "Performance Requirements" Article.

    a. Fill system with nitrogen to the required test pressure.
    b. System shall maintain test pressure at the manifold gage throughout duration of test.

c. Test joints and fittings with electronic leak detector or by brushing a small amount of soap and glycerin solution over joints.
d. Remake leaking joints using new materials, and retest until satisfactory results are achieved.

3.7 SYSTEM CHARGING

A. Charge system using the following procedures:

1. Install core in filter dryers after leak test but before evacuation.
2. Evacuate entire refrigerant system with a vacuum pump to 500 micrometers. If vacuum holds for 12 hours, system is ready for charging.
3. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig.
4. Charge system with a new filter-dryer core in charging line.

3.8 ADJUSTING

A. Adjust thermostatic expansion valve to obtain proper evaporator superheat.

B. Adjust high- and low-pressure switch settings to avoid short cycling in response to fluctuating suction pressure.

C. Adjust set-point temperature of air-conditioning or chilled-water controllers to the system design temperature.

D. Perform the following adjustments before operating the refrigeration system, according to manufacturer's written instructions:

1. Open shutoff valves in condenser water circuit.
2. Verify that compressor oil level is correct.
3. Open compressor suction and discharge valves.
4. Open refrigerant valves except bypass valves that are used for other purposes.
5. Check open compressor-motor alignment and verify lubrication for motors and bearings.

E. Replace core of replaceable filter dryer after system has been adjusted and after design flow rates and pressures are established.

END OF SECTION

SECTION 23 2500

HVAC WATER TREATMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following HVAC water-treatment systems:

1. Bypass chemical-feed equipment and controls.
2. Chemical treatment test equipment.
3. HVAC water-treatment chemicals.

1.3 PERFORMANCE REQUIREMENTS

A. Water quality for HVAC systems shall minimize corrosion, scale buildup, and biological growth for optimum efficiency of HVAC equipment without creating a hazard to operating personnel or the environment.

B. Base HVAC water treatment on quality of water available at Project site, HVAC system equipment material characteristics and functional performance characteristics, operating personnel capabilities, and requirements and guidelines of authorities having jurisdiction.

C. Closed hydronic systems, including hot-water heating and chilled water, shall have the following water qualities:

1. pH: Maintain a value within 9.0 to 10.5.
2. "P" Alkalinity: Maintain a value within 100 to 500 ppm.
3. Boron: Maintain a value within 100 to 200 ppm.
4. Chemical Oxygen Demand: Maintain a maximum value of 100 ppm.
5. Soluble Copper: Maintain a maximum value of 0.20 ppm.
6. TDS: Maintain a maximum value of 10 ppm.
7. Ammonia: Maintain a maximum value of 20 ppm.
8. Free Caustic Alkalinity: Maintain a maximum value of 20 ppm.
9. Microbiological Limits:

    a. Total Aerobic Plate Count: Maintain a maximum value of 1000 organisms/ml.
    b. Total Anaerobic Plate Count: Maintain a maximum value of 100 organisms/ml.
    c. Nitrate Reducers: Maintain a maximum value of 100 organisms/ml.
    d. Sulfate Reducers: Maintain a maximum value of 0 organisms/ml.
    e. Iron Bacteria: Maintain a maximum value of 0 organisms/ml.

1.4 ACTION SUBMITTALS

A. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories for the following products:

1. Bypass feeders.
2. Chemical test equipment.
3. Chemical material safety data sheets.

B. Shop Drawings: Pretreatment and chemical treatment equipment showing tanks, maintenance space required, and piping connections to HVAC systems. Include plans, elevations, sections, details, and attachments to other work.

1. Wiring Diagrams: Power and control wiring.

1.5 INFORMATIONAL SUBMITTALS

A. Field quality-control test reports.

B. Other Informational Submittals:

1. Water-Treatment Program: Written sequence of operation on an annual basis for the application equipment required to achieve water quality defined in the "Performance Requirements" Article above.
2. Water Analysis: Illustrate water quality available at Project site.
3. Passivation Confirmation Report: Verify passivation of galvanized-steel surfaces, and confirm this observation in a letter to Architect.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For sensors, injection pumps, and controllers to include in emergency, operation, and maintenance manuals.

1.7 QUALITY ASSURANCE

A. HVAC Water-Treatment Service Provider Qualifications: An experienced HVAC water-treatment service provider capable of analyzing water qualities, installing water-treatment equipment, and applying water treatment as specified in this Section.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.8 MAINTENANCE SERVICE

A. Scope of Maintenance Service: Provide chemicals and service program to maintain water conditions required above to inhibit corrosion, scale formation, and biological growth for cooling, chilled-water piping, heating, hot-water piping and equipment. Services and chemicals shall be provided for a period of one year from date of Substantial Completion, and shall include the following:

1. Initial water analysis and HVAC water-treatment recommendations.
2. Startup assistance for Contractor to flush the systems, clean with detergents, and initially fill systems with required chemical treatment prior to operation.
3. Periodic field service and consultation.
4. Customer report charts and log sheets.
5. Laboratory technical analysis.
6. Analyses and reports of all chemical items concerning safety and compliance with government regulations.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Anderson Chemical Co, Inc.
2. Aqua-Chem, Inc.; Cleaver-Brooks Div.
3. Barclay Chemical Co.; Water Management, Inc.
4. Boland Trane Services
5. GE Betz.
6. GE Osmonics.
7. Metro Group. Inc. (The); Metropolitan Refining Div.
8. ONDEO Nalco Company.

2.2 MANUAL CHEMICAL-FEED EQUIPMENT

A. Bypass Feeders: Steel, with corrosion-resistant exterior coating, minimum 3-1/2-inch fill opening in the top, and NPS 3/4 bottom inlet and top side outlet. Quarter turn or threaded fill cap with gasket seal and diaphragm to lock the top on the feeder when exposed to system pressure in the vessel.

1. Capacity: 5 gal.
2. Minimum Working Pressure: 125 psig.

2.3 CHEMICAL TREATMENT TEST EQUIPMENT

A. Test Kit: Manufacturer-recommended equipment and chemicals in a wall-mounting cabinet for testing pH, TDS, inhibitor, chloride, alkalinity, and hardness; sulfite and testable polymer tests for high-pressure boilers, and oxidizing biocide test for open cooling systems.

B. Sample Cooler:

1. Tube: Sample.

a. Size: NPS 1/4 tubing.
b. Material: ASTM A 666, Type 316 stainless steel.
c. Pressure Rating: Minimum 2000 psig.
d. Temperature Rating: Minimum 850 deg F.

2. Shell: Cooling water.

a. Material: ASTM A 666, Type 304 stainless steel.
b. Pressure Rating: Minimum 250 psig.
c. Temperature Rating: Minimum 450 deg F.

3. Capacities and Characteristics:

a. Tube: Sample.

1) Flow Rate: 0.25 gpm.
2) Entering Temperature: 400 deg F.
3) Leaving Temperature: 88 deg F.
4) Pressure Loss: 6.5 psig.

b. Shell: Cooling water.

1) Flow Rate: 3 gpm.
2) Entering Temperature: 70 deg F.
3) Pressure Loss: 1.0 psig.

C. Corrosion Test-Coupon Assembly: Constructed of corrosive-resistant material, complete with piping, valves, and mild steel and copper coupons. Locate copper coupon downstream from mild steel coupon in the test-coupon assembly.

1. Two-station rack for closed-loop systems.
2. Four-station rack for open systems.

2.4 CHEMICALS

A. Chemicals shall be as recommended by water-treatment system manufacturer that are compatible with piping system components and connected equipment, and that can attain water quality specified in Part 1 "Performance Requirements" Article.

PART 3 - EXECUTION

3.1 WATER ANALYSIS

A. Perform an analysis of supply water to determine quality of water available at Project site.

3.2 INSTALLATION

A. Install chemical application equipment on concrete bases, level and plumb. Maintain manufacturer's recommended clearances. Arrange units so controls and devices that require servicing are accessible. Anchor chemical tanks and floor-mounting accessories to substrate.

B. Install water testing equipment on wall near water chemical application equipment.

C. Install interconnecting control wiring for chemical treatment controls and sensors.

D. Mount sensors and injectors in piping circuits.

E. Bypass Feeders: Install in closed hydronic systems, including hot-water heating, chilled water, and equipped with the following:

1. Install bypass feeder in a bypass circuit around circulating pumps, unless otherwise indicated on Drawings.
2. Install water meter in makeup water supply.
3. Install test-coupon assembly in bypass circuit around circulating pumps, unless otherwise indicated on Drawings.
4. Install a gate or full-port ball isolation valves on inlet, outlet, and drain below feeder inlet.
5. Install a swing check on inlet after the isolation valve.

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

C. Make piping connections between HVAC water-treatment equipment and dissimilar-metal piping with dielectric fittings. Dielectric fittings are specified in Section "Hydronic Piping."

D. Install shutoff valves on HVAC water-treatment equipment inlet and outlet. Metal general-duty valves are specified in Section "General-Duty Valves for HVAC Piping."

E. Refer to Section "Domestic Water Piping Specialties" for backflow preventers required in makeup water connections to potable-water systems.

F. Confirm applicable electrical requirements in electrical Sections for connecting electrical equipment.

G. Ground equipment according to Section "Grounding and Bonding for Electrical Systems."

H. Connect wiring according to Section "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.

B. Perform tests and inspections and prepare test reports.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

C. Tests and Inspections:

1. Inspect field-assembled components and equipment installation, including piping and electrical connections.
2. Inspect piping and equipment to determine that systems and equipment have been cleaned, flushed, and filled with water, and are fully operational before introducing chemicals for water-treatment system.

3. Place HVAC water-treatment system into operation and calibrate controls during the preliminary phase of HVAC systems' startup procedures.
4. Do not enclose, cover, or put piping into operation until it is tested and satisfactory test results are achieved.
5. Test for leaks and defects. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
6. Leave uncovered and unconcealed new, altered, extended, and replaced water piping until it has been tested and approved. Expose work that has been covered or concealed before it has been tested and approved.
7. 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 test pressure to stand for four hours. Leaks and loss in test pressure constitute defects.
8. Repair leaks and defects with new materials and retest piping until no leaks exist.

D. Remove and replace malfunctioning units and retest as specified above.

E. At eight-week intervals following Substantial Completion, perform separate water analyses on hydronic systems to show that automatic chemical-feed systems are maintaining water quality within performance requirements specified in this Section. Submit written reports of water analysis advising Owner of changes necessary to adhere to Part 1 "Performance Requirements" Article.

F. Comply with ASTM D 3370 and with the following standards:

1. Silica: ASTM D 859.
2. Acidity and Alkalinity: ASTM D 1067.
3. Iron: ASTM D 1068.
4. Water Hardness: ASTM D 1126.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain HVAC water-treatment systems and equipment. Refer to Section "Demonstration and Training."

B. Training: Provide a "how-to-use" self-contained breathing apparatus video that details exact operating procedures of equipment.

END OF SECTION

SECTION 23 3113

METAL DUCTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Single-wall rectangular ducts and fittings.
2. Single-wall round and flat-oval ducts and fittings.
3. Sheet metal materials.
4. Duct liner.
5. Sealants and gaskets.
6. Hangers and supports.

B. Related Sections:

1. Section "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
2. Section "HVAC Casings" for factory- and field-fabricated casings for mechanical equipment.
3. Section "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.3 PERFORMANCE REQUIREMENTS

A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.

B. Structural Performance: Duct hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in “Duct Schedule” Article.

C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of the following products:

1. Liners and adhesives.
2. Sealants and gaskets.

B. LEED Submittals:

1. Product Data for Prerequisite IEQ 1: Documentation indicating that duct systems comply with ASHRAE 62.1, Section 5 - "Systems and Equipment."
2. Product Data for Prerequisite EA 2: Documentation indicating that duct systems comply with ASHRAE/IESNA 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."
3. Leakage Test Report for Prerequisite EA 2: Documentation of work performed for compliance with ASHRAE/IESNA 90.1, Section 6.4.4.2.2 - "Duct Leakage Tests."
4. Duct-Cleaning Test Report for Prerequisite IEQ 1: Documentation of work performed for compliance with ASHRAE 62.1, Section 7.2.4 - "Ventilation System Start-up."
5. Product Data for Credit IEQ 4.1: For adhesives and sealants, documentation including printed statement of VOC content.

C. Delegated-Design Submittal:

1. Sheet metal thicknesses.
2. Joint and seam construction and sealing.
3. Reinforcement details and spacing.
4. Materials, fabrication, assembly, and spacing of hangers and supports.
5. Design Calculations: Calculations for selecting hangers and supports.

1.5 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-up."

B. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

PART 2 - PRODUCTS

2.1 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.2 SINGLE-WALL ROUND AND FLAT-OVAL DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Lindab Inc.
    b. McGill AirFlow LLC.
    c. SEMCO Incorporated.
    d. Sheet Metal Connectors, Inc.

B. Flat-Oval Ducts: Indicated dimensions are the duct width (major dimension) and diameter of the round sides connecting the flat portions of the duct (minor dimension).

C. 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."

D. 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.
2. Fabricate flat-oval ducts larger than 72 inches in width (major dimension) with butt-welded longitudinal seams.

E. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.3 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G90.
2. Finishes for Surfaces Exposed to View: Mill phosphatized.

C. Factory- or Shop-Applied Antimicrobial Coating:

1. Apply to the surface of sheet metal that will form the interior surface of the duct. An untreated clear coating shall be applied to the exterior surface.
2. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.
3. Coating containing the antimicrobial compound shall have a hardness of 2H, minimum, when tested according to ASTM D 3363.
4. Surface-Burning Characteristics: Maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
5. Shop-Applied Coating Color: Black.
6. Antimicrobial coating on sheet metal is not required for duct containing liner treated with antimicrobial coating.

D. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.

E. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.4 DUCT LINER

A. Fibrous-Glass Duct Liner: Comply with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. CertainTeed Corporation; Insulation Group.
b. Johns Manville.
c. Knauf Insulation.
d. Owens Corning.

2. Maximum Thermal Conductivity:

a. Type I, Flexible: 0.27 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
b. Type II, Rigid: 0.23 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.

3. Antimicrobial Erosion-Resistant Coating: Apply to the surface of the liner that will form the interior surface of the duct to act as a moisture repellent and erosion-resistant coating. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.
4. Water-Based Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C 916.

    a. Products:

        1) Foster 85-60/85-00.
        2) Childers CP-127

    b. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
    c. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

B. Insulation Pins and Washers:

1. 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.
2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick galvanized steel, aluminum, or stainless steel; with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

C. Shop Application of Duct Liner: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 7-11, "Flexible Duct Liner Installation."

1. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.
2. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.
3. Butt transverse joints without gaps, and coat joint with adhesive.
4. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.
5. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and dimensions of standard liner make longitudinal joints necessary.
6. Apply adhesive coating on longitudinal seams in ducts with air velocity of 2500 fpm.
7. Secure liner with mechanical fasteners 4 inches from corners and at intervals not exceeding 12 inches transversely; at 3 inches from transverse joints and at intervals not exceeding 18 inches longitudinally.
8. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:

    a. Fan discharges.
    b. Intervals of lined duct preceding unlined duct.
    c. Upstream edges of transverse joints in ducts where air velocities are higher than 2500 fpm or where indicated.

9. Secure insulation between perforated sheet metal inner duct of same thickness as specified for outer shell. Use mechanical fasteners that maintain inner duct at uniform distance from outer shell without compressing insulation.
10. Terminate inner ducts with buildouts attached to fire-damper sleeves, dampers, turning vane assemblies, or other devices. Fabricated buildouts (metal hat sections) or other buildout means are optional; when used, secure buildouts to duct walls with bolts, screws, rivets, or welds.

2.5 SEALANT AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

B. Two-Part Tape Sealing System:

1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
2. Tape Width: 3 inches.
3. Sealant: Modified styrene acrylic.
4. Water resistant.
5. Mold and mildew resistant.
6. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
7. Service: Indoor and outdoor.
8. Service Temperature: Minus 40 to plus 200 deg F.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.
10. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
11. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Water-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Solids Content: Minimum 65 percent.
3. Shore A Hardness: Minimum 20.
4. Water resistant.
5. Mold and mildew resistant.
6. VOC: Maximum 75 g/L (less water).
7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
8. Service: Indoor or outdoor.
9. Substrate: Compatible with galvanized sheet steel, stainless steel, or aluminum sheets.
10. Products:

    a. Foster 32-19.
    b. Childers CP-146.

D. Solvent-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Base: Synthetic rubber resin.
3. Solvent: Toluene and heptane.

4. Solids Content: Minimum 60 percent.
5. Shore A Hardness: Minimum 60.
6. Water resistant.
7. Mold and mildew resistant.
8. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
9. VOC: Maximum 395 g/L.
10. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
11. Maximum Static-Pressure Class: 10-inch wg, positive or negative.
12. Service: Indoor or outdoor.
13. Substrate: Compatible with galvanized sheet steel, stainless steel, or aluminum sheets.
14. Products:

    a. Foster 32-14.
    b. Childers CP-140.

E. Flanged Joint Sealant: Comply with ASTM C 920.

1. General: Single-component, acid-curing, silicone, elastomeric.
2. Type: S.
3. Grade: NS.
4. Class: 25.
5. Use: O.
6. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.6 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-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. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

D. Trapeze and Riser Supports:

1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and

calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.

B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

C. Install round and flat-oval 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 "Air Duct Accessories" for fire and smoke dampers.

L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."

3.2 INSTALLATION OF EXPOSED DUCTWORK

A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.

B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.

C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.

D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.

E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.3 DUCT SEALING

A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

B. Seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":

1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
2. Unconditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class B.
3. Unconditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class A.
4. Unconditioned Space, Exhaust Ducts: Seal Class C.
5. Unconditioned Space, Return-Air Ducts: Seal Class B.
6. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class C.
7. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class A.
8. Conditioned Space, Exhaust Ducts: Seal Class B.
9. Conditioned Space, Return-Air Ducts: Seal Class C.

3.4 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Where practical, install concrete inserts before placing concrete.
2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.

C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.

D. Hangers Exposed to View: Threaded rod and angle or channel supports.

E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.

F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.5 CONNECTIONS

A. Make connections to equipment with flexible connectors complying with Section "Air Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.6 PAINTING

A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Section "Exterior Painting" and Section "Interior Painting."

3.7 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Leakage Tests:

1. Comply with SMACNA's "HVAC Air Duct Leakage Test Manual." Submit a test report for each test.
2. Test the following systems:

    a. Ducts with a Pressure Class Higher Than 3-Inch wg: Test representative duct sections, selected by Architect from sections installed, totaling no less than 25 percent of total installed duct area for each designated pressure class.
    b. Supply Ducts with a Pressure Class of 4-Inch wg or Higher: Test representative duct sections, selected by Architect from sections installed, totaling no less than 50 percent of total installed duct area for each designated pressure class.
    c. Return Ducts with a Pressure Class of 2-Inch wg or Higher: Test representative duct sections, selected by Architect from sections installed, totaling no less than 50 percent of total installed duct area for each designated pressure class.
    d. Exhaust Ducts with a Pressure Class of 2-Inch wg or Higher: Test representative duct sections, selected by Architect from sections installed, totaling no less than 50 percent of total installed duct area for each designated pressure class.
    e. Outdoor Air Ducts with a Pressure Class of 2-Inch wg or Higher: Test representative duct sections, selected by Architect from sections installed, totaling no less than 50 percent of total installed duct area for each designated pressure class.

3. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
4. Test for leaks before applying external insulation.
5. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If static-pressure classes are not indicated, test system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure.
6. Give seven days' advance notice for testing.

C. Duct System Cleanliness Tests:

1. Visually inspect duct system to ensure that no visible contaminants are present.

2. Test sections of metal duct system, chosen randomly by Owner, for cleanliness according to "Vacuum Test" in NADCA ACR, "Assessment, Cleaning and Restoration of HVAC Systems."

    a. Acceptable Cleanliness Level: Net weight of debris collected on the filter media shall not exceed 0.75 mg/100 sq. cm.

D. Duct system will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.8 DUCT CLEANING

A. Clean new and existing duct system(s) before testing, adjusting, and balancing.

B. Use service openings for entry and inspection.

1. Create new openings and install access panels appropriate for duct static-pressure class if required for cleaning access. Provide insulated panels for insulated or lined duct. Patch insulation and liner as recommended by duct liner manufacturer. Comply with Section "Air Duct Accessories" for access panels and doors.
2. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.
3. Remove and reinstall ceiling to gain access during the cleaning process.

C. Particulate Collection and Odor Control:

1. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron-size (or larger) particles.
2. When venting vacuuming system to outdoors, use filter to collect debris removed from HVAC system, and locate exhaust downwind and away from air intakes and other points of entry into building.

D. Clean the following components by removing surface contaminants and deposits:

1. Air outlets and inlets (registers, grilles, and diffusers).
2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
4. Coils and related components.
5. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.
6. Supply-air ducts, dampers, actuators, and turning vanes.
7. Dedicated exhaust and ventilation components and makeup air systems.

E. Mechanical Cleaning Methodology:

1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.

3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet. Replace fibrous-glass duct liner that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.
5. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.
6. Provide drainage and cleanup for wash-down procedures.
7. Antimicrobial Agents and Coatings: Apply EPA-registered antimicrobial agents if fungus is present. Apply antimicrobial agents according to manufacturer's written instructions after removal of surface deposits and debris.

3.9 START UP

A. Air Balance: Comply with requirements in Section "Testing, Adjusting, and Balancing for HVAC."

3.10 DUCT SCHEDULE

A. Fabricate ducts with galvanized sheet steel except as otherwise indicated and as follows:

1. Underground Ducts: Concrete-encased, stainless steel.
2. Grease exhaust ducts: Fabricate with welded black steel ductwork.
3. Other: As indicated on the drawings.

B. Supply Ducts:

1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:

    a. Pressure Class: Positive 1-inch wg.
    b. Minimum SMACNA Seal Class: B.
    c. SMACNA Leakage Class for Rectangular: 12.
    d. SMACNA Leakage Class for Round and Flat Oval: 12.

2. Ducts Connected to Variable-Air-Volume Air-Handling Units:

    a. Pressure Class: Positive 4-inch wg.
    b. Minimum SMACNA Seal Class: A.
    c. SMACNA Leakage Class for Rectangular: 3.
    d. SMACNA Leakage Class for Round and Flat Oval: 3.

3. Ducts Connected to Equipment Not Listed Above:

    a. Pressure Class: Positive 2-inch wg.
    b. Minimum SMACNA Seal Class: B.
    c. SMACNA Leakage Class for Rectangular: 12.
    d. SMACNA Leakage Class for Round and Flat Oval: 12.

C. Return Ducts:

1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:

a. Pressure Class: Positive or negative 1-inch wg.
b. Minimum SMACNA Seal Class: C.
c. SMACNA Leakage Class for Rectangular: 12.
d. SMACNA Leakage Class for Round and Flat Oval: 12.

2. Ducts Connected to Air-Handling Units:

a. Pressure Class: Positive or negative 2-inch wg.
b. Minimum SMACNA Seal Class: B.
c. SMACNA Leakage Class for Rectangular: 12.
d. SMACNA Leakage Class for Round and Flat Oval: 12.

3. Ducts Connected to Equipment Not Listed Above:

a. Pressure Class: Positive or negative 2-inch wg.
b. Minimum SMACNA Seal Class: B.
c. SMACNA Leakage Class for Rectangular: 12.
d. SMACNA Leakage Class for Round and Flat Oval: 12.

D. Exhaust Ducts:

1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:

a. Pressure Class: Negative 2-inch wg.
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: 12.

E. Intermediate Reinforcement:

1. Galvanized-Steel Ducts: Galvanized steel.

F. Liner:
1. Supply Air Ducts: Fibrous glass, Type I, 1-1/2 inches thick.
2. Return Air Ducts: Fibrous glass, Type I, 1 inch thick.
3. Transfer Ducts: Fibrous glass, Type I, 1 inch thick.

G. Elbow Configuration:

1. 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."

2. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."

a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.

1) Velocity up to 1500 fpm: 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.
2) Velocity 1500 fpm or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.

b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.
c. Round Elbows, 14 Inches and Larger in Diameter: Welded.

H. Branch Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."

a. Rectangular Main to Rectangular Branch: 45-degree entry.
b. Rectangular Main to Round Branch: Spin in.

2. Round and Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.

a. Velocity up to 2500 fpm: Conical tap.
b. Velocity 2500 fpm or Higher: 45-degree lateral.

END OF SECTION

SECTION 23 3300

AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
1. Manual volume dampers.
2. Fire dampers.
3. Flange connectors.
4. Turning vanes.
5. Duct-mounted access doors.
6. Flexible connectors.
7. Flexible ducts.
8. Duct accessory hardware.

B. Related Requirements:

1. Section "HVAC Gravity Ventilators" for roof-mounted ventilator caps.
2. Section "Digital, Addressable Fire-Alarm System" for duct-mounted fire and smoke detectors.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. LEED Submittals:

1. Product Data for Prerequisite IEQ 1: Documentation indicating that units comply with ASHRAE 62.1, Section 5 - "Systems and Equipment."
2. Product Data for Prerequisite EA 2: Documentation indicating that duct insulation R-values comply with tables in ASHRAE/IESNA 90.1, Section 6 - "Heating, Ventilating, and Air Conditioning."

1.4 INFORMATIONAL SUBMITTALS

A. Source quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fusible Links: Furnish quantity equal to 5 percent of amount installed.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTION

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

2.2 MATERIALS

A. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G90.
2. Exposed-Surface Finish: Mill phosphatized.

B. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304, and having a No. 2 finish for concealed ducts and No. 4 finish for exposed ducts.

C. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for 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.

2.3 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.
f. Trox USA Inc.
g. Vent Products Company, Inc.

2. Standard leakage rating, with linkage outside airstream.
3. Suitable for horizontal or vertical applications.
4. Frames:

a. Frame: Hat-shaped, 0.094-inch- thick, galvanized sheet steel or 0.05-inch- thick stainless steel.
b. Mitered and welded corners.
c. Flanges for attaching to walls and flangeless frames for installing in ducts.

5. Blades:

a. Multiple or single blade.
b. Parallel- or opposed-blade design.
c. Stiffen damper blades for stability.
d. Galvanized or Stainless-steel, 0.064 inch thick.

6. Blade Axles: Stainless steel.
7. Bearings:

a. Oil-impregnated bronze or Oil-impregnated stainless-steel sleeve.
b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.

8. Tie Bars and Brackets: Galvanized steel.

B. Jackshaft:

1. Size: 0.5-inch diameter.
2. Material: Galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
3. Length and Number of Mountings: As required to connect linkage of each damper in multiple-damper assembly.

C. Damper Hardware:

1. Zinc-plated, die-cast core with dial and handle made of 3/32-inch- thick zinc-plated steel, and a 3/4-inch hexagon locking nut.
2. Include center hole to suit damper operating-rod size.
3. Include elevated platform for insulated duct mounting.

2.4 FIRE DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Greenheck Fan Corporation.
2. Nailor Industries Inc.
3. Pottorff.
4. Prefco; Perfect Air Control, Inc.

5. Ruskin Company.
6. Vent Products Company, Inc.

B. Type: Static and dynamic; rated and labeled according to UL 555 by an NRTL.

C. Closing rating in ducts up to 4-inch wg static pressure class and minimum 2000-fpm velocity.

D. Fire Rating: 1-1/2 and 3 hours.

E. Frame: Curtain type with blades outside airstream; fabricated with roll-formed, 0.034-inch- thick galvanized steel; with mitered and interlocking corners.

F. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel.

1. Minimum Thickness: 0.052 inch thick (18 gauge), or gauge required to meet manufacturer's UL listing, and of length to suit application.
2. Exception: Omit sleeve where damper-frame width permits direct attachment of perimeter mounting angles on each side of wall or floor; thickness of damper frame must comply with sleeve requirements.

G. Mounting Orientation: Vertical or horizontal as indicated.

H. Blades: Roll-formed, interlocking, 0.024-inch- thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch- thick, galvanized-steel blade connectors.

I. Horizontal Dampers: Include blade lock and stainless-steel closure spring.

J. Heat-Responsive Device: Replaceable, 165 deg F rated, fusible links.

2.5 FLANGE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ductmate Industries, Inc.
2. Nexus PDQ; Division of Shilco Holdings Inc.
3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Description: Add-on or roll-formed, factory-fabricated, slide-on transverse flange connectors, gaskets, and components.

C. Material: Galvanized steel.

D. Gage and Shape: Match connecting ductwork.

2.6 TURNING VANES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ductmate Industries, Inc.
2. Duro Dyne Inc.
3. METALAIRE, Inc.

4. SEMCO Incorporated.
5. 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: Double wall.

2.7 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. Flexmaster U.S.A., Inc.
4. Greenheck Fan Corporation.
5. McGill AirFlow LLC.
6. Nailor Industries Inc.
7. Pottorff.
8. Ventfabrics, Inc.
9. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 7-2, "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. Hinges and Latches: 1-by-1-inchbutt or piano hinge and cam latches.
d. 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: Two hinges and two sash locks.
c. Access Doors up to 24 by 48 Inches: Continuous and two compression latches.
d. Access Doors Larger Than 24 by 48 Inches: Continuous and two compression latches with outside and inside handles.

2.8 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. Ventfabrics, Inc.
4. 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-inch- wide, 0.028-inch- thick, galvanized sheet steel sheets. Provide metal compatible with connected ducts.

E. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.

1. Minimum Weight: 26 oz./sq. yd..
2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
3. Service Temperature: Minus 40 to plus 200 deg F.

F. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.

1. Minimum Weight: 24 oz./sq. yd..
2. Tensile Strength: 530 lbf/inch in the warp and 440 lbf/inch in the filling.
3. Service Temperature: Minus 50 to plus 250 deg F.

G. Thrust Limits: Combination coil spring and elastomeric insert with spring and insert in compression, and with a load stop. Include rod and angle-iron brackets for attaching to fan discharge and duct.

1. Frame: Steel, fabricated for connection to threaded rods and to allow for a maximum of 30 degrees of angular rod misalignment without binding or reducing isolation efficiency.
2. Outdoor Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Elastomeric Element: Molded, oil-resistant rubber or neoprene.
7. Coil Spring: Factory set and field adjustable for a maximum of 1/4-inch movement at start and stop.

2.9 FLEXIBLE DUCTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Flexmaster U.S.A., Inc.
2. CASCO.

3. McGill AirFlow LLC.

B. Non-insulated, Flexible Duct: UL 181, Class 1, multiple layers of aluminized laminate supported by helically wound, spring-steel wire.

1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
2. Maximum Air Velocity: 4000 fpm.
3. Temperature Range: Minus 20 to plus 210 deg F.

C. Insulated, Flexible Duct: UL 181, Class 1, 2-ply spun bond nylon fabric supported by helically wound, spring-steel wire; fibrous-glass insulation; aluminized vapor-barrier film.

1. Pressure Rating: 6-inch wg positive and 1.0-inch wg negative.
2. Maximum Air Velocity: 4000 fpm.
3. Temperature Range: Minus 10 to plus 160 deg F.
4. Insulation R-value: 6.0.

D. Insulated, Flexible Metal Duct: UL 181, Class 1, flexible metal inner duct, fibrous-glass insulation; aluminized vapor-barrier film.

1. Pressure Rating: 10-inch wg positive and 4.0-inch wg negative.
2. Maximum Air Velocity: 4000 fpm.
3. Temperature Range: Minus 20 to plus 175 deg F.
4. Insulation R-Value: 6.0.

E. 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. Non-Clamp Connectors: Adhesive plus sheet metal screws.

2.10 DUCT ACCESSORY HARDWARE

A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of Pitot tube and other testing instruments and of length to suit duct-insulation thickness.

B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.

B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel ducts and stainless-steel accessories in stainless-steel ducts.

C. 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.

D. Set dampers to fully open position before testing, adjusting, and balancing.

E. Install test holes at fan inlets and outlets and elsewhere as indicated.

F. Install fire and smoke dampers according to UL listing.

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.
7. At each change in direction and at maximum 50-foot spacing.
8. Upstream and downstream from turning vanes.
9. Upstream or downstream from duct silencers.
10. Control devices requiring inspection.
11. 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 "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.

K. Install flexible connectors to connect ducts to equipment.

L. For fans developing static pressures of 5-inch wg and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.

M. Connect terminal units to supply ducts with maximum 24-inch lengths of flexible duct. Do not use flexible ducts to change directions.

N. Connect diffusers or light troffer boots to ducts with maximum 96-inch lengths of flexible duct clamped or strapped in place.

O. Connect flexible ducts to metal ducts with draw bands or adhesive plus sheet metal screws.

P. Install duct test holes where required for testing and balancing purposes.

Q. 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.

3.2 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Operate dampers to verify full range of movement.
2. Inspect locations of access doors and verify that purpose of access door can be performed.
3. Operate fire, smoke, and combination fire and smoke dampers to verify full range of movement and verify that proper heat-response device is installed.
4. Inspect turning vanes for proper and secure installation.
5. Operate remote damper operators to verify full range of movement of operator and damper.

END OF SECTION

SECTION 23 3423

HVAC POWER VENTILATORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Ceiling-mounted ventilators.

1.3 PERFORMANCE REQUIREMENTS

A. Project Altitude: Base fan-performance ratings on sea level.

B. Operating Limits: Classify according to AMCA 99.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Also include the following:

   1. Certified fan performance curves with system operating conditions indicated.
   2. Certified fan sound-power ratings.
   3. Motor ratings and electrical characteristics, plus motor and electrical accessories.
   4. Material thickness and finishes, including color charts.
   5. Dampers, including housings, linkages, and operators.
   6. Roof curbs.
   7. Fan speed controllers.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

   1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   2. Wiring Diagrams: For power, signal, and control wiring.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For power ventilators to include in emergency, operation, and maintenance manuals.

1.6 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. 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.

PART 2 - PRODUCTS

2.1 CEILING-MOUNTED VENTILATORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Carnes Company.
2. Greenheck Fan Corporation.
3. Loren Cook Company.
4. Panasonic.
5. PennBarry.

B. Housing: Steel, lined with acoustical insulation.

C. Fan Wheel: Centrifugal wheels directly mounted on motor shaft. Fan shrouds, motor, and fan wheel shall be removable for service.

D. Grille: Stainless steel or Aluminum, louvered grille with flange on intake and thumbscrew attachment to fan housing.

E. Electrical Requirements: Junction box for electrical connection on housing and receptacle for motor plug-in.

F. Accessories:

1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
2. Manual Starter Switch: Single-pole rocker switch assembly with cover and pilot light.
3. Isolation: Rubber-in-shear vibration isolators.
4. Manufacturer's standard roof jack or wall cap, and transition fittings.

G. Capacities and Characteristics: As Scheduled.

2.2 MOTORS

A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements.

2.3 SOURCE QUALITY CONTROL

A. Certify sound-power level ratings according to AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.

B. Certify fan performance ratings, including flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests according to AMCA 210, "Laboratory Methods of Testing Fans for Aerodynamic Performance Rating." Label fans with the AMCA-Certified Ratings Seal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install power ventilators level and plumb.

B. Support units using elastomeric mounts or spring isolators having a static deflection of 1 inch. Vibration- control devices are specified in Section "Vibration and Seismic Controls for HVAC Piping and Equipment."

C. Ceiling Units: Suspend units from structure; use steel wire or metal straps.

D. Install units with clearances for service and maintenance.

E. Label units according to requirements specified in Section "Identification for HVAC Piping and Equipment."

3.2 CONNECTIONS

A. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Section "Air Duct Accessories."

B. Install ducts adjacent to power ventilators to allow service and maintenance.

C. Ground equipment according to Section "Grounding and Bonding for Electrical Systems."

D. Connect wiring according to Section "Low-Voltage Electrical Power Conductors and Cables."

3.3 FIELD QUALITY CONTROL

A. 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. Remove and replace malfunctioning units and retest as specified above.

B. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Prepare test and inspection reports.

END OF SECTION

SECTION 23 3600

AIR TERMINAL UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Shutoff, single-duct air terminal units.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of the following products, including rated capacities, furnished specialties, sound-power ratings, and accessories.

   1. Air terminal units.
   2. Liners and adhesives.
   3. Sealants and gaskets.

B. LEED Submittals:

   1. Product Data for Prerequisite IEQ 1: Documentation indicating that units comply with ASHRAE 62.1, Section 5 - "Systems and Equipment."

C. Shop Drawings: For air terminal units. Include plans, elevations, sections, details, and attachments to other work.

   1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   2. Wiring Diagrams: For power, signal, and control wiring.
   3. Hangers and supports, including methods for duct and building attachment and vibration isolation.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air terminal units to include in emergency, operation, and maintenance manuals. In addition to items specified in Section "Operation and Maintenance Data," include the following:

   1. Instructions for resetting minimum and maximum air volumes.
   2. Instructions for adjusting software set points.

1.5 QUALITY ASSURANCE

A. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-Up."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible".

2.2 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.3 SHUTOFF, SINGLE-DUCT AIR TERMINAL UNITS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Carrier.
2. Environmental Technologies, Inc.
3. Krueger.
4. Nailor Industries Inc.
5. Price Industries.
6. Titus.
7. Trane.

B. Configuration: Volume-damper assembly inside unit casing with control components inside a protective metal shroud.

C. Casing: 0.034-inch steel, single wall.

1. Casing Lining: Adhesive attached, 1-inch- thick, coated, fibrous-glass duct liner complying with ASTM C 1071, and having a maximum flame-spread index of 25 and a maximum smoke-developed index of 50, for both insulation and adhesive, when tested according to ASTM E 84.

    a. Cover liner with nonporous foil.

2. Alternate Lining: Adhered, 1-inch- thick fiber-free foam, having a maximum flame-spread index of 25 and a maximum smoke-developed index of 50, for both insulation and adhesive, when tested according to ASTM E 84.
3. Air Inlet: Round stub connection or S-slip and drive connections for duct attachment.
4. Air Outlet: S-slip and drive connections.
5. Access: Removable panels for access to parts requiring service, adjustment, or maintenance; with airtight gasket.

6. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

D. Volume Damper: Galvanized steel with peripheral gasket and self-lubricating bearings.

1. Maximum Damper Leakage: ARI 880 rated, 2 percent of nominal airflow at 6-inch wg inlet static pressure.
2. Damper Position: Normally closed (fail closed or close when indexed to unoccupied mode).

E. Velocity Sensors: Multipoint array with velocity sensors in primary air inlets.

F. Attenuator Section: 0.034-inch steel sheet.

1. Lining: Adhesive attached, 1-inch- thick, coated, fibrous-glass duct liner complying with ASTM C 1071, and having a maximum flame-spread index of 25 and a maximum smoke-developed index of 50, for both insulation and adhesive, when tested according to ASTM E 84.

a. Cover liner with nonporous foil.

2. Alternate Lining: Adhered, 1-inch- thick fiber-free foam, having a maximum flame-spread index of 25 and a maximum smoke-developed index of 50, for both insulation and adhesive, when tested according to ASTM E 84.
3. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

G. Hydronic Coils: Copper tube, with mechanically bonded aluminum fins spaced no closer than 0.1 inch, and rated for a minimum working pressure of 200 psig and a maximum entering-water temperature of 220 deg F. Include manual air vent and drain valve.

H. Direct Digital Controls: Single-package unitary controller and actuator specified in Section "Instrumentation and Control for HVAC."

1. Damper Actuator: 24 V, powered closed, powered open.
2. Terminal Unit Controller: Pressure-independent, variable-air-volume controller with electronic airflow transducer with multipoint velocity sensor at air inlet, factory calibrated to minimum and maximum air volumes, and having the following features:

a. Occupied and unoccupied operating mode.
b. Remote reset of airflow or temperature set points.
c. Adjusting and monitoring with portable terminal.
d. Communication with temperature-control system specified in Section "Instrumentation and Control for HVAC."

3. Room Sensor: Wall mounted with temperature set-point adjustment and access for connection of portable operator terminal.

2.4 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

B. Air Terminal Unit Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

2.5 SOURCE QUALITY CONTROL

A. Factory Tests: Test assembled air terminal units according to ARI 880.

1. Label each air terminal unit with plan number, nominal airflow, maximum and minimum factory-set airflows, coil type, and ARI certification seal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install air terminal units according to NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems."

B. Install air terminal units level and plumb. Maintain sufficient clearance for normal service and maintenance.

C. Install wall-mounted thermostats.

3.2 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 and for slabs more than 4 inches thick.
4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes and for slabs less than 4 inches thick.

C. Hangers Exposed to View: Threaded rod and angle or channel supports.

D. 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.

3.3 CONNECTIONS

A. Install piping adjacent to air terminal unit to allow service and maintenance.

B. Hot-Water Piping: In addition to requirements in Section "Hydronic Piping" and Section “Hydronic Piping Specialties," connect heating coils to supply with shutoff valve, strainer, control valve, and union or flange; and to return with balancing valve and union or flange.

C. Connect ducts to air terminal units according to Section "Metal Ducts."

D. Make connections to air terminal units with flexible connectors complying with requirements in Section "Air Duct Accessories."

3.4 IDENTIFICATION

A. Label each air terminal unit with plan number, nominal airflow, and maximum and minimum factory-set airflows. Comply with requirements in Section "Identification for HVAC Piping and Equipment" for equipment labels and warning signs and labels.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. 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.

D. Tests and Inspections:

1. After installing air terminal units and after electrical circuitry has been energized, test for compliance with requirements.
2. Leak Test: After installation, fill water coils 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 motor rotation and unit operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

E. Air terminal unit will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

3.6 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. Verify that inlet duct connections are as recommended by air terminal unit manufacturer to achieve proper performance.
3. Verify that controls and control enclosure are accessible.
4. Verify that control connections are complete.
5. Verify that nameplate and identification tag are visible.
6. Verify that controls respond to inputs as specified.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain air terminal units.

END OF SECTION

SECTION 23 3713

DIFFUSERS, REGISTERS, AND GRILLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Perforated diffusers.
   2. Louver face diffusers.
   3. Linear bar diffusers.

B. Related Sections:

   1. Section "Operable Wall Louvers" and Section "Fixed Louvers" for fixed and adjustable louvers and wall vents, whether or not they are connected to ducts.
   2. Section "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers, registers, and grilles.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated, include the following:

   1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
   2. Diffuser, Register, and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

PART 2 - PRODUCTS

2.1 CEILING DIFFUSERS

A. Perforated Diffuser:

   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

      a. Carnes.
      b. Krueger.
      c. Nailor Industries Inc.
      d. Price Industries.
      e. Titus.

f. Tuttle & Bailey.

2. Devices shall be specifically designed for variable-air-volume flows.
3. Material: Steel backpan and pattern controllers, with steel or aluminum face.
4. Finish: Baked enamel, white unless otherwise indicated.
5. Face Size: 24 by 24 inches.
6. Duct Inlet: Round.
7. Face Style: As Scheduled.
8. Mounting: As Scheduled.
9. Pattern Controller: Four louvered deflector patches or Adjustable with louvered pattern modules at inlet.
10. Dampers: Opposed blade.

B. Louver Face Diffuser:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Carnes.
b. Krueger.
c. Nailor Industries Inc.
d. Price Industries.
e. Titus.
f. Tuttle & Bailey.

2. Devices shall be specifically designed for variable-air-volume flows.
3. Material: Steel, Aluminized Steel, or Aluminum.
4. Finish: Baked enamel, white unless otherwise indicated.
5. Face Size: As Scheduled.
6. Mounting: As Scheduled.
7. Pattern: Four-way core style.
8. Dampers: As Scheduled.

2.2 CEILING LINEAR SLOT OUTLETS

A. Linear Bar Diffuser:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Carnes.
b. Krueger.
c. Nailor Industries Inc.
d. Price Industries.
e. Titus.
f. Tuttle & Bailey.

2. Devices shall be specifically designed for variable-air-volume flows.
3. Material: Aluminum.
4. Finish: Baked enamel, white unless otherwise indicated.
5. One-Way Deflection Vanes: Extruded construction fixed louvers with removable core.
6. Frame: 3/16 inch wide.
7. Mounting: Concealed bracket or Spring clip.
8. Damper Type: Adjustable opposed-blade assembly.

2.3 SOURCE QUALITY CONTROL

A. Verification of Performance: Rate diffusers, registers, and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install diffusers, registers, and grilles level and plumb.

B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

C. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.3 ADJUSTING

A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION

SECTION 23 5216

CONDENSING BOILERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes fire-tube, trim, and accessories for generating hot water.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for boilers.
2. Include rated capacities, operating characteristics, and furnished specialties and accessories.

B. Shop Drawings: For boilers, boiler trim, and accessories.

1. Include plans, elevations, sections, and mounting details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Source quality-control reports.

B. Field quality-control reports.

C. Warranty: Special warranty specified in this Section.

D. Other Informational Submittals:

1. ASME Stamp Certification and Report: Submit "H" stamp certificate of authorization, as required by authorities having jurisdiction, and document hydrostatic testing of piping external to boiler.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For boilers to include in emergency, operation, and maintenance manuals.

1.6 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of boilers that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Fire-Tube Condensing Boilers:

a. Leakage and Materials: 10 years from date of Substantial Completion.
b. Heat Exchanger Damaged by Thermal Stress and Corrosion: Non-prorated for five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. ASME Compliance: Fabricate and label boilers to comply with 2010 ASME Boiler and Pressure Vessel Code.

C. ASHRAE/IES 90.1 Compliance: Boilers shall have minimum efficiency according to "Gas and Oil Fired Boilers - Minimum Efficiency Requirements."

D. DOE Compliance: Minimum efficiency shall comply with 10 CFR 430, Subpart B, Appendix N.

E. UL Compliance: Test boilers for compliance with UL 795. Boilers shall be listed and labeled by a testing agency acceptable to authorities having jurisdiction.

2.2 FIRE-TUBE CONDENSING BOILERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AERCO International.
2. Bosch Thermotechnology Corp.
3. Heat Transfer Products, Inc.
4. Triangle Tube

B. Description: Factory-fabricated, -assembled, and -tested, fire-tube condensing boiler with heat exchanger sealed pressure tight, including insulated jacket; flue-gas vent; combustion-air intake connections; water supply, return, and condensate drain connections; and controls. Water-heating service only.

C. Heat Exchanger: Stainless steel welded combustion chamber.

D. Burner: Natural gas, forced draft.

E. Blower: Variable speed to operate during each burner firing sequence and to pre-purge and post-purge the combustion chamber.

1. Motors: Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section "Common Motor Requirements for HVAC Equipment."

a. 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.

F. Gas Train: Combination gas valve with manual shutoff and pressure regulator.

G. Ignition: Spark ignition with 100 percent main-valve shutoff with electronic flame supervision.

H. Casing:

1. Jacket: Sheet metal, with snap-in or interlocking closures.
2. Control Compartment Enclosures: NEMA 250, Type 1A.
3. Finish: Baked-enamel or Powder-coated protective finish.
4. Insulation: Mineral-fiber insulation surrounding the heat exchanger.
5. Combustion-Air Connections: Inlet and vent duct collars.
6. Designed for wall mounting.

I. Capacities and Characteristics:

1. Heating Medium: Hot water.
2. Design Water-Pressure Rating: 30 psig.
3. Safety Relief Valve Setting: ASME-rated, manufacturer standard.
4. Entering-Water Temperature: As Scheduled.
5. Leaving-Water Temperature: As Scheduled.
6. Design Water Flow Rate: As Scheduled.
7. Minimum Water Flow Rate: As Scheduled.
8. Design Pressure Drop: As Scheduled.
9. Minimum Efficiency AFUE: As Scheduled.
10. Gas Input: As Scheduled.
11. Electrical Characteristics: As Scheduled.

2.3 CONTROLS

A. Refer to Section "Direct Digital Control (DDC) System for HVAC", Section "Instrumentation and Control for HVAC," and Section "Sequence of Operations for HVAC Controls."

B. Boiler operating controls shall include the following devices and features:

1. Control transformer.
2. Set-Point Adjust: Set points shall be adjustable.
3. Operating Pressure Control: Factory wired and mounted to cycle burner.
4. Sequence of Operation: Electronic or DDC, factory-fabricated and field-installed panel to control burner firing rate to reset supply-water temperature inversely with outside-air temperature. Provide BACnet, LonWorks, or ModBus interface to BMS.

C. Burner Operating Controls: To maintain safe operating conditions, burner safety controls limit burner operation.

1. High Cutoff: Manual reset stops burner if operating conditions rise above maximum boiler design temperature.
2. Low-Water Cutoff Switch: Electronic probe shall prevent burner operation on low water. Cutoff switch shall be manual-reset type.
3. Blocked Inlet Safety Switch: Manual-reset pressure switch field mounted on boiler combustion-air inlet.
4. Audible Alarm: Factory mounted on control panel with silence switch; shall sound alarm for above conditions.

D. Building Management System Interface: Factory install hardware and software to enable building management system (BMS) to monitor, control, and display boiler status and alarms.

1. BACnet, LonWorks, or ModBus.
2. Communication interface with BMS shall enable BMS operator to remotely control and monitor the boiler from an operator workstation. Control features available, and monitoring points displayed, locally at boiler control panel shall be available through BMS.

2.4 ELECTRICAL POWER

A. Controllers, Electrical Devices, and Wiring: Electrical devices and connections are specified in electrical Sections.

B. Single-Point Field Power Connection: Factory-installed and -wired switches, motor controllers, transformers, and other electrical devices necessary shall provide a single-point field power connection to boiler.

1. House in NEMA 250, Type 1 enclosure.
2. Wiring shall be numbered and color coded to match wiring diagram.
3. Install factory wiring outside of an enclosure in a metal raceway.
4. Field power interface shall be to non-fused disconnect switch.
5. Provide branch power circuit to each motor and to controls with a disconnect switch or circuit breaker.
6. Provide each motor with overcurrent protection.

2.5 VENTING KITS

A. Kit: Complete system, Type AL29-4C stainless steel, pipe, vent terminal, thimble, indoor plate, vent adapter, condensate trap and dilution tank, and sealant.

B. Combustion-Air Intake: Complete system, stainless steel, pipe, vent terminal with screen, inlet air coupling, and sealant.

2.6 SOURCE QUALITY CONTROL

A. Burner and Hydrostatic Test: Factory adjust burner to eliminate excess oxygen, carbon dioxide, oxides of nitrogen emissions, and carbon monoxide in flue gas and to achieve combustion efficiency; perform hydrostatic test.

B. Test and inspect factory-assembled boilers, before shipping, according to 2010 ASME Boiler and Pressure Vessel Code.

C. Allow Owner access to source quality-control testing of boilers. Notify Architect 14 days in advance of testing.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for concrete equipment bases, anchor-bolt sizes and locations, and piping and electrical connections to verify actual locations, sizes, and other conditions affecting performance of the Work.

B. Examine mechanical spaces for suitable conditions where boilers will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 BOILER INSTALLATION

A. Equipment Mounting:

1. Provide Unistrut framing assemble secured to building structural elements to support boiler.
2. Comply with requirements for vibration isolation and restraint devices specified in Section "Vibration and Seismic Controls for HVAC."

B. Install gas-fired boilers according to NFPA 54.

C. Assemble and install boiler trim.

D. Install electrical devices furnished with boiler but not specified to be factory mounted.

E. Install control wiring to field-mounted electrical devices.

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to boiler to allow service and maintenance.

C. Install piping from equipment drain connection to nearest floor drain. Piping shall be at least full size of connection. Provide acid neutralization tank.

D. Connect piping to boilers, except safety relief valve connections, with flexible connectors of materials suitable for service. Flexible connectors and their installation are specified in Section "Hydronic Piping Specialties."

E. Connect gas piping to boiler gas-train inlet with union. Piping shall be at least full size of gas-train connection. Provide a reducer if required.

F. Connect hot-water piping to supply- and return-boiler tappings with shutoff valve and union or flange at each connection.

G. Install piping from safety relief valves to nearest floor drain.

H. Boiler Venting:

1. Install flue venting kit and combustion-air intake.
2. Connect full size to boiler connections. Comply with requirements in Section "Breeching, Chimneys, and Stacks."

I. Ground equipment according to Section "Grounding and Bonding for Electrical Systems."

J. Connect wiring according to Section "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

C. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Perform installation and startup checks according to manufacturer's written instructions.
2. Leak Test: Hydrostatic test. Repair leaks and retest until no leaks exist.
3. Operational Test: Start units to confirm proper motor rotation and unit operation. Adjust air-fuel ratio and combustion.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

    a. Check and adjust initial operating set points and high- and low-limit safety set points of fuel supply, water level, and water temperature.
    b. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

D. Boiler will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

F. 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.

G. Performance Tests:

1. Engage a factory-authorized service representative to inspect component assemblies and equipment installations, including connections, and to conduct performance testing.
2. Boilers shall comply with performance requirements indicated, as determined by field performance tests. Adjust, modify, or replace equipment to comply.
3. Perform field performance tests to determine capacity and efficiency of boilers.

    a. Test for full capacity.

b. Test for boiler efficiency at low fire, 40, 60, 80, and 100 percent of full capacity. Determine efficiency at each test point.

4. Repeat tests until results comply with requirements indicated.
5. Provide analysis equipment required to determine performance.
6. Provide temporary equipment and system modifications necessary to dissipate the heat produced during tests if building systems are inadequate.
7. Notify Architect 48 hours in advance of test dates.
8. Document test results in a report and submit to Architect.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain boilers. Refer to Section "Demonstration and Training."

END OF SECTION

SECTION 23 6423

SCROLL WATER CHILLERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Packaged, air-cooled, electric-motor-driven, scroll water chillers.

B. Related Sections:

   1. Section "Refrigerant Detection and Alarm" for refrigerant monitors, alarms, supplemental breathing apparatus, and ventilation equipment interlocks.

1.3 DEFINITIONS

A. COP: Coefficient of performance. The ratio of the rate of heat removal to the rate of energy input using consistent units for any given set of rating conditions.

B. EER: Energy-efficiency ratio. The ratio of the cooling capacity given in terms of Btu/h to the total power input given in terms of watts at any given set of rating conditions.

C. IPLV: Integrated part-load value. A single number part-load efficiency figure of merit calculated per the method defined by ARI 550/590 and referenced to ARI standard rating conditions.

D. kW/Ton: The ratio of total power input of the chiller in kilowatts to the net refrigerating capacity in tons at any given set of rating conditions.

E. NPLV: Nonstandard part-load value. A single number part-load efficiency figure of merit calculated per the method defined by ARI 550/590 and intended for operating conditions other than the ARI standard rating conditions.

1.4 ACTION SUBMITTALS

A. Product Data: Include refrigerant, rated capacities, operating characteristics, furnished specialties, and accessories.

   1. Performance at ARI standard unloading conditions.
   2. Minimum evaporator flow rate.
   3. Refrigerant capacity of water chiller.
   4. Oil capacity of water chiller.
   5. Fluid capacity of evaporator.

6. Fluid capacity of condenser.
7. Characteristics of safety relief valves.

B. LEED Submittals:

1. Product Data for Credit EA 4: Documentation indicating that equipment and refrigerants comply.

C. Shop Drawings: Complete set of manufacturer's prints of water chiller assemblies, control panels, sections and elevations, and unit isolation. Include the following:

1. Assembled unit dimensions.
2. Weight and load distribution.
3. Required clearances for maintenance and operation.
4. Size and location of piping and wiring connections.
5. Wiring Diagrams: For power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Floor 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. Structural supports.
2. Piping roughing-in requirements.
3. Wiring roughing-in requirements, including spaces reserved for electrical equipment.
4. Access requirements, including working clearances for mechanical controls and electrical equipment, and tube pull and service clearances.

B. Certificates: For certification required in "Quality Assurance" Article.

C. Source quality-control test reports.

D. Startup service reports.

E. Warranty: Sample of special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For each water chiller to include in emergency, operation, and maintenance manuals.

1.7 QUALITY ASSURANCE

A. ARI Certification: Certify chiller according to ARI 590 certification program.

B. ARI Rating: Rate water chiller performance according to requirements in ARI 550/590, "Water Chilling Packages Using the Vapor Compression Cycle."

C. ASHRAE Compliance: ASHRAE 15 for safety code for mechanical refrigeration.

D. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

E. ASME Compliance: Fabricate and stamp water chiller heat exchangers to comply with ASME Boiler and Pressure Vessel Code.

F. Comply with NFPA 70.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Ship water chillers from the factory fully charged with refrigerant and filled with oil.

B. Package water chiller for export shipping.

1.9 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

B. Coordinate sizes, locations, and anchoring attachments of structural-steel support structures.

C. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of water chillers that fail in materials or workmanship within specified period.

1. Compressor Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PACKAGED AIR-COOLED WATER CHILLERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Carrier Corporation; a United Technologies company.
2. McQuay International.
3. Trane.
4. York International Corporation.

B. Description: Factory-assembled and run-tested water chiller complete with base and frame, condenser casing, compressors, compressor motors and motor controllers, evaporator, condenser coils, condenser fans and motors, electrical power, controls, and accessories.

C. Fabricate base, frame, and attachment to water chiller components strong enough to resist movement when water chiller base is anchored to field support structure.

D. Cabinet:

1. Base: Galvanized-steel base extending the perimeter of water chiller. Secure frame, compressors, and evaporator to base to provide a single-piece unit.
2. Frame: Rigid galvanized-steel frame secured to base and designed to support cabinet, condenser, control panel, and other chiller components not directly supported from base.
3. Casing: Galvanized steel.
4. Finish: Coat base, frame, and casing with a corrosion-resistant coating capable of withstanding a 500-hour salt-spray test according to ASTM B 117.
5. Sound-reduction package consisting of the following:

    a. Acoustic enclosure around compressors.
    b. Reduced-speed fans with acoustic treatment.
    c. Designed to reduce sound level without affecting performance.

6. Security Package: Provide security grilles with fasteners for additional protection of compressors, evaporator, and condenser coils. Grilles shall be coated for corrosion resistance and shall be removable for service access.

E. Compressors:

1. Description: Positive-displacement direct drive with hermetically sealed casing.
2. Each compressor provided with suction and discharge service valves, crankcase oil heater, and suction strainer.
3. Operating Speed: Nominal 3600 rpm for 60-Hz applications.
4. Capacity Control: On-off compressor cycling, plus hot-gas bypass – digital scroll compressors.
5. Oil Lubrication System: Automatic pump with strainer, sight glass, filling connection, filter with magnetic plug, and initial oil charge.
6. Vibration Isolation: Mount individual compressors on vibration isolators.

F. Compressor Motors:

1. Hermetically sealed and cooled by refrigerant suction gas.
2. High-torque, two-pole induction type with inherent thermal-overload protection on each phase.

G. Compressor Motor Controllers:

1. Across the Line: NEMA ICS 2, Class A, full voltage, non-reversing.

H. Refrigeration:

1. Refrigerant: R-410a. Classified as Safety Group A1 according to ASHRAE 34.
2. Refrigerant Compatibility: Parts exposed to refrigerants shall be fully compatible with refrigerants, and pressure components shall be rated for refrigerant pressures.
3. Refrigerant Circuit: Each circuit shall include a thermal-expansion valve, refrigerant charging connections, a hot-gas muffler, compressor suction and discharge shutoff valves, a liquid-line shutoff valve, a replaceable-core filter-dryer, a sight glass with moisture indicator, a liquid-line solenoid valve, and an insulated suction line.
4. Refrigerant Isolation: Factory install positive shutoff isolation valves in the compressor discharge line and the refrigerant liquid-line to allow the isolation and storage of the refrigerant charge in the chiller condenser.

I. Evaporator:

1. Brazed Plate:

a. Direct-expansion, single-pass, brazed-plate design.
b. Type 316 stainless-steel construction.
c. Code Compliance: Tested and stamped according to ASME Boiler and Pressure Vessel Code.
d. Fluid Nozzles: Terminate with mechanical-coupling end connections for connection to field piping.

2. Heater: Factory-installed and -wired electric heater with integral controls designed to protect the evaporator to minus 20 deg F.
3. Remote Mounting: Designed for remote field mounting where indicated. Provide kit for field installation.

J. Air-Cooled Condenser:

1. Plate-fin coil with integral sub-cooling on each circuit, rated at 450 psig.

a. Construct coils of copper tubes mechanically bonded to aluminum or copper fins.
b. Hail Protection: Provide condenser coils with louvers, baffles, or hoods to protect against hail damage.

2. Fans: Direct-drive propeller type with statically and dynamically balanced fan blades, arranged for vertical air discharge.
3. Fan Motors: Totally enclosed non-ventilating (TENV) or totally enclosed air over (TEAO) enclosure, with permanently lubricated bearings, and having built-in overcurrent- and thermal-overload protection.
4. Fan Guards: Steel safety guards with corrosion-resistant coating.

K. Electrical Power:

1. Factory-installed and -wired switches, motor controllers, transformers, and other electrical devices necessary shall provide a single-point field power connection to water chiller.
2. House in a unit-mounted, NEMA 250, Type 4 enclosure with hinged access door with lock and key or padlock and key.
3. Wiring shall be numbered and color-coded to match wiring diagram.
4. Install factory wiring outside of an enclosure in a raceway.
5. Field power interface shall be to NEMA KS 1, heavy-duty, nonfused disconnect switch.
6. Provide branch power circuit to each motor and to controls with one of the following disconnecting means:

a. NEMA KS 1, heavy-duty, fusible switch with rejection-type fuse clips rated for fuses. Select and size fuses to provide Type 2 protection according to IEC 60947-4-1.
b. NEMA KS 1, heavy-duty, nonfusible switch.
c. NEMA AB 1, motor-circuit protector (circuit breaker) with field-adjustable, short-circuit trip coordinated with motor locked-rotor amperes.

7. Provide each motor with overcurrent protection.
8. Overload relay sized according to UL 1995, or an integral component of water chiller control microprocessor.
9. Phase-Failure and Undervoltage: Solid-state sensing with adjustable settings.
10. Provide power factor correction capacitors to correct power factor to 0.90 at full load.
11. Transformer: Unit-mounted transformer with primary and secondary fuses and sized with enough capacity to operate electrical load plus spare capacity.

a. Power unit-mounted controls where indicated.

b. Power unit-mounted, ground fault interrupt (GFI) duplex receptacle.

12. Control Relays: Auxiliary and adjustable time-delay relays.
13. Indicate the following for water chiller electrical power supply:

a. Current, phase to phase, for all three phases.
b. Voltage, phase to phase and phase to neutral for all three phases.
c. Three-phase real power (kilowatts).
d. Three-phase reactive power (kilovolt amperes reactive).
e. Power factor.
f. Running log of total power versus time (kilowatt hours).
g. Fault log, with time and date of each.

L. Controls:

1. Stand-alone, microprocessor based.
2. Enclosure: Share enclosure with electrical power devices or provide a separate enclosure of matching construction.
3. Operator Interface: Keypad or pressure-sensitive touch screen. Multiple-character, backlit, liquid-crystal display or light-emitting diodes. Display the following:

a. Date and time.
b. Operating or alarm status.
c. Operating hours.
d. Outside-air temperature if required for chilled-water reset.
e. Temperature and pressure of operating set points.
f. Entering and leaving temperatures of chilled water.
g. Refrigerant pressures in evaporator and condenser.
h. Saturation temperature in evaporator and condenser.
i. No cooling load condition.
j. Elapsed time meter (compressor run status).
k. Pump status.
l. Antirecycling timer status.
m. Percent of maximum motor amperage.
n. Current-limit set point.
o. Number of compressor starts.

4. Control Functions:

a. Manual or automatic startup and shutdown time schedule.
b. Entering and leaving chilled-water temperatures, control set points, and motor load limit. Chilled-water leaving temperature shall be reset based on outside-air temperature.
c. Current limit and demand limit.
d. External water chiller emergency stop.
e. Antirecycling timer.
f. Automatic lead-lag switching.

5. Manual-Reset Safety Controls: The following conditions shall shut down water chiller and require manual reset:

a. Low evaporator pressure or high condenser pressure.
b. Low chilled-water temperature.
c. Refrigerant high pressure.
d. High or low oil pressure.

e. High oil temperature.
f. Loss of chilled-water flow.
g. Control device failure.

6. Building Automation System Interface: Factory-installed hardware and software to enable building automation system to monitor, control, and display water chiller status and alarms.

a. ASHRAE 135 (BACnet), LonTalk, or Modbus communication interface with building automation system shall enable building automation system operator to remotely control and monitor the water chiller from an operator workstation. Control features and monitoring points displayed locally at water chiller control panel shall be available through building automation system.

M. Insulation:

1. Material: Closed-cell, flexible elastomeric, thermal insulation complying with ASTM C 534, Type I, for tubular materials and Type II, for sheet materials.
2. Thickness: 3/4 inch.
3. Factory-applied insulation over cold surfaces of water chiller components.

a. Adhesive: As recommended by insulation manufacturer and applied to 100 percent of insulation contact surface. Seal seams and joints.

4. Apply protective coating to exposed surfaces of insulation.

N. Accessories:

1. Factory-furnished, chilled-water flow switches for field installation.
2. Individual compressor suction and discharge pressure gages with shutoff valves for each refrigeration circuit.
3. Factory-furnished spring isolators for field installation.

O. Capacities and Characteristics: As Scheduled.

1. Low Ambient Operation: Chiller designed for operation to 0 deg F.
2. High Ambient Operation: Chiller designed for operation to 115 deg F.
3. Evaporator Configuration: Integral to chiller.
4. Evaporator Fluid Type: Water.
5. Evaporator Fouling Factor: 0.00025 sq. ft. x h x deg F/Btu.
6. Controls Power Connection: Fed through integral transformer.
7. Noise Rating: 95 dBA at 100 feet when measured according to ARI 370.

2.2 SOURCE QUALITY CONTROL

A. Perform functional test of water chillers before shipping.

B. Factory performance test water chillers, before shipping, according to ARI 550/590, "Water Chilling Packages Using the Vapor Compression Cycle."

1. Allow Owner access to place where water chillers are being tested. Notify Architect 14 days in advance of testing.

C. Factory test and inspect evaporator according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1. Stamp with ASME label.

D. For water chillers located outdoors, rate sound power level according to ARI 370 procedure.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Before water chiller installation, examine roughing-in for equipment support, anchor-bolt sizes and locations, piping, and electrical connections to verify actual locations, sizes, and other conditions affecting water chiller performance, maintenance, and operations.

1. Water chiller locations indicated on Drawings are approximate. Determine exact locations before roughing-in for piping and electrical connections.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 WATER CHILLER INSTALLATION

A. Install water chillers on support structure indicated.

B. Maintain manufacturer's recommended clearances for service and maintenance.

C. Charge water chiller with refrigerant if not factory charged and fill with oil if not factory installed.

D. Install separate devices furnished by manufacturer and not factory installed.

3.3 CONNECTIONS

A. Comply with requirements in Section "Hydronic Piping" and Section “Hydronic Piping Specialties." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to chiller to allow service and maintenance.

C. Evaporator Fluid Connections: Connect to evaporator inlet with shutoff valve, strainer, flexible connector, thermometer, and plugged tee with pressure gage. Connect to evaporator outlet with shutoff valve, balancing valve, flexible connector, flow switch, thermometer, plugged tee with pressure gage, flow meter, and drain connection with valve. Make connections to water chiller with a union, flange, or mechanical coupling.

D. Refrigerant Pressure Relief Valve Connections: For water chillers installed indoors, extend vent piping to the outside without valves or restrictions. Comply with ASHRAE 15.

E. Connect each drain connection with a union and drain pipe and extend pipe, full size of connection, to floor drain. Provide a shutoff valve at each connection if required.

3.4 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

B. Inspect field-assembled components, equipment installation, and piping and electrical connections for proper assemblies, installations, and connections.

C. Complete installation and startup checks according to manufacturer's written instructions and perform the following:

1. Verify that refrigerant charge is sufficient and water chiller has been leak tested.
2. Verify that pumps are installed and functional.
3. Verify that thermometers and gages are installed.
4. Operate water chiller for run-in period.
5. Check bearing lubrication and oil levels.
6. Verify that refrigerant pressure relief device for chillers installed indoors is vented outside.
7. Verify proper motor rotation.
8. Verify static deflection of vibration isolators, including deflection during water chiller startup and shutdown.
9. Verify and record performance of chilled-water flow and low-temperature interlocks.
10. Verify and record performance of water chiller protection devices.
11. Test and adjust controls and safeties. Replace damaged or malfunctioning controls and equipment.

D. Prepare a written startup report that records results of tests and inspections.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain water chillers.

END OF SECTION

SECTION 23 7343.16

OUTDOOR, SEMI-CUSTOM AIR-HANDLING UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes outdoor, semi-custom air-handling units that are factory assembled using multiple section components, including:

1. Unit casings.
2. Fan, drive, and motor section.
3. Coil section.
4. Air filtration section.
5. Dampers.
6. Air-to-air energy recovery units.
7. Roof curbs.
8. Intake and relief air openings.

1.3 ACTION SUBMITTALS

A. Product Data: For each air-handling unit.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
3. Include unit dimensions and weight.
4. Include cabinet material, metal thickness, finishes, insulation, and accessories.
5. Fans:

    a. Include certified fan-performance curves with system operating conditions indicated.
    b. Include certified fan-sound power ratings.
    c. Include fan construction and accessories.
    d. Include motor ratings, electrical characteristics, and motor accessories.

6. Include certified coil-performance ratings with system operating conditions indicated.
7. Include certified coil-performance ratings with system operating conditions indicated.
8. Include dampers, including housings, linkages, and operators.

B. Sustainable Design Submittals:

1. <Double click to insert sustainable design text for ASHRAE 62.1.>

2. <Double click to insert sustainable design text for AHU filter performance.>
3. <Double click to insert sustainable design text for adhesives, mastics, and sealants submittals.>

C. Shop Drawings: For each outdoor, semi-custom air-handling unit.

1. Include plans, elevations, sections, and mounting details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Detail fabrication and assembly of outdoor, semi-custom air-handling units, as well as procedure and diagrams.
4. Include diagrams for power, signal, and control wiring.

D. Delegated-Design Submittal: For vibration isolation indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Include design calculations for selecting vibration isolators and for designing vibration isolation bases.

1.4 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For manufacturer's warranty.

B. Product Certificates: Submit certification that specified equipment will withstand wind forces identified in "Performance Requirements" Article and in Section 230548 "Vibration and Seismic Controls for HVAC."

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculations.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of wind force and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Source quality-control reports.

D. Startup service reports.

E. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air-handling units to include in emergency, operation, and maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Filters: One spare set(s) for each air-handling unit, each type filter.

1.7 WARRANTY

A. Warranty: Manufacturer agrees to repair or replace components of outdoor, semi-custom, air-handling unit that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Entire Unit: Manufacturer's standard but not less than one year from date of Substantial Completion.
2. Warranty Period for Heat Wheels: Not less than five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. NFPA Compliance: Comply with NFPA 90A for design, fabrication, and installation of air-handling units and components.

C. ASHRAE 62.1 Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

D. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

E. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design vibration isolation, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

F. Structural Performance:

1. Casing Panels: Self-supporting and capable of withstanding positive/negative 8-inch wg internal static pressure, without exceeding a midpoint deflection of 0.0042 inch/inch of panel span.
2. Floor and Roof Panels: Self-supporting and capable of withstanding 300-lb static load at midspan, without exceeding a midpoint deflection of 0.0042 inch/inch.
3. Roof Panels: Self-supporting and capable of withstanding a static snow load of 30 lb/sq. ft., without exceeding a midpoint deflection of 0.0042 inch/inch.

G. Casing Leakage Performance: ASHRAE 111, Class 6 leakage or better at plus or minus 8-inch wg.

2.2 CAPACITIES AND CHARACTERISTICS – See schedule for additional information.

A. Supply Fan: As scheduled and indicated below.

1. Type: SWSI, airfoil unhoused centrifugal fan.

2. Drive: Direct.

3. Fan Discharge Sound Power, dB:

a. 1st Octave: <**Insert value**>.
b. 2nd Octave: <**Insert value**>.
c. 3rd Octave: <**Insert value**>.
d. 4th Octave: <**Insert value**>.
e. 5th Octave: <**Insert value**>.
f. 6th Octave: <**Insert value**>.
g. 7th Octave: <**Insert value**>.
h. 8th Octave: <**Insert value**>.

B. Return Fan: As scheduled and indicated below.

1. Type: SWSI, airfoil unhoused centrifugal plenum fan.
2. Drive: Direct.

3. Fan Inlet Sound Power, dB:

a. 1st Octave: <**Insert value**>.
b. 2nd Octave: <**Insert value**>.
c. 3rd Octave: <**Insert value**>.
d. 4th Octave: <**Insert value**>.
e. 5th Octave: <**Insert value**>.
f. 6th Octave: <**Insert value**>.
g. 7th Octave: <**Insert value**>.
h. 8th Octave: <**Insert value**>.

C. Exhaust Fan: As scheduled and indicated below.

1. Type: SWSI, airfoil unhoused centrifugal plenum fan.
2. Drive: Direct.

3. Fan Inlet Sound Power, dB:

a. 1st Octave: <**Insert value**>.
b. 2nd Octave: <**Insert value**>.
c. 3rd Octave: <**Insert value**>.
d. 4th Octave: <**Insert value**>.
e. 5th Octave: <**Insert value**>.
f. 6th Octave: <**Insert value**>.
g. 7th Octave: <**Insert value**>.
h. 8th Octave: <**Insert value**>.

D. Cooling Coil: As scheduled and indicated below.
1. Maximum Face Velocity: 350 fpm (m/s).
2. Maximum Air-Side, Static-Pressure Drop: 1 inches wg (Pa).
3. Fin Spacing: Maximum 10 fins per inch (per mm).
4. Water:
a. Maximum Water Pressure Drop: 10 feet of head (kPa).

E. Outside air and return filters:

1. Type: Pleated disposable.

2. Depth: 2-inches .
3. Initial Resistance: 0.15 inches wg .
4. Recommended Final Resistance: 0.75 inches wg .
5. Minimum Efficiency Reporting Value and Average Arrestance:

    a. MERV Rating: MERV 4, and corresponding average arrestance according to ASHRAE 52.2.

F. Final Filters:

1. Type: Pleated disposable
2. Depth: 4-inches.
3. Maximum or Rated Face Velocity: 400 fpm .
4. Initial Resistance: 0.25 inches wg.
5. Recommended Final Resistance: 1 inches wg.
6. Minimum Efficiency Reporting Value:

    a. MERV Rating: MERV 13, according to ASHRAE 52.2.

G. Dampers: Exhaust, Outside air, Return, and Mixing.

H. Air-to-Air Energy Recovery: As scheduled and indicated below.

2.3 MANUFACTURERS – As scheduled or approved equal.

2.4 UNIT CASINGS

A. Frame: Modular and providing overall structural integrity without reliance on casing panels for structural support.

B. Base Rail:

1. Material: **Welded structural steel**.
2. Height: 12 **inches**.

C. Casing Joints: Hermetically sealed at each corner and around entire perimeter.

D. Double-Wall Construction:

1. Outside Casing Wall:

    a. Material, Galvanized Steel: Minimum **18 gauge** thick.
    b. Material, Aluminum: Minimum **16 gauge** thick.
    c. Material, Stainless Steel: Minimum **18 gauge** thick.
    d. Factory Finish: Provide **manufacturer's standard finish**.

2. Inside Casing Wall:

    a. Material, Galvanized Steel: **Solid, 18 gauge** thick.
    b. Material, Aluminum: **Solid**, minimum **16 gauge** thick.
    c. Material, Stainless Steel: **Solid**, minimum **18 gauge** thick.
    d. Antimicrobial Coating: Applied during the manufacturing process. [**EPA approved**] [**NSF approved**] [**FDA listed**].

E. Floor Plate:

1. Material: Galvanized steel, minimum **14 gauge** thick.
2. Material: Aluminum, minimum **12 gauge** thick.
3. Material: Stainless steel, minimum **14 gauge** thick.
4. Antimicrobial Coating: Applied during the manufacturing process. [**EPA approved**] [**NSF approved**] [**FDA listed**].

F. Roof: Cross-broken and pitched with "C" caps over joints to provide watertight seal.

G. Piping Vestibule: Insulated with same insulation and thickness as casing, [**18 inches (450 mm)**] [**24 inches (600 mm)**] [**30 inches (750 mm)**] <**Insert dimension**> deep by full width of piping connections.

H. Casing Insulation:

1. Materials: I**njected polyurethane foam insulation**.
2. Casing Panel R-Value: Minimum [**R-6.5**] [**R-11**] [**R-13**] <**Insert value**>.
3. Insulation Thickness: **2 inches**.
4. Thermal Break: Provide continuity of insulation with no through-casing metal in casing walls, floors, or roofs of air-handling unit.

I. Airstream Surfaces: Surfaces in contact with airstream shall comply with requirements in ASHRAE 62.1.

J. Static-Pressure Classifications:

1. For Unit Sections Upstream of Fans: Minus **6-inch wg**.
2. For Unit Sections Downstream and Including Fans: **6-inch wg**.

K. Panels, Doors, and Windows:

1. Panels:

a. Fabrication: Formed and reinforced, double-wall and insulated panels of same materials and thicknesses as casing.
b. Fasteners: Two or more camlock type for panel lift-out operation. Arrangement shall allow panels to be opened against airflow
c. Gasket: Neoprene, applied around entire perimeters of panel frames.

2. Doors:

a. Fabrication: Formed and reinforced, double-wall and insulated panels of same materials and thicknesses as casing.
b. Hinges: A minimum of two ball-bearing hinges or stainless-steel piano hinge and two wedge-lever latches, operable from inside and outside. Arrange doors to be opened against airflow. Provide safety latch retainers on doors so that doors do not open uncontrollably.
c. Gasket: Neoprene, applied around entire perimeters of panel frames.
d. Size: Large enough to allow for unobstructed access for inspection and maintenance of air-handling unit's internal components. At least **18 inches** wide by full height of unit casing up to a maximum height of **60 inches**.

3. Windows:

a. Construction: Fabricate windows in access panels and doors of double-glazed, safety glass with an airspace between panes and sealed with interior and exterior rubber seals.
b. Size: Minimum **6 inches**, square or round.

4. Locations and Applications:

a. Fan Section: Doors**, with windows**.
b. Coil Section: Panels.
c. Access Sections Immediately Upstream and Downstream of Coil Sections: Doors**, with windows**.
d. Damper Section: Doors[**, with windows**].
e. Filter Section: **Doors** large enough to allow periodic removal and installation of filters.
f. Access Sections Immediately **Upstream** of Filter Sections: **Doors, with windows**.
g. Mixing Section: **Doors, with windows**.

5. Service Lights: **LED** vaporproof luminaire with individual switched junction box located **outside**, adjacent to each access door and panel.

a. Locations: **Each section accessed with door or panel**.

6. Convenience Outlets: One 20-A duplex GFCI receptacle per location with junction box located on outside casing wall.

a. Locations: **Fan section**.

L. Condensate Drain Pans:

1. Location: C**ooling coil** and **heat wheel**.
2. Construction:
a. Double-wall, **stainless-steel** sheet with space between walls filled with foam insulation and moisture-tight seal.

3. Drain Connection:

a. Located at lowest point of pan and sized to prevent overflow. Terminate with threaded nipple on **both ends** of pan.
b. Minimum Connection Size: **NPS 2**.

4. Slope: Minimum **0.125-in./ft.** slope**, to comply with ASHRAE 62.1,** in at least two planes to collect condensate from cooling coils (including coil piping connections, coil headers, and return bends) and from humidifiers and to direct water toward drain connection.
5. Length: Extend drain pan downstream from leaving face **for distance to comply with ASHRAE 62.1**.
6. Width: Entire width of water producing device.
7. Depth: A minimum of **2 inches** deep.
8. Units with stacked coils shall have an intermediate drain pan to collect condensate from top coil.

2.5 FAN, DRIVE, AND MOTOR SECTION

A. Fan and Drive Assemblies: Statically and dynamically balanced and designed for continuous operation at maximum-rated fan speed and motor horsepower.

B. Fans: Centrifugal, rated according to AMCA 210; galvanized steel; mounted on solid-steel shaft.

1. Shafts: With field-adjustable alignment.

    a. Turned, ground, and polished hot-rolled steel with keyway.

2. Shaft Bearings:
    a. Grease-Lubricated Bearings: Self-aligning, pillow-block-type, ball or roller bearings with adapter mount and two-piece, cast-iron housing[**with grease lines extended to outside unit**] and an [**L-50**] <**Insert bearing life rating**> rated life of [**200,000**] <**Insert number**>.
3. Plenum Fan Arrays: [**Contained**] [**Uncontained**] as defined in AHRI 430. Steel or aluminum frame with inlet cone and structural framing around each fan built into an array of multiple fans. Provide [**backdraft**] [**motorized**] dampers at each fan to prevent short circuiting of flow if one fan is not operating.
4. Backward-Inclined, Centrifugal Fan Wheels: Construction with curved inlet flange, backplate, backward-inclined blades welded or riveted to flange and backplate; [**steel**] [**aluminum**] hub riveted to backplate and fastened to shaft with setscrews.
5. Forward-Curved, Centrifugal Fan Wheels: Inlet flange, backplate, and shallow blades with inlet and tip curved forward in direction of airflow and mechanically fastened to flange and backplate; [**steel**] [**aluminum**] hub swaged to backplate and fastened to shaft with setscrews.
6. Airfoil, Centrifugal Fan Wheels (Plenum Fan Wheels): Smooth-curved inlet flange, backplate, and hollow die-formed airfoil-shaped blades continuously welded at tip flange and backplate; steel hub riveted to backplate and fastened to shaft with setscrews.
7. Mounting: For internal vibration isolation. Factory-mount fans with manufacturer's standard vibration isolation mounting devices having a minimum static deflection of **1 inch**.
8. Shaft Lubrication Lines: Extended to a location outside the casing.

C. Drive, Direct: Factory-mounted, direct drive.

D. Motors:

1. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors.
2. 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.
3. Unusual Service Conditions:

    a. Ambient Temperature: <**Insert deg C**>.
    b. Altitude: 6200 **feet** above sea level.
    c. High humidity.

4. Efficiency: Premium efficient as defined in NEMA MG 1.
5. Mount unit-mounted disconnect switches on **interior** of unit.

E. Variable-Frequency Motor Controller: Provide for each fan individually in fan array and comply with Section 262923 "Variable-Frequency Motor Controllers."

2.6 COIL SECTION

A. General Requirements for Coil Section:

1. Comply with AHRI 410.
2. Fabricate coil section to allow removal and replacement of coil for maintenance and to allow in-place access for service and maintenance of coil(s).
3. For multizone units, provide air deflectors and air baffles to balance airflow across coils.
4. Coils shall not act as structural component of unit.

B. Cooling Coils:

1. Chilled-Water Coil: [**Continuous circuit**] [**Self-draining**] [**Cleanable**].

a. Piping Connections: **Flanged**, **same end** of coil.
b. Tube Material: **Copper**.
c. Fin Type: Plate.
d. Fin Material: **Aluminum**.
e. Fin and Tube Joint: **Mechanical bond**.
f. Headers:
1) Seamless copper tube with brazed joints, prime coated.

g. Frames: Channel frame, **0.0625-inch- thick, stainless steel**.
h. Coatings: **None**.

2.7 AIR FILTRATION SECTION

A. Particulate air filtration is specified in Section 234100 "Particulate Air Filtration."

B. High-efficiency particulate air (HEPA) filtration is specified in Section 234133 "High-Efficiency Particulate Air Filtration."

C. Gas-phase air filtration is specified in Section 234200 "Gas-Phase Air Filtration."

D. Panel Filters:

1. Description: **Pleated** factory-fabricated, self-supported, disposable air filters with holding frames.
2. Filter Unit Class: UL 900.
3. Media: Interlaced glass, synthetic, or cotton fibers coated with nonflammable adhesive.
4. Filter-Media Frame: **Beverage board** with perforated metal retainer, or metal grid, on outlet side.

E. Adhesive, Sustainability Projects: As recommended by air-filter manufacturer and with a VOC content of 80 g/L or less.

F. Side-Access Filter Mounting Frames:

1. Particulate Air Filter Frames: Match inner casing and outer casing material, and insulation thickness. **Galvanized steel** or **Aluminum** track.
a. Sealing: Incorporate positive-sealing device to ensure seal between gasketed material on channels to seal top and bottom of filter cartridge frames to prevent bypass of unfiltered air.

2.8 DAMPERS

A. Dampers: Comply with requirements in Section 230923.12 "Control Dampers."

B. Outdoor- Relief- and Return-Air Dampers: Low-leakage, double-skin, airfoil-blade, **aluminum** dampers with compressible jamb seals and extruded-vinyl blade edge seals in **opposed**-blade arrangement with **zinc-replated** steel operating rods rotating in **sintered bronze or nylon** bearings mounted in a single **aluminum** frame, and with operating rods connected with a common linkage. Leakage rate shall not exceed **8 cfm/sq. ft. at 4-inch wg** .

C. Electronic Damper Operators:

1. Direct-coupled type designed for minimum 60,000 full-stroke cycles at rated torque.
2. Electronic damper position indicator shall have visual scale indicating percent of travel and 2- to 10-V dc, feedback signal.
3. Operator Motors:

    a. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
    b. Size to operate with sufficient reserve power to provide smooth modulating action or two-position action.
    c. Permanent Split-Capacitor or Shaded-Pole Type: Gear trains completely oil immersed and sealed. Equip spring-return motors with integral spiral-spring mechanism in housings designed for easy removal for service or adjustment of limit switches, auxiliary switches, or feedback potentiometer.
4. Overload Protection: Electronic overload or digital rotation-sensing circuitry.
5. Fail-Safe Operation: Mechanical, spring-return mechanism with external, manual gear release on nonspring-return actuators.

D. Mixing Section: Multiple-blade, air-mixer assembly located immediately downstream of mixing section.

E. Combination Filter and Mixing Section:

1. Cabinet support members shall hold [**2-inch- (50-mm-)**] <**Insert dimension**> thick, pleated, flat, permanent or throwaway filters.
2. Multiple-blade, air-mixer assembly shall mix air to prevent stratification, located immediately downstream of mixing box.

2.9 AIR-TO-AIR ENERGY RECOVERY UNITS

A. Heat Wheels:

1. Casing:

    a. Galvanized steel, stainless steel, or aluminum with manufacturer's standard factory finish.
    b. Integral purge section limiting carryover of exhaust air to between **0.05 percent at 1.6-inch wg and 0.20 percent at 4-inch wg** differential pressure.
    c. Casing seals on periphery of rotor, on duct divider, and on purge section.
    d. Support vertical rotors on grease-lubricated ball bearings with extended grease fittings. Mount horizontal rotors on tapered roller bearing.

2. Rotor, Aluminum or Polymer: Segmented wheel, strengthened with radial spokes[**, with nontoxic, noncorrosive, silica-gel desiccant coating**].

3. Rotor - Aluminum, Metallic, or Polymer: Segmented wheel, strengthened with radial spokes impregnated with nonmigrating, water-selective, 3-angstrom molecular-sieve desiccant coating.
4. Drive: Fractional horsepower motor and gear reducer[**, with speed changed by variable-frequency controller**]. Permanently lubricated wheel bearings with an [**L-10**] <**Insert bearing life**> [**400,000 hours**] <**Insert hours**>.
5. Controls:

    a. Starting relay, factory mounted and wired, and manual motor starter for field wiring.
    b. Variable-frequency controller, factory mounted and wired, permitting input of field connected 4- to 20-mA or 1- to 10-V control signal.
    c. Variable-frequency controller, factory mounted and wired, with exhaust-air sensor to vary rotor speed and maintain exhaust temperature above freezing.
    d. Variable-frequency controller, factory mounted and wired, with exhaust- and outdoor-air sensors, automatic changeover thermostat and set-point adjuster, to vary rotor speed and maintain [**exhaust temperature above freezing and**]air differential temperature above set point. Provide maximum rotor speed when exhaust-air temperature is less than outdoor-air temperature.
    e. Pilot-Light Indicator: Display rotor rotation and speed.
    f. Speed Settings: Adjustable settings for maximum and minimum rotor speed limits.

2.10 ROOF CURBS

A. Roof curbs with vibration isolators and wind or seismic restraints are specified in Section 230548 "Vibration and Seismic Controls for HVAC."

B. Materials: Galvanized steel with corrosion-resistant 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: **2 inches**.

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 airstream 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.

C. Curb Dimensions: Height of **12 inches**

D. Wind and Seismic Restraints: Metal brackets compatible with the curb and casing, painted to match unit, used to anchor unit to the curb, and designed for loads at Project site. Comply with requirements in Section 230548 "Vibration and Seismic Controls for HVAC" for wind-load requirements.

2.11 INTAKE AND RELIEF AIR OPENINGS

A. Provide hood, including moisture eliminator, over all unit intake and relief openings. Match material and finish of casing exterior.

2.12 MATERIALS

A. Steel:

1. ASTM A36/A36M for carbon structural steel.
2. ASTM A568/A568M for steel sheet.

B. Stainless Steel:

1. Manufacturer's standard grade for casing.
2. Manufacturer's standard type, ASTM A240/A240M for bare steel exposed to airstream or moisture.

C. Galvanized Steel: ASTM A653/A653M.

D. Aluminum: ASTM B209.

2.13 SOURCE QUALITY CONTROL

A. AHRI 430 Certification: Air-handling units and their components shall be factory tested according to AHRI 430 and shall be listed and labeled by AHRI.

B. AHRI 1060 Certification: Air-handling units that include air-to-air energy recovery devices shall be factory tested according to AHRI 1060 and shall be listed and labeled by AHRI.

C. AMCA 301 or AHRI 260: Air-handling unit fan sound ratings shall comply with AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data," or AHRI 260, "Sound Rating of Ducted Air Moving and Conditioning Equipment."

D. Fan Sound-Power Level Ratings: Comply with AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Fans shall bear AMCA-certified sound ratings seal.

E. Fan Performance Rating: Factory test fan performance for airflow, pressure, power, air density, rotation speed, and efficiency. Rate performance according to AMCA 210, "Laboratory Methods of Testing Fans for Aerodynamic Performance Rating."

F. Water Coils: Factory tested to 300 psig according to AHRI 410 and ASHRAE 33.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine casing insulation materials and filter media before air-handling unit installation. Reject insulation materials and filter media that are wet, moisture damaged, or mold damaged.

C. Examine roughing-in for hydronic and condensate drainage piping systems and electrical services to verify actual locations of connections before installation.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Roof Curb: Install on roof structure , level and secure, according to NRCA's "NRCA Roofing Manual: Membrane Roof Systems." Install units on curbs and coordinate roof penetrations and flashing with roof construction specified in Section 077200 "Roof Accessories." Secure units to upper curb rail, and secure curb base to roof framing or concrete base with anchor bolts. Coordinate sizes and locations of roof curbs with actual equipment provided.

B. Unit Support: Install unit level on structural curbs. Coordinate roof penetrations and flashing with roof construction. Secure units to structural support with anchor bolts. Coordinate sizes and locations of curbs with actual equipment provided.

1. Comply with requirements for vibration isolation and seismic-control devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."

C. Arrange installation of units to provide access space around air-handling units for service and maintenance.

D. Do not operate fan system until filters (temporary or permanent) are in place. Replace temporary filters used during construction and testing, with new, clean filters.

E. Install filter-gauge, static-pressure taps upstream and downstream of filters. Mount filter gauges on outside of filter housing or filter plenum in accessible position. Provide filter gauges on filter banks, installed with separate static-pressure taps upstream and downstream of filters.

F. Connect duct to air-handling units with flexible connections. Comply with requirements in Section 233300 "Air Duct Accessories."

3.3 PIPING CONNECTIONS

A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where installing piping adjacent to air-handling unit, allow space for service and maintenance.

C. Connect piping to air-handling units mounted on vibration isolators with flexible connectors.

D. Connect condensate drain pans using NPS 1-1/4, ASTM B88, Type M copper tubing. Extend to nearest equipment or roof drain. Construct deep trap at connection to drain pan and install cleanouts at changes in direction.

E. Chilled-Water Piping: Comply with applicable requirements in Section 232113 "Hydronic Piping" and Section 232116 "Hydronic Piping Specialties." Install shutoff valve and union or flange at each coil supply connection. Install balancing valve and union or flange at each coil return connection.

3.4 ELECTRICAL CONNECTIONS

A. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

B. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

C. Install electrical devices furnished by manufacturer, but not factory mounted, according to NFPA 70 and NECA 1.

3.5 CONTROL CONNECTIONS

A. Install control and electrical power wiring to field-mounted control devices.

B. Connect control wiring according to Section 260523 "Control-Voltage Electrical Power Cables."

3.6 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. Verify that shipping, blocking, and bracing are removed.
3. Verify that unit is secure on mountings and supporting devices and that connections to piping, ducts, and electrical systems are complete. Verify that proper thermal-overload protection is installed in motors, controllers, and switches.
4. Verify proper motor rotation direction, free fan wheel rotation, and smooth bearing operations. Reconnect fan drive system, align belts, and install belt guards.
5. Verify that bearings, pulleys, belts, and other moving parts are lubricated with factory-recommended lubricants.
6. Verify that dampers fully open and close.
7. Comb coil fins for parallel orientation.
8. Verify that proper thermal-overload protection is installed for electric coils.
9. Install new, clean filters.
10. Verify that manual and automatic volume control and fire and smoke dampers in connected duct systems are in fully open position.

B. Starting procedures for air-handling units include the following:

1. Energize motor; verify proper operation of motor, drive system, and fan wheel. Adjust fan to indicated rpm.
2. Measure and record motor electrical values for voltage and amperage.
3. Manually operate dampers from fully closed to fully open position and record fan performance.

3.7 ADJUSTING

A. Adjust damper linkages for proper damper operation.

B. Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC" for air-handling system testing, adjusting, and balancing.

C. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.8 CLEANING

A. After completing system installation and testing, adjusting, and balancing air-handling unit and air-distribution systems and after completing startup service, clean air-handling units internally to remove foreign material and construction dirt and dust. Clean fan wheels, cabinets, dampers, coils, and filter housings, and install new, clean filters.

3.9 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

C. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

D. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
   1. Fan Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
   2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

E. Air-handling unit and components will be considered defective if unit or components do not pass tests and inspections.

F. Prepare test and inspection reports.

3.10 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain air-handling units.

END OF SECTION 23 7343.16

SECTION 23 8126

SPLIT-SYSTEM AIR-CONDITIONERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes split-system air-conditioning and heat-pump units consisting of separate evaporator-fan and compressor-condenser components.

1.3 ACTION 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. LEED Submittals:

1. Product Data for Credit EA 4: Documentation indicating that equipment and refrigerants comply.

C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Wiring Diagrams: For power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

B. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For split-system air-conditioning units to include in emergency, operation, and maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Filters: One set for each air-handling unit.

1.7 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.

1.8 COORDINATION

A. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of split-system air-conditioning units that fail in materials or workmanship within specified warranty period.

1. Warranty Period:

a. For Compressor: Five years from date of Substantial Completion.
b. For Parts: One year from date of Substantial Completion.
c. For Labor: One year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. 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. Mitsubishi Electric & Electronics USA, Inc.; HVAC Advanced Products Division.
4. SANYO North America Corporation; SANYO Fisher Company.

5. Trane; a business of American Standard companies.
6. YORK; a Johnson Controls company.

2.2 INDOOR UNITS (5 TONS OR LESS)

A. Wall-Mounted, Evaporator-Fan Components:

1. Cabinet: Plastic with removable panels on front and ends in color selected by Architect, and discharge drain pans with drain connection.
2. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and thermal-expansion valve. Comply with ARI 210/240.
3. Fan: Direct drive, centrifugal.
4. Fan Motors:

    a. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements specified in Section "Common Motor Requirements for HVAC Equipment."
    b. Multitapped, multispeed with internal thermal protection and permanent lubrication.
    c. Enclosure Type: Totally enclosed, fan cooled.
    d. NEMA Premium (TM) efficient motors as defined in NEMA MG 1.
    e. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in electrical Sections.
    f. Mount unit-mounted disconnect switches on interior 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 two percent slope in at least two planes to collect condensate from cooling coils (including coil piping connections, coil headers, and return bends) and humidifiers, and to direct water toward drain connection.

        1) Length: Extend drain pan downstream from leaving face to comply with ASHRAE 62.1.
        2) Depth: A minimum of 1 inch deep.

    b. 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.

2.3 OUTDOOR UNITS (5 TONS OR LESS)

A. Air-Cooled, Compressor-Condenser Components:

1. Casing: Steel, finished with baked enamel in color selected by Architect, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.
2. Compressor: Hermetically sealed with crankcase heater and mounted on vibration isolation device. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.

    a. Compressor Type: Scroll.

b. Two-speed compressor motor with manual-reset high-pressure switch and automatic-reset low-pressure switch.
c. Refrigerant Charge: R-410A.
d. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and liquid sub-cooler. Comply with ARI 210/240.

3. Heat-Pump Components: Reversing valve and low-temperature-air cutoff thermostat.
4. Fan: Aluminum-propeller type, directly connected to motor.
5. Motor: Permanently lubricated, with integral thermal-overload protection.
6. Mounting Base: Polyethylene.

2.4 ACCESSORIES

A. Thermostat: Wireless infrared functioning to remotely control compressor and evaporator fan, with the following features:

1. Compressor time delay.
2. 24-hour time control of system stop and start.
3. Liquid-crystal display indicating temperature, set-point temperature, time setting, operating mode, and fan speed.
4. Fan-speed selection including auto setting.

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.

2.5 CAPACITIES AND CHARACTERISTICS – AS SCHEDULED

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install units level and plumb.

B. Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.

C. Install roof-mounted, compressor-condenser components on equipment supports specified in Section "Roof Accessories." Anchor units to supports with removable, cadmium-plated fasteners.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where piping is installed adjacent to unit, allow space for service and maintenance of unit.

3.3 FIELD QUALITY CONTROL

A. 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.

B. Remove and replace malfunctioning units and retest as specified above.

C. Prepare test and inspection reports.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain units.

END OF SECTION

SECTION 23 8239.19

WALL AND CEILING UNIT HEATERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes wall and ceiling heaters with propeller fans and electric-resistance heating coils.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, furnished specialties, and accessories.

B. LEED Submittals:

1. Product Data for Prerequisite IEQ 1: Documentation indicating that units comply with ASHRAE 62.1, Section 5 - "Systems and Equipment."

C. Shop Drawings:

1. Include plans, elevations, sections, and details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include details of anchorages and attachments to structure and to supported equipment.
4. Include equipment schedules to indicate rated capacities, operating characteristics, furnished specialties, and accessories.
5. Wiring Diagrams: Power, signal, and control wiring.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For wall and ceiling unit heaters to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Berko; Marley Engineered Products.
2. Chromalox, Inc.
3. Indeeco.
4. Markel Products Company; TPI Corporation.
5. QMark; Marley Engineered Products.
6. Trane Inc.

2.2 DESCRIPTION

A. Assembly including chassis, electric heating coil, fan, motor, and controls. Comply with UL 2021.

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.

2.3 CABINET

A. Front Panel: Extruded-aluminum bar grille, with removable panels fastened with tamperproof fasteners.

B. Finish: Baked enamel over baked-on primer with manufacturer's custom color selected by Architect, applied to factory-assembled and -tested wall and ceiling heaters before shipping.

C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

D. Surface-Mounted Cabinet Enclosure: Steel with finish to match cabinet.

2.4 COIL

A. Electric-Resistance Heating Coil: Nickel-chromium heating wire, free from expansion noise and 60-Hz hum, embedded in magnesium oxide refractory and sealed in corrosion-resistant metallic sheath. Terminate elements in stainless-steel, machine-staked terminals secured with stainless-steel hardware, and limit controls for high-temperature protection. Provide integral circuit breaker for overcurrent protection.

2.5 FAN AND MOTOR

A. Fan: Aluminum propeller directly connected to motor.

B. Motor: Permanently lubricated. Comply with requirements in Section "Common Motor Requirements for HVAC Equipment."

2.6 CONTROLS

A. Controls: Unit-mounted thermostat. Low-voltage relay with transformer kit.

B. Electrical Connection: Factory wire motors and controls for a single field connection with disconnect switch.

2.7 CAPACITIES AND CHARACTERISTICS – AS SCHEDULED

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive wall and ceiling unit heaters for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

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.

3.2 INSTALLATION

A. Install wall and ceiling unit heaters to comply with NFPA 90A.

B. Install wall and ceiling unit heaters level and plumb.

C. Install wall-mounted thermostats and switch controls in electrical outlet boxes at heights to match lighting controls. Verify location of thermostats and other exposed control sensors with Drawings and room details before installation.

D. Ground equipment according to Section "Grounding and Bonding for Electrical Systems."

E. Connect wiring according to Section "Low-Voltage Electrical Power Conductors and Cables."

END OF SECTION 23 8239.19

SECTION 26 0500

BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Electrical equipment coordination and installation.
2. Sleeves for raceways and cables.
3. Sleeve seals.
4. Grout.
5. Common electrical installation requirements.

1.3 DEFINITIONS

A. EPDM: Ethylene-propylene-diene terpolymer rubber.

B. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

A. Product Data: For sleeve seals.

1.5 COORDINATION

A. Coordinate arrangement, mounting, and support of electrical equipment:

1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
3. To allow right of way for piping and conduit installed at required slope.
4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.

B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

C. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Section "Access Doors and Frames."

D. Coordinate sleeve selection and application with selection and application of firestopping specified in Section "Penetration Firestopping."

PART 2 - PRODUCTS

2.1 SLEEVES FOR RACEWAYS AND CABLES

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

C. Sleeves for Rectangular Openings: Galvanized sheet steel.

1. Minimum Metal Thickness:

a. For sleeve cross-section rectangle perimeter less than 50 inches and no side more than 16 inches, thickness shall be 0.052 inch.
b. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches and 1 or more sides equal to, or more than, 16 inches, thickness shall be 0.138 inch.

2.2 SLEEVE SEALS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Advance Products & Systems, Inc.
b. Calpico, Inc.
c. Metraflex Co.

2. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
3. Pressure Plates: Stainless steel. Include two for each sealing element.
4. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.3 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, non-staining, mixed with water to consistency suitable for application and a 30-minute working time.

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

A. Comply with NECA 1.

B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.

C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.

E. Right of Way: Give to piping systems installed at a required slope.

3.2 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Electrical penetrations occur when raceways, cables, wireways, cable trays, or busways penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.

B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

E. Cut sleeves to length for mounting flush with both surfaces of walls.

F. Extend sleeves installed in floors 2 inches above finished floor level.

G. Size pipe sleeves to provide 1/4-inch minimum annular clear space between sleeve and raceway or cable, unless indicated otherwise.

H. Seal space outside of sleeves with grout for penetrations of concrete and masonry

1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.

I. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Section "Joint Sealants."

J. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway and cable penetrations. Install sleeves and seal raceway and cable penetration sleeves with firestop materials. Comply with requirements in Section "Penetration Firestopping."

K. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

L. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel or cast-iron pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

M. Underground, Exterior-Wall Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing mechanical sleeve seals.

3.3 SLEEVE-SEAL INSTALLATION

A. Install to seal exterior wall penetrations.

B. Use type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.4 FIRESTOPPING

A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for electrical installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Section "Penetration Firestopping."

END OF SECTION

SECTION 26 0519

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - **GENERAL**

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Building wires and cables rated 600 V and less.
2. Connectors, splices, and terminations rated 600 V and less.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Alcan Products Corporation; Alcan Cable Division.
2. Belden Inc.
3. General Cable Technologies Corporation.
4. Southwire Incorporated.

B. Copper Conductors: Comply with NEMA WC 70/ICEA S-95-658.

C. Conductor Insulation: Comply with NEMA WC 70/ICEA S-95-658 for Type THHN/THWN-2 Type XHHW-2 Type USE and Type SO.

D. Multiconductor Cable: Comply with NEMA WC 70/ICEA S-95-658 for armored cable, Type AC metal-clad cable, Type MC mineral-insulated, metal-sheathed cable, Type MI with ground wire.

2.2 CONNECTORS AND SPLICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Gardner Bender.
2. Hubbell Power Systems, Inc.
3. Ideal Industries, Inc.
4. O-Z/Gedney; a brand of the EGS Electrical Group.
5. 3M; Electrical Markets Division.
6. Tyco Electronics.

B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

2.3 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger, except VFC cable, which shall be extra flexible stranded.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Service Entrance: Type THHN/THWN-2, single conductors in raceway.

B. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces: Type THHN/THWN-2, single conductors in raceway.

C. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN-2, single conductors in raceway.

D. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN/THWN-2, single conductors in raceway.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.

B. Complete raceway installation between conductor and cable termination points according to Section "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.

C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

F. Support cables according to Section "Hangers and Supports for Electrical Systems."

G. Complete cable tray systems installation according to Section "Cable Trays for Electrical Systems" prior to installing conductors and cables.

3.4 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than un-spliced conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

3.5 IDENTIFICATION

A. Identify and color-code conductors and cables according to Section "Identification for Electrical Systems."

B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.6 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 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.7 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Section "Penetration Firestopping."

3.8 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

C. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors and conductors feeding critical equipment and services for compliance with requirements.
2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
3. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each splice in conductors No. 3 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner. Correct deficiencies determined during the scan.

    a. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each splice 11 months after date of Substantial Completion.
    b. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
    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.

D. Test and Inspection Reports: Prepare a written report to record the following:

1. Procedures used.
2. Results that comply with requirements.
3. Results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

E. Cables will be considered defective if they do not pass tests and inspections.

END OF SECTION

SECTION 26 0526

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes grounding and bonding systems and equipment.

B. Section includes grounding and bonding systems and equipment, plus the following special applications:

1. Underground distribution grounding.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1.4 INFORMATIONAL SUBMITTALS

A. As-Built Data: Plans showing dimensioned as-built locations of grounding features specified in "Field Quality Control" Article, including the following:

1. Test wells.
2. Ground rods.
3. Grounding arrangements and connections for separately derived systems.

B. Qualification Data: For testing agency and testing agency's field supervisor.

C. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For grounding to include in emergency, operation, and maintenance manuals.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

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

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Burndy; Part of Hubbell Electrical Systems.
2. ERICO International Corporation.
3. Fushi Copperweld Inc.
4. Harger Lightning and Grounding.
5. O-Z/Gedney; A Brand of the EGS Electrical Group.
6. Robbins Lightning, Inc.

2.2 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with UL 467 for grounding and bonding materials and equipment.

2.3 CONDUCTORS

A. Insulated Conductors: Copper or tinned-copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Bare Copper Conductors:

1. Solid Conductors: ASTM B 3.
2. Stranded Conductors: ASTM B 8.
3. Tinned Conductors: ASTM B 33.
4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.
5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
6. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

C. Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4 by 4 inches, or as indicated, in cross section, with 9/32-inch holes spaced 1-1/8 inches apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V and shall be Lexan or PVC, impulse tested at 5000 V.

2.4 CONNECTORS

A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.

B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy.

C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

D. Bus-Bar Connectors: Mechanical type, cast silicon bronze, solderless, compression, or exothermic-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

2.5 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad or Stainless steel; 3/4 inch by 10 feet unless otherwise indicated.

B. 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 long.
2. Backfill Material: Electrode manufacturer's recommended material.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.

B. Underground Grounding Conductors: Install bare copper conductor, No. 2/0 AWG minimum.

1. Bury at least 24 inches below grade.
2. Duct-Bank Grounding Conductor: Bury 12 inches above duct bank when indicated as part of duct-bank installation.

C. 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 minimum from wall, 6 inches above finished floor unless otherwise indicated.
2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down; connect to horizontal bus.

D. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
3. Connections to Ground Rods at Test Wells: Bolted connectors.
4. Connections to Structural Steel: Welded connectors.

3.2 GROUNDING AT THE SERVICE

A. Equipment grounding conductors and grounding electrode conductors shall be connected to the ground bus. Install a main bonding jumper between the neutral and ground buses.

3.3 GROUNDING SEPARATELY DERIVED SYSTEMS

A. Generator: Install grounding electrodes at the generator location. The electrodes shall be connected to the equipment grounding conductor and to the frame of the generator.

3.4 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

A. Comply with IEEE C2 grounding requirements.

B. Pad-Mounted Transformers and Switches: Install two ground rods and ground ring around the pad. Ground pad-mounted equipment and noncurrent-carrying metal items associated with substations by connecting them to underground cable and grounding electrodes. Install tinned-copper conductor not less than No. 2 AWG for ground ring and for taps to equipment grounding terminals. Bury ground ring not less than 6 inches from the foundation.

3.5 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:

1. Feeders and branch circuits.
2. Lighting circuits.
3. Receptacle circuits.
4. Single-phase motor and appliance branch circuits.
5. Three-phase motor and appliance branch circuits.
6. Flexible raceway runs.
7. Busway Supply Circuits: Install insulated equipment grounding conductor from grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.

C. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.

3.6 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Ground Bonding Common with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service

grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.

C. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade unless otherwise indicated.

1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
2. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.

D. Test Wells: Ground rod driven through drilled hole in bottom of handhole. Handholes are specified in Section "Underground Ducts and Raceways for Electrical Systems," and shall be at least 12 inches 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.

3.7 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. 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.

D. 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, and at individual ground rods. 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.

E. Grounding system will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

G. Report measured ground resistances that exceed the following values:
1. Power and Lighting Equipment or System with Capacity of 500 to 1000 kVA: 5 ohms.
2. Substations and Pad-Mounted Equipment: 5 ohms.

H. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION

SECTION 26 0529

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Hangers and supports for electrical equipment and systems.
2. Construction requirements for concrete bases.

B. Related Requirements:

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:

   a. Steel slotted support systems.
   b. Trapeze hangers.

2. Include rated capacities and furnished specialties and accessories.

B. Shop Drawings: For fabrication and installation details for electrical hangers and support systems.

1. Trapeze hangers. Include product data for components.
2. Steel slotted-channel systems.
3. Equipment supports.

C. Delegated-Design Submittal: For hangers and supports for electrical systems.

1. Include design calculations and details of trapeze hangers.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling 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. Suspended ceiling components.
2. Structural members to which hangers and supports will be attached.
3. Size and location of initial access modules for acoustical tile.
4. Items penetrating finished ceiling, including the following:

    a. Lighting fixtures.
    b. Air outlets and inlets.
    c. Speakers.
    d. Sprinklers.
    e. Access panels.
    f. Fire alarm devices and occupancy sensors.

B. Welding certificates.

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section "Quality Requirements," to design hanger and support system.

B. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame Rating: Class 1.
2. Self-extinguishing according to ASTM D 635.

2.2 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Comply with MFMA-4 factory-fabricated components for field assembly.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. Allied Tube & Conduit.
    b. Cooper B-Line, Inc.; a division of Cooper Industries.
    c. Thomas & Betts Corporation.
    d. Unistrut; Tyco International, Ltd.

2. Material: Galvanized steel, Stainless Steel, Type 304, or Stainless Steel, Type 316.
3. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
4. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
5. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
6. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
7. Channel Dimensions: Selected for applicable load criteria.

B. Aluminum Slotted Support Systems: Comply with MFMA-4 factory-fabricated components for field assembly.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Allied Tube & Conduit.
      b. Cooper B-Line, Inc.; a division of Cooper Industries.
      c. Thomas & Betts Corporation.
      d. Unistrut; Tyco International, Ltd.

   2. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
   3. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
   4. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
   5. Channel Dimensions: Selected for applicable load criteria.

C. Conduit and Cable Support Devices: Steel and malleable-iron or Stainless-steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be made of malleable iron.

E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M steel plates, shapes, and bars; black and galvanized.

F. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

   1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
      a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
         1) Hilti Inc.
         2) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
         3) MKT Fastening, LLC.

   2. Mechanical-Expansion Anchors: Insert-wedge-type, stainless steel, for use in hardened portland cement concrete, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
      a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
         1) Cooper B-Line, Inc.; a division of Cooper Industries.
         2) Hilti Inc.
         3) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
         4) MKT Fastening, LLC.

   3. Concrete Inserts: Steel or malleable-iron, slotted support system units are similar to MSS Type 18 units and comply with MFMA-4 or MSS SP-58.
   4. Clamps for Attachment to Steel Structural Elements: MSS SP-58 units are suitable for attached structural element.

5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
6. Toggle Bolts: All-steel springhead type.
7. Hanger Rods: Threaded steel.

2.3 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

B. Materials: Comply with requirements in Section "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems unless requirements in this Section are stricter.

B. Comply with requirements for raceways and boxes specified in Section "Raceways and Boxes for Electrical Systems."

C. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMTs, IMCs, and RMCs as scheduled in NECA 1, where its Table 1 lists maximum spacings that are less than those stated in NFPA 70. Minimum rod size shall be 1/4 inch in diameter.

D. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted [**or other**]support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.

1. Secure raceways and cables to these supports with two-bolt conduit clamps or single-bolt conduit clamps using spring friction action for retention in support channel.

E. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.2 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this article.

B. Raceway Support Methods: In addition to methods described in NECA 1, EMT and RMC may be supported by openings through structure members, according to NFPA 70.

C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
   1. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
   2. To Existing Concrete: Expansion anchor fasteners.
   3. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.
   4. To Steel: Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts or Beam clamps (MSS SP-58, Type 19, 21, 23, 25, or 27), complying with MSS SP-69.
   5. To Light Steel: Sheet metal screws.
   6. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.

E. Drill holes for expansion anchors in concrete at locations and to depths that avoid the need for reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in Section "Metal Fabrications" for site-fabricated metal supports.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

C. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 CONCRETE BASES

A. Construct concrete bases of dimensions indicated but not less than 4 inches larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.

B. Use 3000-psi, 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Section "Cast-in-Place Concrete."

C. Anchor equipment to concrete base as follows:

   1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   2. Install anchor bolts to elevations required for proper attachment to supported equipment.
   3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION

SECTION 26 0533

RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Metal conduits, tubing, and fittings.
2. Metal wireways and auxiliary gutters.
3. Boxes, enclosures, and cabinets.

1.3 DEFINITIONS

A. GRC: Galvanized rigid steel conduit.

B. IMC: Intermediate metal conduit.

1.4 ACTION SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

B. LEED Submittals:

1. Product Data for Credit IEQ 4.1: For solvent cements and adhesive primers, documentation including printed statement of VOC content.
2. Laboratory Test Reports for Credit IEQ 4: For solvent cements and adhesive primers, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:

1. Structural members in paths of conduit groups with common supports.
2. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.

B. Source quality-control reports.

PART 2 - PRODUCTS

2.1 METAL CONDUITS, TUBING, AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Allied Tube & Conduit; a Tyco International Ltd. Co.
2. O-Z/Gedney; a brand of EGS Electrical Group.
3. Republic Conduit.
4. Southwire Company.
5. Thomas & Betts Corporation.
6. Western Tube and Conduit Corporation.
7. Wheatland Tube Company; a division of John Maneely Company.

B. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. GRC: Comply with ANSI C80.1 and UL 6.

D. EMT: Comply with ANSI C80.3 and UL 797.

E. FMC: Comply with UL 1; zinc-coated steel or aluminum.

F. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.

G. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
1. Fittings for EMT:

a. Material: Steel or die cast.
b. Type: compression.

2. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.
3. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch, with overlapping sleeves protecting threaded joints.

H. Joint Compound for GRC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 SURFACE RACEWAYS

A. Listing and Labeling: Surface raceways and tele-power poles shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Surface Metal Raceways: Galvanized steel with snap-on covers complying with UL 5. Manufacturer's standard enamel finish in color selected by Architect.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Panduit Corp.
b. Wiremold / Legrand.

2. Material: Galvanized steel with ivory baked-enamel finish.

2.3 BOXES, ENCLOSURES, AND CABINETS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper Technologies Company; Cooper Crouse-Hinds.
2. EGS/Appleton Electric.
3. Erickson Electrical Equipment Company.
4. Hoffman; a Pentair company.
5. Hubbell Incorporated; Killark Division.
6. O-Z/Gedney; a brand of EGS Electrical Group.
7. RACO; a Hubbell Company.
8. Thomas & Betts Corporation.
9. Wiremold / Legrand.

B. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.

C. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

D. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy or aluminum, Type FD, with gasketed cover.

E. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb. Outlet boxes designed for attachment of luminaires weighing more than 50 lb shall be listed and marked for the maximum allowable weight.

F. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

G. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum with gasketed cover.

H. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

I. Device Box Dimensions: 4 inches square by 2-1/8 inches deep or 4 inches by 2-1/8 inches by 2-1/8 inches deep, as indicated.

J. Gangable boxes are allowed.

K. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 1 or Type 3R with continuous-hinge cover with flush latch unless otherwise indicated.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
2. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.

L. Cabinets:

1. NEMA 250, Type 1 galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed Conduit: GRC as indicated.
2. Concealed Conduit, Aboveground: EMT as indicated.
3. Underground Conduit: Type EPC-40-PVC, direct buried or concrete encased, as indicated.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.

B. Indoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: EMT.
2. Exposed and Subject to Severe Physical Damage: GRC. Raceway locations include the following:

a. Loading dock.
b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
c. Mechanical rooms.
d. Gymnasiums.

3. Concealed in Ceilings and Interior Walls and Partitions: EMT.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
5. Damp or Wet Locations: GRC.
6. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel in institutional and commercial kitchens and damp or wet locations.

C. Minimum Raceway Size: 3/4-inch trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after

installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.

3. EMT: Use compression, steel or cast-metal fittings. Comply with NEMA FB 2.10.
4. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

E. Install surface raceways only where indicated on Drawings.

3.2 INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.

B. Keep raceways at least 6 inches away from parallel runs of flues and hot-water pipes. Install horizontal raceway runs above water and steam piping.

C. Complete raceway installation before starting conductor installation.

D. Comply with requirements in Section "Hangers and Supports for Electrical Systems" for hangers and supports.

E. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches of changes in direction.

F. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

G. Support conduit within 12 inches of enclosures to which attached.

H. Raceways Embedded in Slabs:

1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure raceways to reinforcement at maximum 10-footintervals.
2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
3. Arrange raceways to keep a minimum of 1 inch of concrete cover in all directions.
4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.

I. Stub-ups to Above Recessed Ceilings:

1. Use EMT for raceways.
2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

J. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

K. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.

L. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.

M. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch trade size and insulated throat metal bushings on 1-1/2-inch trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.

N. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.

O. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.

P. Cut conduit perpendicular to the length. For conduits 2-inch trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.

Q. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.

R. Surface Raceways:

1. Install surface raceway with a minimum 2-inch radius control at bend points.
2. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inches and with no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.

S. Expansion-Joint Fittings:

1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F and that has straight-run length that exceeds 25 feet. Install in each run of aboveground RMC and EMT conduit that is located where environmental temperature change may exceed 100 deg F and that has straight-run length that exceeds 100 feet.
2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:

    a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F temperature change.
    b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.
    c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F temperature change.
    d. Attics: 135 deg F temperature change.
3. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
4. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

T. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches of flexible conduit for recessed and semi-recessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

1. Use LFMC in damp or wet locations.

U. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.

V. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.

W. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

X. Locate boxes so that cover or plate will not span different building finishes.

Y. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.

Z. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

AA. Set metal floor boxes level and flush with finished floor surface.

3.3 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:

1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Section "Earth Moving" for pipe less than 6 inches in nominal diameter.
2. Install backfill as specified in Section "Earth Moving."
3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Section "Earth Moving."
4. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through floor unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.
5. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through floor.

    a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete for a minimum of 12 inches on each side of the coupling.
    b. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a minimum of 60 inches from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.

6. Warning Planks: Bury warning planks approximately 12 inches above direct-buried conduits but a minimum of 6 inches below grade. Align planks along centerline of conduit.
7. Underground Warning Tape: Comply with requirements in Section "Identification for Electrical Systems."

3.4 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 "Basic Electrical Requirements."

3.5 FIRESTOPPING

A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section "Penetration Firestopping."

3.6 PROTECTION

A. Protect coatings, finishes, and cabinets from damage and deterioration.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION

SECTION 26 0553

IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Identification for raceways.
2. Identification of power and control cables.
3. Identification for conductors.
4. Underground-line warning tape.
5. Warning labels and signs.
6. Instruction signs.
7. Equipment identification labels, including arc-flash warning labels.
8. Miscellaneous identification products.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for electrical identification products.

B. Samples: For each type of label and sign to illustrate composition, size, colors, lettering style, mounting provisions, and graphic features of identification products.

C. Identification Schedule: For each piece of electrical equipment and electrical system components to be an index of nomenclature for electrical equipment and system components used in identification signs and labels. Use same designations indicated on Drawings.

D. Delegated-Design Submittal: For arc-flash hazard study.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Comply with ASME A13.1 and IEEE C2.

B. Comply with NFPA 70.

C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.

D. Comply with ANSI Z535.4 for safety signs and labels.

E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

F. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 COLOR AND LEGEND REQUIREMENTS

A. Raceways and Cables Carrying Circuits at 600 V or Less:

1. Black letters on an orange field.
2. Legend: Indicate voltage and system or service type.

B. Warning labels and signs shall include, but are not limited to, the following legends:

1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."

2.3 LABELS

A. Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible labels laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing label ends.

B. Snap-Around Labels for Raceways and Cables Carrying Circuits at 600 V or Less: Slit, pre-tensioned, flexible, preprinted, color-coded acrylic sleeves, with diameters sized to suit diameters of raceways they identify, and that stay in place by gripping action.

C. Self-Adhesive Labels:

1. Preprinted, 3-mil-thick, polyester or vinyl flexible label with acrylic pressure-sensitive adhesive.

a. Self-Lamination: Clear; UV-, weather- and chemical-resistant; self-laminating, protective shield over the legend. Labels sized to fit the cable or raceway diameter, such that the clear shield overlaps the entire printed legend.

2. Polyester or Vinyl, thermal, transfer-printed, 3-mil-thick, multicolor, weather- and UV-resistant, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.
3. Marker for Tags: Machine-printed, permanent, waterproof, black ink recommended by printer manufacturer.

2.4 BANDS AND TUBES:

A. Snap-Around, Color-Coding Bands for Raceways and Cables: Slit, pre-tensioned, flexible, solid-colored acrylic sleeves, 2 inches long, with diameters sized to suit diameters of raceways or cables they identify, and that stay in place by gripping action.

B. Heat-Shrink Preprinted Tubes: Flame-retardant polyolefin tubes with machine-printed identification labels, sized to suit diameters of and shrunk to fit firmly around cables they identify. Full shrink recovery occurs at a maximum of 200 deg F. Comply with UL 224.

2.5 TAPES AND STENCILS:

A. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

B. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; not less than 3 mils thick by 1 to 2 inches wide; compounded for outdoor use.

C. Tape and Stencil for Raceways Carrying Circuits 600 V or Less: 4-inch-wide black stripes on 10-inch centers placed diagonally over orange background that extends full length of raceway or duct and is 12 inches wide. Stop stripes at legends.

D. Floor Marking Tape: 2-inch-wide, 5-mil pressure-sensitive vinyl tape, with yellow and black stripes and clear vinyl overlay.

E. Underground-Line Warning Tape

1. Tape:

a. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.
b. Printing on tape shall be permanent and shall not be damaged by burial operations.
c. Tape material and ink shall be chemically inert and not subject to degradation when exposed to acids, alkalis, and other destructive substances commonly found in soils.

2. Color and Printing:

a. Comply with ANSI Z535.1, ANSI Z535.2, ANSI Z535.3, ANSI Z535.4, and ANSI Z535.5.
b. Inscriptions for Red-Colored Tapes: "ELECTRIC LINE, HIGH VOLTAGE".
c. Inscriptions for Orange-Colored Tapes: "TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE".

3. Tag: Type I:

a. Pigmented polyolefin, bright colored, continuous-printed on one side with the inscription of the utility, compounded for direct-burial service.
b. Width: 3 inches.
c. Thickness: 4 mils.
d. Weight: 18.5 lb./1000 sq. ft.
e. Tensile according to ASTM D 882: 30 lbf and 2500 psi.

4. Tag: Type II:

    a. Multilayer laminate, consisting of high-density polyethylene scrim coated with pigmented polyolefin; bright colored, continuous-printed on one side with the inscription of the utility, compounded for direct-burial service.
    b. Width: 3 inches.
    c. Thickness: 12 mils.
    d. Weight: 36.1 lb./1000 sq. ft.
    e. Tensile according to ASTM D 882: 400 lbf and 11,500 psi.

5. Tag: Type ID:

    a. Detectable three-layer laminate, consisting of a printed pigmented polyolefin film, a solid aluminum-foil core, and a clear protective film that allows inspection of the continuity of the conductive core; bright colored, continuous-printed on one side with the inscription of the utility, compounded for direct-burial service.
    b. Width: 3 inches.
    c. Overall Thickness: 5 mils.
    d. Foil Core Thickness: 0.35 mil.
    e. Weight: 28 lb./1000 sq. ft.
    f. Tensile according to ASTM D 882: 70 lbf and 4600 psi.

6. Tag: Type IID:

    a. Reinforced, detectable three-layer laminate, consisting of a printed pigmented woven scrim, a solid aluminum-foil core, and a clear protective film that allows inspection of the continuity of the conductive core; bright-colored, continuous-printed on one side with the inscription of the utility, compounded for direct-burial service.
    b. Width: 3 inches.
    c. Overall Thickness: 8 mils.
    d. Foil Core Thickness: 0.35 mil.
    e. Weight: 34 lb./1000 sq. ft.
    f. Tensile according to ASTM D 882: 300 lbf and 12,500 psi.

F. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 inch.

2.6 Tags

A. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch, with stamped legend, punched for use with self-locking cable tie fastener.

B. Nonmetallic Preprinted Tags: Polyethylene tags, 0.023 inch thick, color-coded for phase and voltage level, with factory screened or printed permanent designations; punched for use with self-locking cable tie fastener.

2.7 Signs

A. Baked-Enamel Signs:

1. Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.

2. 1/4-inch grommets in corners for mounting.
3. Nominal Size: 7 by 10 inches.

B. Metal-Backed Butyrate Signs:

1. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs, with 0.0396-inch galvanized-steel backing and with colors, legend, and size required for application.
2. 1/4-inch grommets in corners for mounting.
3. Nominal Size: 10 by 14 inches.

C. Laminated Acrylic or Melamine Plastic Signs:

1. Engraved legend.
2. Thickness:

a. For signs up to 20 sq. inches, minimum 1/16-inch-.
b. For signs larger than 20 sq. inches, 1/8 inch thick.
c. Engraved legend with black letters on white face unless otherwise indicated.
d. Punched or drilled for mechanical fasteners.
e. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.8 CABLE TIES

A. General-Purpose Cable Ties: Fungus inert, self-extinguishing, one piece, self-locking, Type 6/6 nylon.

1. Minimum Width: 3/16 inch.
2. Tensile Strength at 73 deg F according to ASTM D 638: 12,000 psi.
3. Temperature Range: Minus 40 to plus 185 deg F.
4. Color: Black, except where used for color-coding.

B. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self-extinguishing, one piece, self-locking, Type 6/6 nylon.

1. Minimum Width: 3/16 inch.
2. Tensile Strength at 73 deg F according to ASTM D 638: 12,000 psi.
3. Temperature Range: Minus 40 to plus 185 deg F.
4. Color: Black.

C. Plenum-Rated Cable Ties: Self-extinguishing, UV stabilized, one piece, self-locking.

1. Minimum Width: 3/16 inch.
2. Tensile Strength at 73 deg F according to ASTM D 638: 7000 psi.
3. UL 94 Flame Rating: 94V-0.
4. Temperature Range: Minus 50 to plus 284 deg F.
5. Color: Black.

2.9 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Retain paint system applicable for surface material and location (exterior or interior).

B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 PREPARATION

A. Self-Adhesive Identification Products: Before applying electrical identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.

3.2 INSTALLATION

A. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.

B. Install identifying devices before installing acoustical ceilings and similar concealment.

C. Verify identity of each item before installing identification products.

D. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.

E. Apply identification devices to surfaces that require finish after completing finish work.

F. Attach signs and plastic labels with mechanical fasteners appropriate to the location and substrate.

G. Attach plastic raceway and cable labels that are not self-adhesive type with clear vinyl tape, with adhesive appropriate to the location and substrate.

H. Cable Ties: For attaching tags. Use general-purpose type, except as listed below:

1. Outdoors: UV-stabilized nylon.
2. In Spaces Handling Environmental Air: Plenum rated.

I. Painted Identification: Comply with requirements in painting Sections for surface preparation and paint application.

J. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.

K. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.

L. During backfilling of trenches, install continuous underground-line warning tape directly above cable or raceway at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches overall.

3.3 IDENTIFICATION SCHEDULE

A. Concealed Raceways, Duct Banks, More Than 600 V, within Buildings: Tape and stencil 4-inch-wide black stripes on 10-inch centers over orange background that extends full length of raceway or duct and is 12 inches wide. Stencil legend "DANGER CONCEALED HIGH VOLTAGE WIRING" with 3-inch-high black letters on 20-inch centers. Stop stripes at legends. Apply stripes to the following finished surfaces:

1. Floor surface directly above conduits running beneath and within 12 inches of a floor that is in contact with earth or is framed above unexcavated space.
2. Wall surfaces directly external to raceways concealed within wall.
3. Accessible surfaces of concrete envelope around raceways in vertical shafts, exposed in the building, or concealed above suspended ceilings.

B. Accessible Raceways, Armored and Metal-Clad Cables, More Than 600 V: Self-adhesive vinyl or Snap-around labels. Install labels at 30-foot maximum intervals.

C. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits, More Than 30 A and 120 V to Ground: Identify with self-adhesive vinyl label or self-adhesive vinyl tape applied in bands. Install labels at 30-foot maximum intervals.

D. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels containing the wiring system legend and system voltage. System legends shall be as follows:

1. "EMERGENCY POWER."
2. "POWER."

E. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.

1. Color-Coding for Phase- and Voltage-Level Identification, 600 V or Less: Use colors listed below for ungrounded service, feeder, and branch-circuit conductors.

a. Color shall be factory applied or field applied for sizes larger than No. 8 AWG if authorities having jurisdiction permit.
b. Colors for 208/120-V Circuits:

1) Phase A: Black.
2) Phase B: Red.
3) Phase C: Blue.

c. Colors for 480/277-V Circuits:

1) Phase A: Brown.
2) Phase B: Orange.
3) Phase C: Yellow.

d. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or

taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

F. Power-Circuit Conductor Identification, More Than 600 V: For conductors in vaults, pull and junction boxes, manholes, and handholes, use nonmetallic preprinted tags colored and marked to indicate phase, and a separate tag with the circuit designation.

G. Install instructional sign, including the color code for grounded and ungrounded conductors using adhesive-film-type labels.

H. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes, manholes, and handholes, use self-adhesive, self-laminating polyester labels or self-adhesive vinyl labels with the conductor or cable designation, origin, and destination.

I. Control-Circuit Conductor Termination Identification: For identification at terminations, provide heat-shrink preprinted tubes, self-adhesive, self-laminating polyester labels, or self-adhesive vinyl labels with the conductor designation.

J. Conductors To Be Extended in the Future: Attach marker tape to conductors and list source.

K. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.

1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
2. Use system of marker-tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.

L. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical-fiber cable.

1. Install underground-line warning tape for direct-buried cables and cables in raceways.

M. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall comply with NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.

N. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Baked-enamel warning signs or Metal-backed, butyrate warning signs.

1. Comply with 29 CFR 1910.145.
2. Identify system voltage with black letters on an orange background.
3. Apply to exterior of door, cover, or other access.
4. For equipment with multiple power or control sources, apply to door or cover of equipment, including, but not limited to, the following:

    a. Power-transfer switches.
    b. Controls with external control power connections.

O. Arc Flash Warning Labeling: Self-adhesive thermal transfer vinyl labels.

1. Comply with NFPA 70E and ANSI Z535.4.

2. Comply with Section 260574 "Overcurrent Protective Device Arc-Flash Study" requirements for arc-flash warning labels.

P. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.

Q. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch-high letters for emergency instructions at equipment used for power transfer or load shedding.

R. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and operation and maintenance manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm unless equipment is provided with its own identification.

1. Labeling Instructions:

   a. Indoor Equipment: Engraved, laminated acrylic or melamine plastic label, punched or drilled for mechanical fasteners. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on 1-1/2-inch-high label; where two lines of text are required, use labels 2 inches high.
   b. Outdoor Equipment: Engraved, laminated acrylic or melamine label or Stenciled legend 4 inches high.
   c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
   d. Unless labels are provided with self-adhesive means of attachment, fasten them with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.

2. Equipment To Be Labeled:

   a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be in the form of an engraved, laminated acrylic or melamine label.
   b. Enclosures and electrical cabinets.
   c. Access doors and panels for concealed electrical items.
   d. Switchgear.
   e. Switchboards.
   f. Transformers: Label that includes tag designation shown on Drawings for the transformer, feeder, and panelboards or equipment supplied by the secondary.
   g. Substations.
   h. Emergency system boxes and enclosures.
   i. Enclosed switches.
   j. Push-button stations.
   k. Power-transfer equipment.
   l. Contactors.
   m. Remote-controlled switches, dimmer modules, and control devices.
   n. Battery-inverter units.
   o. Power-generating units.
   p. Other equipment or components as indicated.

END OF SECTION

SECTION 26 0800

ELECTRICAL COMMISSIONING REQUIREMENTS

PART 1 - GENERAL

1.1 DESCRIPTION

A. The purpose of this section is to specify Division 26 responsibilities in the commissioning process which are being directed by the CA. Other electrical system testing is required under the direction of the GC.

B. The list of commissioned equipment and systems is found in Section 01 91 13.

C. Commissioning requires the participation of Division 26 to ensure that all systems are operating in a manner consistent with the Contract Documents. The general commissioning requirements and coordination are detailed in Section 01 91 13. Division 26 shall be familiar with all parts of Section 01 91 13 and the commissioning plan issued by the CA and shall execute all commissioning responsibilities assigned to them in the Contract Documents.

1.2 RESPONSIBILITIES

A. Division 26 Contractors. The commissioning responsibilities applicable to the Division 26 contractors are as follows *(all references apply to commissioned equipment only)*:

1. Construction and Acceptance Phases
    a. Include the cost of commissioning in the contract price.
    b. In each purchase order or subcontract written, include requirements for submittal data, O&M data and training.
    c. Attend a commissioning scoping meeting and other necessary meetings scheduled by the CA and GC to facilitate the Cx process.
    d. Provide additional requested documentation, prior to normal O&M manual submittals, to the CA for development of start-up and functional testing procedures.
        1) Typically this will include detailed manufacturer installation and start-up, operating, troubleshooting and maintenance procedures, full details of any owner-contracted tests, full factory testing reports, if any, and full warranty information, including all responsibilities of the Owner to keep the warranty in force clearly identified. In addition, the installation and checkout materials that are shipped inside the equipment and the actual field checkout sheet forms to be used by the factory or field technicians shall be submitted to the Commissioning Agent.
        2) The Commissioning Agent may request further documentation necessary for the commissioning process.
    e. Contractors shall assist in clarifying the operation and control of commissioned equipment in areas where the specifications, control drawings or equipment documentation is not sufficient for writing detailed testing procedures.
    f. Provide assistance to the CA in preparation of the specific functional performance test procedures specified. Subs shall review test procedures to ensure feasibility, safety and equipment protection and provide necessary written alarm limits to be used during the tests.
    g. Develop a full start-up and initial checkout plan using manufacturer's start-up procedures and the prefunctional checklists from the CA. Submit manufacturer's detailed start-up procedures and the full start-up plan and procedures and other requested equipment documentation to CA for review.
    h. During the startup and initial checkout process, execute and document the electrical-related portions of the pre-functional checklists provided by the CA for all commissioned equipment.

i. Perform and clearly document all completed startup and system operational checkout procedures, providing a copy to the CA.
j. Provide skilled technicians to execute starting of equipment and to execute the functional performance tests. Ensure that they are available and present during the agreed upon schedules and for sufficient duration to complete the necessary tests, adjustments and problem-solving.
k. Correct deficiencies (differences between specified and observed performance) as interpreted by the CA, PM, GC and A/E, and retest the equipment.
l. Prepare O&M manuals according to the Contract Documents, including clarifying and updating the original sequences of operation to as-built conditions.
m. During construction, maintain as-built red-line drawings for all drawings and final CAD as-builts for contractor-generated coordination drawings. Update after completion of commissioning.
n. Provide training of the Owner's operating personnel as specified.
o. Coordinate with equipment manufacturers to determine specific requirements to maintain the validity of the warranty.

2. Warranty Period
   a. Correct deficiencies and make necessary adjustments to O&M manuals and as-built drawings for applicable issues identified during the Warranty Period.

1.3 RELATED WORK

A. Refer to Section 01 91 13, Part 1.4 for a listing of all sections where commissioning requirements are found.

B. Refer to Section 01 91 13 Part 1.7 for systems to be commissioned and Part 1.5 for contractor requirements.

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

A. Division 26 contractors shall provide all test equipment necessary to fulfill the testing requirements of this Division.

B. Refer to Section 01 91 13 Part 2.1 for additional Division 26 requirements.

PART 3 - EXECUTION

3.1 SUBMITTALS

A. Division 26 shall provide submittal documentation relative to commissioning to the CA as requested by the CA. Refer to Section 01 9113 Part 3.3 for additional Division 26 requirements.

3.2 STARTUP

A. The Division 26 contractors shall follow the start-up and initial checkout procedures listed in the Responsibilities list in this section and in 019113 Part 3.4. Division 26 has start-up responsibility and is required to complete systems and sub-systems so they are fully functional, meeting the design objectives of the Contract Documents. The commissioning procedures and functional testing do not relieve or lessen this responsibility or shift that responsibility partially to the commissioning agent or Owner.

B. Functional testing is intended to begin upon completion of system installation, pre-functional testing, and system start-up.

3.3 FUNCTIONAL PERFORMANCE TESTS

A. Refer to Section 019113 Part 1.7 for a list of systems to be commissioned and to Part 3.6 for a description of the process.

3.4 TESTING DOCUMENTATION, NON-CONFORMANCE AND APPROVALS

A. Refer to 019113 Part 3.4 for specific details on non-conformance issues relating to prefunctional checklists and tests.

B. Refer to Section 019113 Part 3.7 for issues relating to functional performance tests.

3.5 OPERATIONS AND MAINTENANCE (O&M) MANUALS

A. Division 26 shall compile and prepare documentation for all equipment and systems covered in Division 26 and deliver to the GC for inclusion in the O&M manuals.

B. The CA shall receive a copy of the O&M manuals for review.

3.6 TRAINING OF OWNER PERSONNEL

A. The GC shall be responsible for training coordination and scheduling and ultimately to ensure that training is completed. Refer to Section 019113 for additional details.

B. The CA shall be responsible for overseeing and approving the content and adequacy of the training of Owner personnel for commissioned equipment. Refer to Section 019113 for additional details.

C. Electrical Contractor. The electrical contractor shall have the following training responsibilities:
   1. Provide the CA with a training plan two weeks before the planned training according to the outline described in Section 019113, Part 3.9.
   2. Provide designated Owner personnel with comprehensive training in the understanding of the systems and the operation and maintenance of each major piece of commissioned electrical equipment or system.
   3. Training shall include:
      a. Use the printed installation, operation and maintenance instruction material included in the O&M manuals.
      b. Include a review of the written O&M instructions emphasizing safe and proper operating requirements, preventative maintenance, special tools needed and spare parts inventory suggestions.
      c. Discuss warranties and guarantees.
      d. Cover common troubleshooting problems and solutions.
      e. Explain information included in the O&M manuals and the location of all plans and manuals in the facility.
   4. Training shall occur after functional testing is complete, unless approved otherwise by the Project Manager.

3.7 DEFERRED TESTING

A. Deferred testing on any commissioned electrical equipment is not anticipated for this project.

3.8 WRITTEN WORK PRODUCTS

A. Written work products of Contractors will consist of the startup and intitial checkout plan described in Section 019113 and the filled-out startup, initial checkout and prefunctional checklists.

END OF SECTION

SECTION 26 0923

LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Digital daylight-harvesting dimming controls.
2. Digital indoor occupancy and vacancy sensors.
3. Digital room controller.
4. Digital wall switches.
5. Digital zone controller (Time Clock)
6. Emergency Lighting Control Device

B. Related Requirements:

1. Section 262726 "Wiring Devices" for wall-box dimmers, non-networkable wall-switch occupancy sensors, and manual light switches.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:

1. Show installation details for the following:

a. Digital Occupancy sensors.
b. Digital Vacancy sensors.
c. Digital daylight sensor
d. Digital room controller
e. Digital wall switches
f. Digital zone controller (Time Clock)

2. Interconnection diagrams showing field-installed wiring.
3. Include diagrams for power, signal, and control wiring.
4. Floor plan that show location of all devices, including at minimum, sensors, controllers, switches and dimmers.
5. Floor plan that show the different lighting zones per room or space as shown on the lighting plans, enlarged plans, and sequence of operations.
6. Sequence of operation for each room type or space.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plan(s) and elevations, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Suspended ceiling components.
2. Structural members to which equipment will be attached.
3. Items penetrating finished ceiling, including the following:

    a. Luminaires.
    b. Air outlets and inlets.
    c. Speakers.
    d. Sprinklers.
    e. Access panels.
    f. Control modules.

B. Field quality-control reports.

C. Sample Warranty: For manufacturer's warranties.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For each type of lighting control device to include in operation and maintenance manuals.

B. Software and Firmware Operational Documentation:

1. Software operating and upgrade manuals.
2. Program Software Backup: On USB media. Provide names, versions, and website addresses for locations of installed software.
3. Device address list.
4. Printout of software application and graphic screens.

1.6 WARRANTY

A. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace lighting control devices that fail(s) in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

    a. Faulty operation of lighting control software.
    b. Faulty operation of lighting control devices.

2. Warranty Period: Two year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 DIGITAL DAYLIGHT-HARVESTING DIMMING CONTROLS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. WattStopper; Legrand North America, LLC.

B. Description: Sensing daylight and electrical lighting levels, the system adjusts continuously the indoor electrical lighting levels. As daylight increases, lights are dimmed.

   1. Lighting control set point is based on the following two lighting conditions:

      a. When no daylight is present (target level).
      b. When significant daylight is present.

   2. System programming is done with two hand-held, remote-control tools.

      a. Initial setup tool.
      b. Tool for occupants to adjust the target levels by increasing the set point up to 25 percent, or by minimizing the electric lighting level.

C. Ceiling-Mounted Dimming Controls: Solid-state, light-level sensor unit to detect changes in indoor lighting levels that are perceived by the eye.

D. Electrical Components, Devices, and Accessories:

   1. Single zone closed loop, multi-zone open loop, and single zone dual-loop
   2. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
   3. Sensor Output: 0- to 10-V dc to operate luminaires. Sensor is powered by digital room controller unit.
   4. Light-Level Sensor Set-Point Adjustment Range: 1 to 6,553 fc.
   5. Sensor status LED.
   6. One RF-45 port for connection to digital system network.

2.2 DIGITAL INDOOR OCCUPANCY AND VACANCY SENSORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. WattStopper; Legrand North America, LLC.

B. General Requirements for Sensors:

   1. Wall or Ceiling-mounted, solid-state indoor occupancy and vacancy sensors.
   2. Passive Infrared (PIR), Ultrasonic, or Dual technology.
   3. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
   4. Operation:

      a. Occupancy Sensor: Unless otherwise indicated, turn lights on when coverage area is occupied, and turn them off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.

b. Vacancy Sensor: Unless otherwise indicated, lights are manually turned on and sensor turns lights off when the room is unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
c. Combination Sensor: Unless otherwise indicated, sensor shall be programmed to turn lights on when coverage area is occupied and turn them off when unoccupied, or to turn off lights that have been manually turned on; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.

5. Sensor Output: Sensor is powered from digital room controller.
6. Power: 24-V dc via RJ45 connection
7. One or two RJ-45 ports for connection to digital system network or other sensors.
8. Sensor status LED
9. Manual override of controlled loads.
10. Mounting:

a. Sensor: Suitable for mounting in any position on a standard outlet box.
b. Relay: Externally mounted through a 1/2-inch knockout in a standard electrical enclosure.
c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.

11. Indicator: Digital display, to show when motion is detected during testing and normal operation of sensor.
12. Sensitivity: 0-100 Percent in 10 percent increments.

C. Dual-Technology Type: Wall or 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-minimum movement of any portion of a human body that presents a target of not less than 36 sq. in., and detect a person of average size and weight moving not less than 12 inches in either a horizontal or a vertical manner at an approximate speed of 12 inches/s.
3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. when mounted on a 96-inch-high ceiling.
4. Detection Coverage (Room, Wall Mounted): Detect occupancy anywhere within a 180-degree pattern centered on the sensor over an area of 1000 square feet or 2000 square feet or 3000 square feet when mounted 48 inches above finished floor.

2.3 DIGITAL ROOM CONTROLLER

A. Manufacturers: Subject to compliance with requirements, provide products by the following:
1. WattStopper; Legrand North America, LLC.

B. Description: Digital controllers for lighting zones, fixtures and/or plug loads automatically bind room loads to the connected control devices in the space without commissioning or the use of any tools. Provide controllers to match the room lighting and plug load control requirements. Controllers are simple to install, and do not have dip switches/potentiometers, or require special configuration for standard Plug n' Go applications.

1. 120/277V, 60Hz, 20A, 1P.
2. On/Off Switching and 0-10V dimming.
3. Real-Time current monitoring.

4. One, two or three relay configurations.
5. Smart 250 mA switching power supply.
6. Four RF-45 local network ports.
7. One dimming output per relay.
8. Plenum rated.

2.4 DIGITAL WALL SWITCHING

A. Description: Self-configuring, digitally addressable push button switches with the following features
1. 1,2,3,4,5 or 8 button configurations.
2. Removable and engravable buttons.
3. Scene status LED.
4. Two RJ-45 ports for connection to digital system network or other switches via local network.
5. Scenes can be reprogrammed and reconfigured for individual buttons.

2.5 DIGITAL ZONE CONTROLLER

A. Manufacturers: Subject to compliance with requirements, provide products by the following:
1. WattStopper; Legrand North America, LLC.

B. Description: A digital controller that provides power and connectivity to digital system room and load controllers, and enables automation of lighting functions, i.e. astronomical time-clock function.

1. 120/277, 60HZ, 20A,1P
2. Two RJ-45 Ports for connection for digital system network.
3. Support up to 94 communication devices and up to 64 connection loads.
4. Support Astronomical, time-based and photocell-based event types.
5. Optional connection to Building Automation System (BAS).

2.6 EMERGENCY LIGHTING CONTROL DEIVCE

A. Manufacturers: Subject to compliance with requirements, provide products by the following:
1. WattStopper; Legrand North America, LLC.

B. Description: Allows a standard lighting control device to control emergency lighting in conjunction with normal lighting in any area within a building.
1. UL 924 Listed device
2. 120/277V, 50/60HZ, 20A Ballast rating
3. Push to test button
4. Auxiliary contact for remote test or fire alarm interface.

2.7 CONDUCTORS AND CABLES

A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Section 260519 "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 260519 "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 260519 "Low-Voltage Electrical Power Conductors and Cables."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine lighting control devices before installation. Reject lighting control devices that are wet, moisture damaged, or mold damaged.

B. Examine walls and ceilings for suitable conditions where lighting control devices will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SENSOR INSTALLATION

A. Comply with NECA 1.

B. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression systems, and partition assemblies.

C. Install and aim sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

3.3 WIRING INSTALLATION

A. Comply with NECA 1.

B. Wiring Method: Comply with Section 260519 "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size is 1/2 inch.

C. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.

D. Size conductors according to lighting control device manufacturer's written instructions unless otherwise indicated.

E. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.4 IDENTIFICATION

A. Identify components and power and control wiring according to Section 260553 "Identification for Electrical Systems."

1. Identify controlled circuits in lighting contactors.
2. Identify circuits or luminaires controlled by photoelectric and occupancy sensors at each sensor.

B. Label time switches and contactors with a unique designation.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to evaluate lighting control devices and perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

C. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Operational Test: After installing time switches and sensors, and after electrical circuitry has been energized, start units to confirm proper unit operation.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Lighting control devices will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports.

3.6 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting lighting control devices 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.

3.7 SOFTWARE SERVICE AGREEMENT

A. Technical Support: Beginning at Substantial Completion, service agreement shall include software support for two years.

B. Upgrade Service: At Substantial Completion, update software to latest version. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system and new or revised licenses for using software.

1. Upgrade Notice: At least 30 days to allow Owner to schedule and access the system and to upgrade computer equipment if necessary.

3.8 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain lighting control devices.

END OF SECTION

SECTION 26 2200

LOW-VOLTAGE TRANSFORMERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following types of dry-type transformers rated 600 V and less, with capacities up to 1000 kVA:

1. Distribution transformers.

1.3 ACTION SUBMITTALS

A. Product Data: Include rated nameplate data, capacities, weights, dimensions, minimum clearances, installed devices and features, and performance for each type and size of transformer 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. Wiring Diagrams: Power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Source quality-control test reports.

C. Field quality-control test reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For transformers to include in emergency, operation, and maintenance manuals.

1.6 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. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7.

C. Source Limitations: Obtain each transformer type through one source from a single manufacturer.

D. 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.

E. Comply with IEEE C57.12.91, "Test Code for Dry-Type Distribution and Power Transformers."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Temporary Heating: Apply temporary heat according to manufacturer's written instructions within the enclosure of each ventilated-type unit, throughout periods during which equipment is not energized and when transformer is not in a space that is continuously under normal control of temperature and humidity.

1.8 COORDINATION

A. Coordinate size and location of concrete bases with actual transformer provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

B. Coordinate installation of wall-mounting and structure-hanging supports with actual transformer provided.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Products.
2. General Electric Company.
3. Square D; Schneider Electric.

2.2 GENERAL TRANSFORMER REQUIREMENTS

A. Description: Factory-assembled and -tested, air-cooled units for 60-Hz service.

B. Cores: Grain-oriented, non-aging silicon steel.

C. Coils: Continuous windings without splices except for taps.

1. Internal Coil Connections: Brazed or pressure type.
2. Coil Material: Copper.

2.3 DISTRIBUTION TRANSFORMERS

A. Comply with NEMA ST 20, and list and label as complying with UL 1561.

B. Provide transformers that are constructed to withstand seismic forces specified in Section "Vibration and Seismic Controls for Electrical Systems."

C. Cores: One leg per phase.

D. Enclosure: Ventilated, NEMA 250, Type 2.

1. Core and coil shall be encapsulated within resin compound, sealing out moisture and air.

E. Transformer Enclosure Finish: Comply with NEMA 250.

1. Finish Color: Gray.

F. Taps for Transformers Smaller Than 3 kVA: One 5 percent tap above normal full capacity.

G. Taps for Transformers 7.5 to 24 kVA: One 5 percent tap above and one 5 percent tap below normal full capacity.

H. Taps for Transformers 25 kVA and Larger: Two 2.5 percent taps above and four 2.5 percent taps below normal full capacity.

I. Insulation Class: 220 deg C, UL-component-recognized insulation system with a maximum of 150 deg C rise above 40 deg C ambient temperature.

J. Energy Efficiency for Transformers Rated 15 kVA and Larger:

1. Complying with NEMA TP 1, Class 1 efficiency levels.
2. Tested according to NEMA TP 2.

K. Wall Brackets: Manufacturer's standard brackets.

L. Fungus Proofing: Permanent fungicidal treatment for coil and core.

M. Low-Sound-Level Requirements: Minimum of 3 dBA less than NEMA ST 20 standard sound levels when factory tested according to IEEE C57.12.91.

N. Low-Sound-Level Requirements: Maximum sound levels, when factory tested according to IEEE C57.12.91, as follows:

1. 9 kVA and Less: 50 dBA
2. 30 to 50 kVA: 52 dBA
3. 51 to 150 kVA: 54 dBA
4. 151 to 300 kVA: 55 dBA

2.4 IDENTIFICATION DEVICES

A. Nameplates: Engraved, laminated-plastic or metal nameplate for each distribution transformer, mounted with corrosion-resistant screws. Nameplates and label products are specified in Section "Identification for Electrical Systems."

2.5 SOURCE QUALITY CONTROL

A. Test and inspect transformers according to IEEE C57.12.91.

B. Factory Sound-Level Tests: Conduct sound-level tests on equipment for this Project.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions for compliance with enclosure- and ambient-temperature requirements for each transformer.

B. Verify that field measurements are as needed to maintain working clearances required by NFPA 70 and manufacturer's written instructions.

C. Examine walls, floors, roofs, and concrete bases for suitable mounting conditions where transformers will be installed.

D. Verify that ground connections are in place and requirements in Section "Grounding and Bonding for Electrical Systems" have been met. Maximum ground resistance shall be 5 ohms at location of transformer.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install wall-mounting transformers level and plumb with wall brackets fabricated by transformer manufacturer.

1. Brace wall-mounting transformers as specified in Section "Vibration and Seismic Controls for Electrical Systems."

B. Construct concrete bases and anchor floor-mounting transformers according to manufacturer's written instructions and requirements in Section "Hangers and Supports for Electrical Systems."

3.3 CONNECTIONS

A. Ground equipment according to Section "Grounding and Bonding for Electrical Systems."

B. Connect wiring according to Section "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.

C. 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.

D. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

E. Remove and replace units that do not pass tests or inspections and retest as specified above.

F. Infrared Scanning: Two months after Substantial Completion, perform an infrared scan of transformer connections.

1. Use an infrared-scanning device designed to measure temperature or detect significant deviations from normal values. Provide documentation of device calibration.
2. Perform 2 follow-up infrared scans of transformers, one at 4 months and the other at 11 months after Substantial Completion.
3. Prepare a certified report identifying transformer checked and describing results of scanning. Include notation of deficiencies detected, remedial action taken, and scanning observations after remedial action.

G. Test Labeling: On completion of satisfactory testing of each unit, attach a dated and signed "Satisfactory Test" label to tested component.

3.5 ADJUSTING

A. Record transformer secondary voltage at each unit for at least 48 hours of typical occupancy period. Adjust transformer taps to provide optimum voltage conditions at secondary terminals. Optimum is defined as not exceeding nameplate voltage plus 10 percent and not being lower than nameplate voltage minus 3 percent at maximum load conditions. Submit recording and tap settings as test results.

B. Connect buck-boost transformers to provide nameplate voltage of equipment being served, plus or minus 5 percent, at secondary terminals.

C. Output Settings Report: Prepare a written report recording output voltages and tap settings.

3.6 CLEANING

A. Vacuum dirt and debris; do not use compressed air to assist in cleaning.

END OF SECTION

SECTION 26 2413

SWITCHBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Service and distribution switchboards rated 600 V and less.
2. Transient voltage suppression devices.
3. Disconnecting and overcurrent protective devices.
4. Instrumentation.
5. Control power.
6. Accessory components and features.
7. Identification.
8. Mimic bus.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of switchboard, overcurrent protective device, transient voltage suppression device, ground-fault protector, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.

B. Shop Drawings: For each switchboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show tabulations of installed devices, equipment features, and ratings.
2. Detail enclosure types for types other than NEMA 250, Type 1.
3. Detail bus configuration, current, and voltage ratings.
4. Detail short-circuit current rating of switchboards and overcurrent protective devices.
5. Include descriptive documentation of optional barriers specified for electrical insulation and isolation.
6. Detail utility company's metering provisions with indication of approval by utility company.
7. Include evidence of NRTL listing for series rating of installed devices.
8. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
9. Include time-current coordination curves for each type and rating of overcurrent protective device included in switchboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device.
10. Include diagram and details of proposed mimic bus.
11. Include schematic and wiring diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Field Quality-Control Reports:

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For switchboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section "Operation and Maintenance Data," include the following:

1. Routine maintenance requirements for switchboards and all installed components.
2. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
3. Time-current coordination curves for each type and rating of overcurrent protective device included in switchboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Potential Transformer Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than two of each size and type.
2. Control-Power Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than two of each size and type.
3. Indicating Lights: Equal to 10 percent of quantity installed for each size and type, but no fewer than one of each size and type.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers qualified as defined in NEMA PB 2.1 and trained in electrical safety as required by NFPA 70E.

B. 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.

C. Source Limitations: Obtain switchboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.

D. Product Selection for Restricted Space: Drawings indicate maximum dimensions for switchboards including clearances between switchboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.

E. 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.

F. Comply with NEMA PB 2.

G. Comply with NFPA 70.

H. Comply with UL 891.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver switchboards in sections or lengths that can be moved past obstructions in delivery path.

B. Remove loose packing and flammable materials from inside switchboards and install temporary electric heating (250 W per section) to prevent condensation.

C. Handle and prepare switchboards for installation according to NECA 400 or NEMA PB 2.1.

1.9 PROJECT CONDITIONS

A. Installation Pathway: Remove and replace access fencing, doors, lift-out panels, and structures to provide pathway for moving switchboards into place.

B. Environmental Limitations:

1. Do not deliver or install switchboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above switchboards 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 104 deg F.
    b. Altitude: Not exceeding 6600 feet.

C. Service Conditions: NEMA PB 2, usual service conditions, as follows:

1. Ambient temperatures within limits specified.
2. Altitude not exceeding 6600 feet.

D. 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 seven days in advance of proposed interruption of electric service.
2. Indicate method of providing temporary electric service.
3. Do not proceed with interruption of electric service without Owner's written permission.
4. Comply with NFPA 70E.

1.10 COORDINATION

A. Coordinate layout and installation of switchboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

1.11 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace transient voltage suppression devices that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Square D; a brand of Schneider Electric.

B. Front-Connected, Front-Accessible Switchboards:

1. Main Devices: Fixed, individually mounted.
2. Branch Devices: Panel mounted.
3. Sections front and rear aligned.

C. Front- and Side-Accessible Switchboards:

1. Main Devices: Fixed, individually mounted.
2. Branch Devices: Panel mounted.
3. Sections front and rear aligned.

D. Front- and Rear-Accessible Switchboards:

1. Main Devices: Fixed, individually mounted.
2. Branch Devices: Panel and fixed, individually mounted.
3. Sections front and rear aligned.

E. Nominal System Voltage: As Indicated.

F. Main-Bus Continuous: As Indicated.

G. Indoor Enclosures: Steel, NEMA 250, Type 1 or Type 5, as indicated.

H. Enclosure Finish for Indoor Units: Factory-applied finish in manufacturer's standard gray finish over a rust-inhibiting primer on treated metal surface.

I. Outdoor Enclosures: Type 3R.

1. Finish: Factory-applied finish in manufacturer's standard color; undersurfaces treated with corrosion-resistant undercoating.
2. Enclosure: Downward, rearward sloping roof; rear hinged doors for each section, with provisions for padlocking.
3. Doors: Personnel door on front and rear of gear, minimum width of 30 inches; opening outwards; with provisions for padlocking.
4. Accessories: ground-fault circuit interrupter (GFCI) duplex receptacle.

J. Barriers: Between adjacent switchboard sections.

K. Insulation and isolation for main bus of main section and main and vertical buses of feeder sections.

L. Cubical Space Heaters: Factory-installed electric space heaters of sufficient wattage in each vertical section to maintain enclosure temperature above expected dew point.

1. Space-Heater Control: Thermostats to maintain temperature of each section above expected dew point.
2. Space-Heater Power Source: Transformer, factory installed in switchboard.

M. Utility Metering Compartment: Fabricated, barrier compartment and section complying with utility company's requirements; hinged sealed door; buses provisioned for mounting utility company's current transformers and potential transformers or potential taps as required by utility company. If separate vertical section is required for utility metering, match and align with basic switchboard. Provide service entrance label and necessary applicable service entrance features.

N. Bus Transition and Incoming Pull Sections: Matched and aligned with basic switchboard.

O. Removable, Hinged Rear Doors and Compartment Covers: Secured by captive thumb screws, for access to rear interior of switchboard.

P. Hinged Front Panels: Allow access to circuit breaker, metering, accessory, and blank compartments.

Q. Buses and Connections: Three phase, four wire unless otherwise indicated.

1. Phase- and Neutral-Bus Material: Hard-drawn copper of 98 percent conductivity, with copper feeder circuit-breaker line connections.
2. Load Terminals: Insulated, rigidly braced, runback bus extensions, of same material as through buses, equipped with mechanical connectors for outgoing circuit conductors. Provide load terminals for future circuit-breaker positions at full-ampere rating of circuit-breaker position.
3. Ground Bus: 1/4-by-2-inch- or Minimum-size required by UL 891, whichever is greater, hard-drawn copper of 98 percent conductivity, equipped with mechanical connectors for feeder and branch-circuit ground conductors. For busway feeders, extend insulated equipment grounding cable to busway ground connection and support cable at intervals in vertical run.

4. Main Phase Buses and Equipment Ground Buses: Uniform capacity for entire length of switchboard's main and distribution sections. Provide for future extensions from both ends.
5. Neutral Buses: 100 percent of the ampacity of phase buses unless otherwise indicated, equipped with mechanical connectors for outgoing circuit neutral cables. Brace bus extensions for busway feeder neutral bus.
6. Isolation Barrier Access Provisions: Permit checking of bus-bolt tightness.

R. Future Devices: Equip compartments with mounting brackets, supports, bus connections, and appurtenances at full rating of circuit-breaker compartment.

S. Bus-Bar Insulation: Factory-applied, flame-retardant, tape wrapping of individual bus bars or flame-retardant, spray-applied insulation.

T. Fungus Proofing: Permanent fungicidal treatment for overcurrent protective devices and other components including instruments and instrument transformers.

2.2 TRANSIENT VOLTAGE SUPPRESSION DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Square D; a brand of Schneider Electric.

B. Surge Protection Device Description: IEEE C62.41-compliant, integrally mounted, bolt-on, solid-state, parallel-connected, modular (with field-replaceable modules) type, with sine-wave tracking suppression and filtering modules, UL 1449, third edition, short-circuit current rating matching or exceeding the switchboard short-circuit rating, and with the following features and accessories:

1. Fuses, rated at 200-kA interrupting capacity.
2. Fabrication using bolted compression lugs for internal wiring.
3. Integral disconnect switch.
4. Redundant suppression circuits.
5. Redundant replaceable modules.
6. Arrangement with wire connections to phase buses, neutral bus, and ground bus.
7. LED indicator lights for power and protection status.
8. Audible alarm, with silencing switch, to indicate when protection has failed.
9. Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of system protection status. Contacts shall reverse position on failure of any surge diversion module or on opening of any current-limiting device. Coordinate with building power monitoring and control system.
10. Six-digit, transient-event counter set to totalize transient surges.

C. Peak Single-Impulse Surge Current Rating: 150 kA per mode/300 kA per phase.

D. Withstand Capabilities: 12,000 IEEE C62.41, Category C3 (10 kA), 8-by-20-mic.sec. surges with less than 5 percent change in clamping voltage.

E. Protection modes and UL 1449 SVR for grounded wye circuits with 480Y/277 (three-phase, four-wire circuits) shall be as follows:

1. Line to Neutral: 1200 V for 480Y/277.
2. Line to Ground: 1200 V for 480Y/277.
3. Neutral to Ground: 1500 V for 480Y/277.

F. Protection modes and UL 1449 SVR for 240-, 480-V, or 600-V three-phase, three-wire, delta circuits shall be as follows:

1. Line to Line: 1800 V for 480 V.
2. Line to Ground: 1800 V for 480 V.

2.3 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
2. Ground-Fault Equipment Protection (GFEP) Circuit Breakers: Class B ground-fault protection (30-mA trip).
3. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:

    a. Standard frame sizes, trip ratings, and number of poles.
    b. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor material.
    c. Application Listing: Appropriate for application.

    d. Select first option in first subparagraph below for solid-state trip units; select second option for thermal-magnetic trip units. If selecting second option, also retain "Shunt Trip" Subparagraph below.

    e. Motor Operated Circuit Breakers: Provide motor operated circuit breakers for the generator load shed scheme. Control to automatically open when utility power is lost. Control to automatically close upon restoration of utility power.

B. Insulated-Case Circuit Breaker (ICCB): 100 percent rated, sealed, insulated-case power circuit breaker with interrupting capacity rating to meet available fault current.

1. Fixed circuit-breaker mounting.
2. Two-step, stored-energy closing.
3. Full-function, microprocessor-based trip units with interchangeable rating plug, trip indicators, and the following field-adjustable settings:

    a. Instantaneous trip.
    b. Long- and short-time time adjustments.
    c. Ground-fault pickup level, time delay, and I^2t response.

4. Zone-Selective Interlocking: Integral with electronic trip unit; for interlocking ground-fault protection function.
5. Control Voltage: 120-V ac.
6. Motor Operated Circuit Breakers: Provide motor operated circuit breakers for the generator load shed scheme. Control to automatically open when utility power is lost. Control to automatically close upon restoration of utility power.

2.4 INSTRUMENTATION

A. Instrument Transformers: IEEE C57.13, NEMA EI 21.1, and the following:

1. Potential Transformers: IEEE C57.13; 120 V, 60 Hz, single secondary; disconnecting type with integral fuse mountings. Burden and accuracy shall be consistent with connected metering and relay devices.
2. Current Transformers: IEEE C57.13; 5 A, 60 Hz, secondary; wound type; single secondary winding and secondary shorting device. Burden and accuracy shall be consistent with connected metering and relay devices.
3. Control-Power Transformers: Dry type, mounted in separate compartments for units larger than 3 kVA.
4. Current Transformers for Neutral and Ground-Fault Current Sensing: Connect secondary wiring to ground overcurrent relays, via shorting terminals, to provide selective tripping of main and tie circuit breaker. Coordinate with feeder circuit-breaker, ground-fault protection.

B. Multifunction Digital-Metering Monitor: Microprocessor-based unit suitable for three- or four-wire systems and with the following features:

1. Switch-selectable digital display of the following values with maximum accuracy tolerances as indicated:

a. Phase Currents, Each Phase: Plus or minus 1 percent.
b. Phase-to-Phase Voltages, Three Phase: Plus or minus 1 percent.
c. Phase-to-Neutral Voltages, Three Phase: Plus or minus 1 percent.
d. Megawatts: Plus or minus 2 percent.
e. Megavars: Plus or minus 2 percent.
f. Power Factor: Plus or minus 2 percent.
g. Frequency: Plus or minus 0.5 percent.
h. Accumulated Energy, Megawatt Hours: Plus or minus 2 percent; accumulated values unaffected by power outages up to 72 hours.
i. Megawatt Demand: Plus or minus 2 percent; demand interval programmable from five to 60 minutes.
j. Contact devices to operate remote impulse-totalizing demand meter.

2. Mounting: Display and control unit flush or semi-flush mounted in instrument compartment door.

C. Ammeters, Voltmeters, and Power-Factor Meters: ANSI C39.1.

1. Meters: 4-inch diameter or 6 inches square, flush or semi-flush, with antiparallax 250-degree scales and external zero adjustment.
2. Voltmeters: Cover an expanded-scale range of nominal voltage plus 10 percent.

D. Instrument Switches: Rotary type with off position.

1. Voltmeter Switches: Permit reading of all phase-to-phase voltages and, where a neutral is indicated, phase-to-neutral voltages.
2. Ammeter Switches: Permit reading of current in each phase and maintain current-transformer secondaries in a closed-circuit condition at all times.

2.5 CONTROL POWER

A. Control Circuits: 120-V ac, supplied through secondary disconnecting devices from control-power transformer.

B. Electrically Interlocked Main and Tie Circuit Breakers: Two control-power transformers in separate compartments, with interlocking relays, connected to the primary side of each control-power transformer at the line side of the associated main circuit breaker. 120-V secondaries connected through automatic transfer relays to ensure a fail-safe automatic transfer scheme.

C. Control-Power Fuses: Primary and secondary fuses for current-limiting and overload protection of transformer and fuses for protection of control circuits.

D. Control Wiring: Factory installed, with bundling, lacing, and protection included. Provide flexible conductors for No. 8 AWG and smaller, for conductors across hinges, and for conductors for interconnections between shipping units.

2.6 IDENTIFICATION

A. Mimic Bus: Entire single-line switchboard bus work, as depicted on factory record drawing, on an engraved laminated-plastic (Gravoply) nameplate.

1. Nameplate: At least 0.0625-inch- thick laminated plastic (Gravoply), located at eye level on front cover of the switchboard incoming service section.

B. Coordinate mimic-bus segments with devices in switchboard sections to which they are applied. Produce a concise visual presentation of principal switchboard components and connections.

C. Presentation Media: Painted graphics in color contrasting with background color to represent bus and components, complete with lettered designations.

D. Service Equipment Label: NRTL labeled for use as service equipment for switchboards with one or more service disconnecting and overcurrent protective devices.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Receive, inspect, handle, and store switchboards according to NECA 400 or NEMA PB 2.1.

B. Examine switchboards before installation. Reject switchboards that are moisture damaged or physically damaged.

C. Examine elements and surfaces to receive switchboards for compliance with installation tolerances and other conditions affecting performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install switchboards and accessories according to NECA 400 or NEMA PB 2.1.

B. Equipment Mounting: Install switchboards on concrete base, 4-inch nominal thickness. Comply with requirements for concrete base specified in Section "Cast-in-Place Concrete."

1. 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.
2. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
4. Install anchor bolts to elevations required for proper attachment to switchboards.

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from switchboard units and components.

D. Operating Instructions: Frame and mount the printed basic operating instructions for switchboards, including control and key interlocking sequences and emergency procedures. Fabricate frame of finished wood or metal and cover instructions with clear acrylic plastic. Mount on front of switchboards.

E. Install filler plates in unused spaces of panel-mounted sections.

F. Install overcurrent protective devices, transient voltage suppression devices, and instrumentation.

1. Set field-adjustable switches and circuit-breaker trip ranges.

G. Install spare-fuse cabinet.

H. Comply with NECA 1.

3.3 CONNECTIONS

A. Comply with requirements for terminating feeder bus specified in Section "Enclosed Bus Assemblies." Drawings indicate general arrangement of bus, fittings, and specialties.

B. Comply with requirements for terminating cable trays specified in Section "Cable Trays for Electrical Systems." Drawings indicate general arrangement of cable trays, fittings, and specialties.

3.4 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with requirements for identification specified in Section "Identification for Electrical Systems."

B. Switchboard Nameplates: Label each switchboard compartment with a nameplate complying with requirements for identification specified in Section "Identification for Electrical Systems."

C. Device Nameplates: Label each disconnecting and overcurrent protective device and each meter and control device mounted in compartment doors with a nameplate complying with requirements for identification specified in Section "Identification for Electrical Systems."

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. 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.

D. Acceptance Testing Preparation:

1. Test insulation resistance for each switchboard bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

E. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
3. Perform the following infrared scan tests and inspections and prepare reports:

a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each switchboard. Remove front and rear panels so joints and connections are accessible to portable scanner.
b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each switchboard 11 months after date of Substantial Completion.
c. Instruments and Equipment:

1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

4. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

F. Switchboard will be considered defective if it does not pass tests and inspections.

G. Prepare test and inspection reports, including a certified report that identifies switchboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.6 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges as indicated or as specified in Section "Overcurrent Protective Device Coordination Study."

3.7 PROTECTION

A. Temporary Heating: Apply temporary heat, to maintain temperature according to manufacturer's written instructions, until switchboard is ready to be energized and placed into service.

3.8 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain switchboards, overcurrent protective devices, instrumentation, and accessories, and to use and reprogram microprocessor-based trip, monitoring, and communication units.

END OF SECTION

SECTION 26 2416

PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Distribution panelboards.
2. Lighting and appliance branch-circuit panelboards.

1.3 DEFINITIONS

A. ATS: Acceptance testing specification.

B. GFCI: Ground-fault circuit interrupter.

C. GFEP: Ground-fault equipment protection.

D. HID: High-intensity discharge.

E. MCCB: Molded-case circuit breaker.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of panelboard. Include materials, switching and overcurrent protective devices, accessories, and components indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each panelboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices with nameplates, conductor termination sizes, equipment features, and ratings.
2. Detail enclosure types including mounting and anchorage, environmental protection, knockouts, corner treatments, covers and doors, gaskets, hinges, and locks.
3. Detail bus configuration, current, and voltage ratings.
4. Short-circuit current rating of panelboards and overcurrent protective devices.
5. Include evidence of NRTL listing for series rating of installed devices.
6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

7. Include wiring diagrams for power, signal, and control wiring.
8. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device. Include an Internet link for electronic access to downloadable PDF of the coordination curves.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section "Operation and Maintenance Data," include the following:

1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Keys: Two spares for each type of panelboard cabinet lock.

1.8 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.

1.9 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 or NEMA PB 1.

1.10 FIELD CONDITIONS

A. Environmental Limitations:

1. Do not deliver or install panelboards until spaces are enclosed and weather-tight, 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 23 deg F to plus 104 deg F.
    b. Altitude: Not exceeding 6600 feet.

B. Service Conditions: NEMA PB 1, usual service conditions, as follows:

1. Ambient temperatures within limits specified.
2. Altitude not exceeding 6600 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 seven 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.

B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

1.12 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace panelboards that fail in materials or workmanship within specified warranty period.

1. Panelboard Warranty Period: 18 months from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PANELBOARDS COMMON REQUIREMENTS

A. Fabricate and test panelboards according to IEEE 344.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with NEMA PB 1.

D. Comply with NFPA 70.

E. Enclosures: Flush and Surface-mounted, dead-front cabinets.

1. Rated for environmental conditions at installed location.

a. Indoor Dry and Clean Locations: NEMA 250, Type 1.

2. Height: 84 inches maximum.
3. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box. Trims shall cover all live parts and shall have no exposed hardware.
4. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover. Trims shall cover all live parts and shall have no exposed hardware.
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. Gutter Extension and Barrier: Same gage and finish as panelboard enclosure; integral with enclosure body. Arrange to isolate individual panel sections.
7. Finishes:

a. Panels and Trim: Steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
b. Back Boxes: Same finish as panels and trim.
c. Fungus Proofing: Permanent fungicidal treatment for overcurrent protective devices and other components.

8. Directory Card: Inside panelboard door, mounted in metal frame with transparent protective cover.

F. Incoming Mains:

1. Location: As Indicated or Scheduled.

G. Phase, Neutral, and Ground Buses:

1. Material: Hard-drawn copper, 98 percent conductivity.

a. Bus shall be fully rated the entire length.

2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
3. Isolated Ground Bus: Adequate for branch-circuit isolated ground conductors; insulated from box.
4. Full-Sized Neutral: Equipped with full-capacity bonding strap for service entrance applications. Mount electrically isolated from enclosure. Do not mount neutral bus in gutter.
5. Extra-Capacity Neutral Bus: Neutral bus rated 200 percent of phase bus and listed and labeled by an NRTL acceptable to authority having jurisdiction, as suitable for nonlinear loads in electronic-grade panelboards and others designated on Drawings. Connectors shall be sized for double-sized or parallel conductors as indicated on Drawings. Do not mount neutral bus in gutter.

H. Conductor Connectors: Suitable for use with conductor material and sizes.

1. Material: Hard-drawn copper, 98 percent conductivity.
2. Terminations shall allow use of 75 deg C rated conductors without de-rating.
3. Size: Lugs suitable for indicated conductor sizes, with additional gutter space, if required, for larger conductors.
4. Main and Neutral Lugs: Mechanical type, with a lug on the neutral bar for each pole in the panelboard.
5. Ground Lugs and Bus-Configured Terminators: Mechanical type, with a lug on the bar for each pole in the panelboard.
6. Feed-Through Lugs: Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
7. Sub-feed (Double) Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
8. Gutter-Tap Lugs: Mechanical type suitable for use with conductor material and with matching insulating covers. Locate at same end of bus as incoming lugs or main device.
9. Extra-Capacity Neutral Lugs: Rated 200 percent of phase lugs mounted on extra-capacity neutral bus.

I. NRTL Label: Panelboards or load centers shall be labeled by an NRTL acceptable to authority having jurisdiction for use as service equipment with one or more main service disconnecting and overcurrent protective devices. Panelboards or load centers shall have meter enclosures, wiring, connections, and other provisions for utility metering. Coordinate with utility company for exact requirements.

J. Future Devices: Panelboards or load centers shall have mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

K. Panelboard Short-Circuit Current Rating: Rated for series-connected system with integral or remote upstream overcurrent protective devices and labeled by an NRTL. Include label or manual with size and type of allowable upstream and branch devices listed and labeled by an NRTL for series-connected short-circuit rating.

L. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals. Assembly listed by an NRTL for 100 percent interrupting capacity.

2.2 POWER PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. Siemens, Inc.
3. Square D; a brand of Schneider Electric.

B. Panelboards: NEMA PB 1, distribution type.

C. Doors: Secured with vault-type latch with tumbler lock; keyed alike.

1. For doors more than 36 inches high, provide two latches, keyed alike.

D. Mains: As Indicated or Scheduled.

E. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.

F. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers.

2.3 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. Siemens, Inc.
3. Square D; a brand of Schneider Electric.

B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

C. Mains: As Indicated or Scheduled.

D. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

E. Doors: Door-in-door construction with concealed hinges; secured with multipoint latch with tumbler lock; keyed alike. Outer door shall permit full access to the panel interior. Inner door shall permit access to breaker operating handles and labeling, but current carrying terminals and bus shall remain concealed.

2.4 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. Siemens, Inc.
3. Square D; a brand of Schneider Electric.

B. MCCB: Comply with UL 489, with series-connected rating or interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers:

a. Inverse time-current element for low-level overloads.
b. Instantaneous magnetic trip element for short circuits.
c. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

2.5 IDENTIFICATION

A. Panelboard Label: Manufacturer's name and trademark, voltage, amperage, number of phases, and number of poles shall be located on the interior of the panelboard door.

B. Breaker Labels: Faceplate shall list current rating, UL and IEC certification standards, and AIC rating.

C. Circuit Directory: Directory card inside panelboard door, mounted in transparent card holder or metal frame with transparent protective cover.

1. Circuit directory shall identify specific purpose with detail sufficient to distinguish it from all other circuits.

D. Circuit Directory: Computer-generated circuit directory mounted inside panelboard door with transparent plastic protective cover.

1. Circuit directory shall identify specific purpose with detail sufficient to distinguish it from all other circuits.

2.6 ACCESSORY COMPONENTS AND FEATURES

A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.

B. Portable Test Set: For testing functions of solid-state trip devices without removing from panelboard. Include relay and meter test plugs suitable for testing panelboard meters and switchboard class relays.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify actual conditions with field measurements prior to ordering panelboards to verify that equipment fits in allocated space in, and comply with, minimum required clearances specified in NFPA 70.

B. Receive, inspect, handle, and store panelboards according to NECA 407 or NEMA PB 1.1.

C. Examine panelboards before installation. Reject panelboards that are damaged, rusted, or have been subjected to water saturation.

D. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Comply with NECA 1.

C. Install panelboards and accessories according to NECA 407 or NEMA PB 1.1.

D. Equipment Mounting:

1. Install panelboards on cast-in-place concrete equipment bases, where indicated. Comply with requirements for equipment bases and foundations specified in Section "Cast-in-Place Concrete."
2. Attach panelboard to the vertical finished or structural surface behind the panelboard.

E. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.

F. Mount top of trim 90 inches maximum above finished floor unless otherwise indicated.

G. Mount panelboard cabinet plumb and rigid without distortion of box.

H. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.

I. Mount surface-mounted panelboards to steel slotted supports 5/8 inch in depth. Orient steel slotted supports vertically.

J. Install overcurrent protective devices and controllers not already factory installed.

1. Set field-adjustable, circuit-breaker trip ranges.
2. Tighten bolted connections and circuit breaker connections using calibrated torque wrench or torque screwdriver per manufacturer's written instructions.

K. Make grounding connections and bond neutral for services and separately derived systems to ground. Make connections to grounding electrodes, separate grounds for isolated ground bars, and connections to separate ground bars.

L. Install filler plates in unused spaces.

M. Stub four 1-inch empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch empty conduits into raised floor space or below slab not on grade.

N. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.

O. Mount spare fuse cabinet in accessible location.

3.3 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; install warning signs complying with requirements in Section "Identification for Electrical Systems."

B. Create a directory to indicate installed circuit loads after balancing panelboard loads; incorporate Owner's final room designations. Obtain approval before installing. Handwritten directories are not acceptable. Install directory inside panelboard door.

C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section "Identification for Electrical Systems."

D. Device Nameplates: Label each branch circuit device in power panelboards with a nameplate complying with requirements for identification specified in Section "Identification for Electrical Systems."

E. Install warning signs complying with requirements in Section "Identification for Electrical Systems" identifying source of remote circuit.

3.4 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. 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. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test for low-voltage air circuit breakers and low-voltage surge arrestors stated in NETA ATS, Paragraph 7.6 Circuit Breakers and Paragraph 7.19.1 Surge Arrestors, Low-Voltage. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
3. Perform the following infrared scan tests and inspections and prepare reports:

    a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each panelboard. Remove front panels so joints and connections are accessible to portable scanner.
    b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each panelboard 11 months after date of Substantial Completion.
    c. Instruments and Equipment:

1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

E. Panelboards will be considered defective if they do not pass tests and inspections.

F. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results, with comparisons of the two scans. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

B. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes. Prior to making circuit changes to achieve load balancing, inform Architect of effect on phase color coding.

1. Measure loads during period of normal facility operations.
2. Perform circuit changes to achieve load balancing outside normal facility operation schedule or at times directed by the Architect. Avoid disrupting services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
3. After changing circuits to achieve load balancing, recheck loads during normal facility operations. Record load readings before and after changing circuits to achieve load balancing.
4. Tolerance: Maximum difference between phase loads, within a panelboard, shall not exceed 20 percent.

3.6 PROTECTION

A. Temporary Heating: Prior to energizing panelboards, apply temporary heat to maintain temperature according to manufacturer's written instructions.

END OF SECTION

SECTION 26 2726

WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Receptacles, receptacles with integral GFCI, and associated device plates.
2. Weather-resistant receptacles.
3. Snap switches and wall-box dimmers.
4. Wall-switch and exterior occupancy sensors.

1.3 DEFINITIONS

A. EMI: Electromagnetic interference.

B. GFCI: Ground-fault circuit interrupter.

C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.

D. RFI: Radio-frequency interference.

E. TVSS: Transient voltage surge suppressor.

F. UTP: Unshielded twisted pair.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Receptacles for Owner-Furnished Equipment: Match plug configurations.
2. Cord and Plug Sets: Match equipment requirements.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: List of legends and description of materials and process used for pre-marking wall plates.

C. Samples: One for each type of device and wall plate specified, in each color specified.

1.6 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing-label warnings and instruction manuals that include labeling conditions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:

1. Cooper Wiring Devices; Division of Cooper Industries, Inc. (Cooper).
2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
3. Leviton Mfg. Company Inc. (Leviton).
4. Pass & Seymour/Legrand (Pass & Seymour).

B. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.2 GENERAL WIRING-DEVICE REQUIREMENTS

A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

C. Devices that are manufactured for use with modular plug-in connectors may be substituted under the following conditions:

1. Connectors shall comply with UL 2459 and shall be made with stranding building wire.
2. Devices shall comply with the requirements in this Section.

2.3 STRAIGHT-BLADE RECEPTACLES

A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; 5351 (single), CR5362 (duplex).
b. Hubbell; HBL5351 (single), HBL5352 (duplex).
c. Leviton; 5891 (single), 5352 (duplex).

d. Pass & Seymour; 5361 (single), 5362 (duplex).

2.4 GFCI RECEPTACLES

A. General Description:

1. Straight blade, non-feed-through type.
2. Comply with NEMA WD 1, NEMA WD 6, UL 498, UL 943 Class A, and FS W-C-596.
3. Include indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection.

B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; VGF20.
b. Hubbell; GFR5352L.
c. Pass & Seymour; 2095.
d. Leviton; 7590.

2.5 TOGGLE SWITCHES

A. Comply with NEMA WD 1, UL 20, and FS W-S-896.

B. Switches, 120/277 V, 20 A:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Single Pole:

1) Cooper; AH1221.
2) Hubbell; HBL1221.
3) Leviton; 1221-2.
4) Pass & Seymour; CSB20AC1.

b. Two Pole:

1) Cooper; AH1222.
2) Hubbell; HBL1222.
3) Leviton; 1222-2.
4) Pass & Seymour; CSB20AC2.

c. Three Way:

1) Cooper; AH1223.
2) Hubbell; HBL1223.
3) Leviton; 1223-2.
4) Pass & Seymour; CSB20AC3.

d. Four Way:

1) Cooper; AH1224.
2) Hubbell; HBL1224.

3) Leviton; 1224-2.
4) Pass & Seymour; CSB20AC4.

2.6 WALL PLATES

A. Single and combination types shall match corresponding wiring devices.

1. Plate-Securing Screws: Metal with head color to match plate finish.
2. Material for Finished Spaces: Steel with white baked enamel, suitable for field painting.
3. Material for Unfinished Spaces: Galvanized steel.

B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant, die-cast aluminum with lockable cover.

2.7 FINISHES

A. Device Color:

1. Wiring Devices Connected to Normal Power System: As selected by Architect unless otherwise indicated or required by NFPA 70 or device listing.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.

B. Coordination with Other Trades:

1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:

1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
4. Existing Conductors:

a. Cut back and pigtail, or replace all damaged conductors.

b. Straighten conductors that remain and remove corrosion and foreign matter.
c. Pigtailing existing conductors is permitted, provided the outlet box is large enough.

D. Device Installation:

1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles up, and on horizontally mounted receptacles to the right.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multi-gang wall plates.

H. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.2 GFCI RECEPTACLES

A. Install non-feed-through-type GFCI receptacles where protection of downstream receptacles is not required.

3.3 IDENTIFICATION

A. Comply with Section "Identification for Electrical Systems."

B. Identify each receptacle with panelboard identification and circuit number. Use hot, stamped, or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. In healthcare facilities, prepare reports that comply with recommendations in NFPA 99.
2. Test Instruments: Use instruments that comply with UL 1436.
3. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.

B. Tests for Convenience Receptacles:

1. Line Voltage: Acceptable range is 105 to 132 V.
2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
3. Ground Impedance: Values of up to 2 ohms are acceptable.
4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
5. Using the test plug, verify that the device and its outlet box are securely mounted.
6. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

C. Test straight-blade hospital-grade convenience outlets for the retention force of the grounding blade according to NFPA 99. Retention force shall be not less than 4 oz.

D. Wiring device will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

END OF SECTION

SECTION 26 2816

ENCLOSED SWITCHES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Fusible switches.
2. Nonfusible switches.
3. Enclosures.

1.3 DEFINITIONS

A. NC: Normally closed.

B. NO: Normally open.

C. SPDT: Single pole, double throw.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of enclosed switch, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.

1. Enclosure types and details for types other than NEMA 250, Type 1.
2. Current and voltage ratings.
3. Short-circuit current ratings (interrupting and withstand, as appropriate).
4. Include evidence of NRTL listing for series rating of installed devices.
5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.
6. Include time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.

B. Shop Drawings: For enclosed switches, include plans, elevations, sections, details, and attachments to other work.

1. Wiring Diagrams: For power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency.

B. Field quality-control reports.

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

C. Manufacturer's field service report.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For enclosed switches to include in emergency, operation, and maintenance manuals. In addition to items specified in Section "Operation and Maintenance Data," include the following:

1. Manufacturer's written instructions for testing and adjusting enclosed switches .
2. Time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than two of each size and type.
2. Fuse Pullers: Two for each size and type.

1.8 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 enclosed switches overcurrent protective devices, components, and accessories, within same product category, from single source from single manufacturer.

C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches including clearances between enclosures, 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 NFPA 70.

1.9 PROJECT CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:

1. Ambient Temperature: Not less than minus 22 deg F and not exceeding 104 deg F.
2. Altitude: Not exceeding 6600 feet.

B. 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 seven days in advance of proposed interruption of electric service.
2. Indicate method of providing temporary electric service.
3. Do not proceed with interruption of electric service without Owner's written permission.
4. Comply with NFPA 70E.

1.10 COORDINATION

A. Coordinate layout and installation of switches, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 - PRODUCTS

2.1 FUSIBLE SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Square D; a brand of Schneider Electric.

B. Type GD, General Duty, Single Throw, 240-V ac, 800 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with cartridge fuse interiors to accommodate indicated fuses, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.

C. Type HD, Heavy Duty, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate indicated fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

D. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. bonded; labeled for copper and aluminum neutral conductors.
3. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
4. Auxiliary Contact Kit: Two NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open.

5. Lugs: Mechanical type, suitable for number, size, and conductor material.

2.2 NONFUSIBLE SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Square D; a brand of Schneider Electric.

B. Type GD, General Duty, Single Throw, 600 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.

C. Type HD, Heavy Duty, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

D. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Auxiliary Contact Kit: Two NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open.
3. Lugs: Mechanical type, suitable for number, size, and conductor material.

2.3 ENCLOSURES

A. Enclosed Switches : NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.

1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
2. Outdoor Locations: NEMA 250, Type 3R.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine elements and surfaces to receive enclosed switches for compliance with installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install individual wall-mounted switches with tops at uniform height unless otherwise indicated.

B. Comply with mounting and anchoring requirements specified in Section "Vibration and Seismic Controls for Electrical Systems."

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

D. Install fuses in fusible devices.

E. Comply with NECA 1.

3.3 IDENTIFICATION

A. Comply with requirements in Section "Identification for Electrical Systems."

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. 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.

D. Acceptance Testing Preparation:

1. Test insulation resistance for each enclosed switch and component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

E. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
3. Perform the following infrared scan tests and inspections and prepare reports:

    a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each enclosed switch and circuit breaker. Remove front panels so joints and connections are accessible to portable scanner.
    b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each enclosed switch and circuit breaker 11 months after date of Substantial Completion.
    c. Instruments and Equipment: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

4. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

F. Enclosed switches will be considered defective if they do not pass tests and inspections.

G. Prepare test and inspection reports, including a certified report that identifies enclosed switches and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges as specified in Section "Overcurrent Protective Device Coordination Study."

END OF SECTION

SECTION 26 3213

ENGINE GENERATORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes packaged engine-generator sets for emergency and/or standby power supply with the following features:

1. Diesel engine.
2. Unit-mounted cooling system.
3. Unit-mounted control and monitoring.
4. Outdoor enclosure.

B. Related Sections include the following:

1. Section "Transfer Switches" for transfer switches including sensors and relays to initiate automatic-starting and -stopping signals for engine-generator sets.

1.3 DEFINITIONS

A. Operational Bandwidth: The total variation from the lowest to highest value of a parameter over the range of conditions indicated, expressed as a percentage of the nominal value of the parameter.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of packaged engine generator indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. In addition, include the following:

1. Thermal damage curve for generator.
2. Time-current characteristic curves for generator protective device.

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. Dimensioned outline plan and elevation drawings of engine-generator set and other components specified.
2. Design Calculations: Signed and sealed by a qualified professional engineer. Calculate requirements for selecting vibration isolators and for designing vibration isolation bases.

3. Vibration Isolation Base Details: Signed and sealed by a qualified professional engineer. Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include base weights.
4. Wiring Diagrams: Power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For installer, manufacturer, and testing agency.

B. Source quality-control test reports.

1. Certified summary of prototype-unit test report.
2. Certified Test Reports: For components and accessories that are equivalent, but not identical, to those tested on prototype unit.
3. Certified Summary of Performance Tests: Certify compliance with specified requirement to meet performance criteria for sensitive loads.
4. Report of factory test on units to be shipped for this Project, showing evidence of compliance with specified requirements.
5. Report of sound generation.
6. Report of exhaust emissions showing compliance with applicable regulations.
7. Certified Torsional Vibration Compatibility: Comply with NFPA 110.

C. Field quality-control test reports.

D. Warranty: Special warranty specified in this Section.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For packaged engine generators to include in emergency, operation, and maintenance manuals. In addition to items specified in Section "Operation and Maintenance Data," include the following:

1. List of tools and replacement items recommended to be stored at Project for ready access. Include part and drawing numbers, current unit prices, and source of supply.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fuses: One for every 10 of each type and rating, but no fewer than one of each.
2. Indicator Lamps: Two for every six of each type used, but no fewer than two of each.
3. Filters: One set each of lubricating oil, fuel, and combustion-air filters.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

1. Maintenance Proximity: Not more than four hours' normal travel time from Installer's place of business to Project site.

2. Engineering Responsibility: Preparation of data for vibration isolators of engine skid mounts, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.

B. Manufacturer Qualifications: A qualified manufacturer. Maintain, within 200 miles of Project site, a service center capable of providing training, parts, and emergency maintenance repairs.

C. 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), 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.

D. Source Limitations: Obtain packaged generator sets and auxiliary components through one source from a single manufacturer.

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.

F. Comply with ASME B15.1.

G. Comply with NFPA 37.

H. Comply with NFPA 70.

I. Comply with NFPA 99.

J. Comply with NFPA 110 requirements for Level 1 emergency power supply system.

K. Comply with UL 2200.

L. Engine Exhaust Emissions: Comply with applicable state and local government requirements.

M. Noise Emission: Comply with applicable state and local government requirements for maximum noise level at adjacent property boundaries due to sound emitted by generator set including engine, engine exhaust, engine cooling-air intake and discharge, and other components of installation.

1.9 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 seven days in advance of proposed interruption of electrical service.
2. Do not proceed with interruption of electrical service without Owner's written permission.

B. Environmental Conditions: Engine-generator system shall withstand the following environmental conditions without mechanical or electrical damage or degradation of performance capability:

1. Ambient Temperature: Minus 15 to plus 40 deg C.
2. Relative Humidity: 0 to 95 percent.
3. Altitude: Sea level to 6,600 feet.

1.10 COORDINATION

A. Coordinate size and location of concrete bases for package engine generators. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

B. Coordinate size and location of roof curbs, equipment supports, and roof penetrations for remote radiators. These items are specified in Section "Roof Accessories."

1.11 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of packaged engine generators and associated auxiliary components that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

1.12 MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, provide 12 months' full maintenance by skilled employees of manufacturer's designated service organization. Include quarterly exercising to check for proper starting, load transfer, and running under load. Include routine preventive maintenance as recommended by manufacturer and adjusting as required for proper operation. Provide parts and supplies same as those used in the manufacture and installation of original equipment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Caterpillar; Engine Div.
2. Generac Power Systems, Inc.
3. Kohler Co.; Generator Division.
4. Onan/Cummins Power Generation; Industrial Business Group.

2.2 ENGINE-GENERATOR SET

A. Factory-assembled and -tested, engine-generator set.

B. Mounting Frame: Maintain alignment of mounted components without depending on concrete foundation; and have lifting attachments.

1. Rigging Diagram: Inscribed on metal plate permanently attached to mounting frame to indicate location and lifting capacity of each lifting attachment and generator-set center of gravity.

C. Capacities and Characteristics:

1. Power Output Ratings: Nominal ratings as indicated, with capacity as required to operate as a unit as evidenced by records of prototype testing.
2. Output Connections: Three-phase, four wire.
3. Nameplates: For each major system component to identify manufacturer's name and address, and model and serial number of component.

D. Generator-Set Performance:

1. Steady-State Voltage Operational Bandwidth: 3 percent of rated output voltage from no load to full load.
2. Transient Voltage Performance: Not more than 20 percent variation for 50 percent step-load increase or decrease. Voltage shall recover and remain within the steady-state operating band within three seconds.
3. Steady-State Frequency Operational Bandwidth: 0.5 percent of rated frequency from no load to full load.
4. Steady-State Frequency Stability: When system is operating at any constant load within the rated load, there shall be no random speed variations outside the steady-state operational band and no hunting or surging of speed.
5. Transient Frequency Performance: Less than 5 percent variation for 50 percent step-load increase or decrease. Frequency shall recover and remain within the steady-state operating band within five seconds.
6. Output Waveform: At no load, harmonic content measured line to line or line to neutral shall not exceed 5 percent total and 3 percent for single harmonics. Telephone influence factor, determined according to NEMA MG 1, shall not exceed 50 percent.
7. Sustained Short-Circuit Current: For a 3-phase, bolted short circuit at system output terminals, system shall supply a minimum of 250 percent of rated full-load current for not less than 10 seconds and then clear the fault automatically, without damage to generator system components.
8. Start Time: Comply with NFPA 110, Type 10, system requirements.

2.3 ENGINE

A. Fuel: Fuel oil, Grade DF-2, low sulfur.

B. Rated Engine Speed: 1800 rpm.

C. Maximum Piston Speed for Four-Cycle Engines: 2250 fpm.

D. Lubrication System: The following items are mounted on engine or skid:

1. Filter and Strainer: Rated to remove 90 percent of particles 5 micrometers and smaller while passing full flow.
2. Thermostatic Control Valve: Control flow in system to maintain optimum oil temperature. Unit shall be capable of full flow and is designed to be fail-safe.

3. Crankcase Drain: Arranged for complete gravity drainage to an easily removable container with no disassembly and without use of pumps, siphons, special tools, or appliances.

E. Engine Fuel System:

1. Main Fuel Pump: Mounted on engine. Pump ensures adequate primary fuel flow under starting and load conditions.
2. Relief-Bypass Valve: Automatically regulates pressure in fuel line and returns excess fuel to source.

F. Coolant Jacket Heater: Electric-immersion type, factory installed in coolant jacket system. Comply with NFPA 110 requirements for Level 1 equipment for heater capacity.

G. Governor: Adjustable isochronous, with speed sensing.

H. Cooling System: Closed loop, liquid cooled, with radiator factory mounted on engine-generator-set mounting frame and integral engine-driven coolant pump.

1. Coolant: Solution of 50 percent ethylene-glycol-based antifreeze and 50 percent water, with anticorrosion additives as recommended by engine manufacturer.
2. Size of Radiator: Adequate to contain expansion of total system coolant from cold start to 110 percent load condition.
3. Expansion Tank: Constructed of welded steel plate and rated to withstand maximum closed-loop coolant system pressure for engine used. Equip with gage glass and petcock.
4. Temperature Control: Self-contained, thermostatic-control valve modulates coolant flow automatically to maintain optimum constant coolant temperature as recommended by engine manufacturer.
5. Coolant Hose: Flexible assembly with inside surface of nonporous rubber and outer covering of aging-, ultraviolet-, and abrasion-resistant fabric.

a. Rating: 50-psig maximum working pressure with coolant at 180 deg F, and non-collapsible under vacuum.
b. End Fittings: Flanges or steel pipe nipples with clamps to suit piping and equipment connections.

I. Muffler/Silencer: Critical type, sized as recommended by engine manufacturer and selected with exhaust piping system to not exceed engine manufacturer's engine backpressure requirements.

1. Minimum sound attenuation of 25 dB at 500 Hz.
2. Sound level measured at a distance of 10 feet from exhaust discharge after installation is complete shall be 85 Insert number dBA or less.

J. Air-Intake Filter: Heavy-duty, engine-mounted air cleaner with replaceable dry-filter element and "blocked filter" indicator.

K. Starting System: 12-V electric, with negative ground, unless otherwise indicated.

1. Components: Sized so they will not be damaged during a full engine-cranking cycle with ambient temperature at maximum specified in Part 1 "Project Conditions" Article.
2. Cranking Motor: Heavy-duty unit that automatically engages and releases from engine flywheel without binding.
3. Cranking Cycle: As required by NFPA 110 for system level specified.

4. Battery: Adequate capacity within ambient temperature range specified in Part 1 "Project Conditions" Article to provide specified cranking cycle at least three times without recharging.
5. Battery Cable: Size as recommended by engine manufacturer for cable length indicated. Include required interconnecting conductors and connection accessories.
6. Battery Compartment: Factory fabricated of metal with acid-resistant finish and thermal insulation. Thermostatically controlled heater shall be arranged to maintain battery above 10 deg C regardless of external ambient temperature within range specified in Part 1 "Project Conditions" Article. Include accessories required to support and fasten batteries in place.
7. Battery-Charging Alternator: Factory mounted on engine with solid-state voltage regulation and 35-A minimum continuous rating.
8. Battery Charger: Current-limiting, automatic-equalizing and float-charging type. Unit shall comply with UL 1236 and include the following features:

    a. Operation: Equalizing-charging rate of 10 A shall be initiated automatically after battery has lost charge until an adjustable equalizing voltage is achieved at battery terminals. Unit shall then be automatically switched to a lower float-charging mode and shall continue to operate in that mode until battery is discharged again.
    b. Automatic Temperature Compensation: Adjust float and equalize voltages for variations in ambient temperature from minus 40 deg C to plus 60 deg C to prevent overcharging at high temperatures and undercharging at low temperatures.
    c. Automatic Voltage Regulation: Maintain constant output voltage regardless of input voltage variations up to plus or minus 10 percent.
    d. Ammeter and Voltmeter: Flush mounted in door. Meters shall indicate charging rates.
    e. Safety Functions: Sense abnormally low battery voltage and close contacts providing low battery voltage indication on control and monitoring panel. Sense high battery voltage and loss of ac input or dc output of battery charger. Either condition shall close contacts that provide a battery-charger malfunction indication at system control and monitoring panel.
    f. Enclosure and Mounting: NEMA 250, Type 1, wall-mounted cabinet.

2.4 FUEL OIL STORAGE

A. Comply with NFPA 30.
    1.

B. Base-Mounted Fuel Oil Tank: Factory installed and piped, complying with UL 142 fuel oil tank. Features include the following:

    1. Tank level indicator.
    2. Capacity: Fuel for eight hours' continuous operation at 100 percent rated power output.
    3. Vandal-resistant fill cap.
    4. Containment Provisions: Comply with requirements of authorities having jurisdiction.

2.5 CONTROL AND MONITORING

A. Automatic Starting System Sequence of Operation: When mode-selector switch on the control and monitoring panel is in the automatic position, remote-control contacts in one or more separate automatic transfer switches initiate starting and stopping of generator set. When mode-selector switch is switched to the on position, generator set starts. The off position of same switch initiates generator-set shutdown. When generator set is running, specified system

or equipment failures or derangements automatically shut down generator set and initiate alarms. Operation of a remote emergency-stop switch also shuts down generator set.

B. Manual Starting System Sequence of Operation: Switching on-off switch on the generator control panel to the on position starts generator set. The off position of same switch initiates generator-set shutdown. When generator set is running, specified system or equipment failures or derangements automatically shut down generator set and initiate alarms. Operation of a remote emergency-stop switch also shuts down generator set.

C. Configuration: Operating and safety indications, protective devices, basic system controls, and engine gages shall be grouped in a common control and monitoring panel mounted on the generator set. Mounting method shall isolate the control panel from generator-set vibration.

D. Configuration: Operating and safety indications, protective devices, basic system controls, and engine gages shall be grouped in a common wall-mounted control and monitoring panel.

E. Indicating and Protective Devices and Controls: As required by NFPA 110 for Level 1 system, and the following:

1. AC voltmeter.
2. AC ammeter.
3. AC frequency meter.
4. DC voltmeter (alternator battery charging).
5. Engine-coolant temperature gage.
6. Engine lubricating-oil pressure gage.
7. Running-time meter.
8. Ammeter-voltmeter, phase-selector switches.
9. Generator-voltage adjusting rheostat.
10. Fuel tank derangement alarm.
11. Fuel tank high-level shutdown of fuel supply alarm.
12. Generator overload.

F. Supporting Items: Include sensors, transducers, terminals, relays, and other devices and include wiring required to support specified items. Locate sensors and other supporting items on engine or generator, unless otherwise indicated.

G. Connection to Data Link: A separate terminal block, factory wired to Form C dry contacts, for each alarm and status indication is reserved for connections for data-link transmission of indications to remote data terminals.

H. Common Remote Audible Alarm: Comply with NFPA 110 requirements for Level 1 systems. Include necessary contacts and terminals in control and monitoring panel.

1. Overcrank shutdown.
2. Coolant low-temperature alarm.
3. Control switch not in auto position.
4. Battery-charger malfunction alarm.
5. Battery low-voltage alarm.

I. Remote Alarm Annunciator: Comply with NFPA 99. An LED labeled with proper alarm conditions shall identify each alarm event and a common audible signal shall sound for each alarm condition. Silencing switch in face of panel shall silence signal without altering visual indication. Connect so that after an alarm is silenced, clearing of initiating condition will reactivate alarm until silencing switch is reset. Cabinet and faceplate are surface- or flush-mounting type to suit mounting conditions indicated.

J. Remote Emergency-Stop Switch: Flush; wall mounted, unless otherwise indicated; and labeled. Push button shall be protected from accidental operation.

2.6 GENERATOR OVERCURRENT AND FAULT PROTECTION

A. Generator Circuit Breaker: Molded-case, thermal-magnetic type; 100 percent rated; complying with NEMA AB 1 and UL 489.

1. Tripping Characteristic: Designed specifically for generator protection.
2. Trip Rating: Matched to generator rating.
3. Shunt Trip: Connected to trip breaker when generator set is shut down by other protective devices.
4. Mounting: Adjacent to or integrated with control and monitoring panel.

2.7 GENERATOR, EXCITER, AND VOLTAGE REGULATOR

A. Comply with NEMA MG 1.

B. Drive: Generator shaft shall be directly connected to engine shaft. Exciter shall be rotated integrally with generator rotor.

C. Electrical Insulation: Class H or Class F.

D. Stator-Winding Leads: Brought out to terminal box to permit future reconnection for other voltages if required.

E. Construction shall prevent mechanical, electrical, and thermal damage due to vibration, overspeed up to 125 percent of rating, and heat during operation at 110 percent of rated capacity.

F. Enclosure: Drip proof.

G. Instrument Transformers: Mounted within generator enclosure.

H. Voltage Regulator: Solid-state type, separate from exciter, providing performance as specified.

1. Adjusting rheostat on control and monitoring panel shall provide plus or minus 5 percent adjustment of output-voltage operating band.

I. Strip Heater: Thermostatically controlled unit arranged to maintain stator windings above dew point.

J. Windings: Two-thirds pitch stator winding and fully linked amortisseur winding.

K. Sub-transient Reactance: 12 percent, maximum.

2.8 OUTDOOR GENERATOR-SET ENCLOSURE

A. Description: Vandal-resistant, weatherproof steel housing, wind resistant up to 100 mph. Multiple panels shall be lockable and provide adequate access to components requiring maintenance. Panels shall be removable by one person without tools. Instruments and control shall be mounted within enclosure.

B. Description: Prefabricated or pre-engineered walk-in enclosure with the following features:

1. Construction: Galvanized-steel, metal-clad, integral structural-steel-framed building erected on concrete foundation.
2. Structural Design and Anchorage: Comply with ASCE 7 for wind loads.
3. Space Heater: Thermostatically controlled and sized to prevent condensation.
4. Louvers: Equipped with bird screen and filter arranged to permit air circulation when engine is not running while excluding exterior dust, birds, and rodents.
5. Hinged Doors: With padlocking provisions.
6. Ventilation: Louvers equipped with bird screen and filter arranged to permit air circulation while excluding exterior dust, birds, and rodents.
7. Thermal Insulation: Manufacturer's standard materials and thickness selected in coordination with space heater to maintain winter interior temperature within operating limits required by engine-generator-set components.
8. Muffler Location: Within enclosure.

C. Engine Cooling Airflow through Enclosure: Maintain temperature rise of system components within required limits when unit operates at 110 percent of rated load for 2 hours with ambient temperature at top of range specified in system service conditions.

1. Louvers: Fixed-engine, cooling-air inlet and discharge. Storm-proof and drainable louvers prevent entry of rain and snow.
2. Automatic Dampers: At engine cooling-air inlet and discharge. Dampers shall be closed to reduce enclosure heat loss in cold weather when unit is not operating.

D. Interior Lights with Switch: Factory-wired, vaporproof-type fixtures within housing; arranged to illuminate controls and accessible interior. Arrange for external electrical connection.

1. AC lighting system and connection point for operation when remote source is available.
2. DC lighting system for operation when remote source and generator are both unavailable.

E. Convenience Outlets: Factory wired, GFCI. Arrange for external electrical connection.

2.9 VIBRATION ISOLATION DEVICES

A. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic restraint.

1. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to wind loads or if weight is removed; factory-drilled baseplate bonded to 1/4-inch- thick, elastomeric isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation.
2. Outside Spring Diameter: Not less than 80 percent of compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

2.10 FINISHES

A. Indoor and Outdoor Enclosures and Components: Manufacturer's standard finish over corrosion-resistant pretreatment and compatible primer.

2.11 SOURCE QUALITY CONTROL

A. Prototype Testing: Factory test engine-generator set using same engine model, constructed of identical or equivalent components and equipped with identical or equivalent accessories.

1. Tests: Comply with NFPA 110, Level 1 Energy Converters and with IEEE 115.

B. Project-Specific Equipment Tests: Before shipment, factory test engine-generator set and other system components and accessories manufactured specifically for this Project. Perform tests at rated load and power factor. Include the following tests:

1. Test components and accessories furnished with installed unit that are not identical to those on tested prototype to demonstrate compatibility and reliability.
2. Full load run.
3. Maximum power.
4. Voltage regulation.
5. Transient and steady-state governing.
6. Single-step load pickup.
7. Safety shutdown.
8. Provide 14 days' advance notice of tests and opportunity for observation of tests by Owner's representative.
9. Report factory test results within 10 days of completion of test.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, equipment bases, and conditions, with Installer present, for compliance with requirements for installation and other conditions affecting packaged engine-generator performance.

B. Examine roughing-in of piping systems and electrical connections. Verify actual locations of connections before packaged engine-generator installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with packaged engine-generator manufacturers' written installation and alignment instructions and with NFPA 110.

B. Install packaged engine generator to provide access, without removing connections or accessories, for periodic maintenance.

C. Install packaged engine generator with restrained spring isolators having a minimum deflection of 1 inch on 4-inch- high concrete base. Secure sets to anchor bolts installed in concrete bases. Concrete base construction is specified in Section "Vibration and Seismic Controls for Electrical Systems."

D. Install Schedule 40, black steel piping with welded joints for cooling water piping between engine-generator set and remote radiator. Piping materials and installation requirements are specified in Section "Hydronic Piping."

E. Install Schedule 40, black steel piping with welded joints and connect to engine muffler. Install thimble at wall. Piping shall be same diameter as muffler outlet. Flexible connectors and steel piping materials and installation requirements are specified in Section Hydronic Piping Specialties."

1. Install condensate drain piping to muffler drain outlet full size of drain connection with a shutoff valve, stainless-steel flexible connector, and Schedule 40, black steel pipe with welded joints. Flexible connectors and piping materials and installation requirements are specified in Section Hydronic Piping Specialties."

F. Electrical Wiring: Install electrical devices furnished by equipment manufacturers but not specified to be factory mounted.

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping and specialties.

B. Connect fuel, cooling-system, and exhaust-system piping adjacent to packaged engine generator to allow service and maintenance.

C. Connect cooling-system water piping to engine-generator set and remote radiator with flexible connectors.

D. Connect engine exhaust pipe to engine with flexible connector.

E. Connect fuel piping to engines with a gate valve and union and flexible connector.

F. Ground equipment according to Section "Grounding and Bonding for Electrical Systems."

G. Connect wiring according to Section "Low-Voltage Electrical Power Conductors and Cables."

3.4 IDENTIFICATION

A. Identify system components according to Section "Identification for HVAC Piping and Equipment" and Section "Identification for Electrical Systems."

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.

C. 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.

D. Tests and Inspections:

1. Perform tests recommended by manufacturer and each electrical test and visual and mechanical inspection for "AC Generators and for Emergency Systems" specified in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. NFPA 110 Acceptance Tests: Perform tests required by NFPA 110 that are additional to those specified here including, but not limited to, single-step full-load pickup test.
3. Battery Tests: Equalize charging of battery cells according to manufacturer's written instructions. Record individual cell voltages.

    a. Measure charging voltage and voltages between available battery terminals for full-charging and float-charging conditions. Check electrolyte level and specific gravity under both conditions.
    b. Test for contact integrity of all connectors. Perform an integrity load test and a capacity load test for the battery.
    c. Verify acceptance of charge for each element of the battery after discharge.
    d. Verify that measurements are within manufacturer's specifications.

4. Battery-Charger Tests: Verify specified rates of charge for both equalizing and float-charging conditions.
5. System Integrity Tests: Methodically verify proper installation, connection, and integrity of each element of engine-generator system before and during system operation. Check for air, exhaust, and fluid leaks.
6. Exhaust-System Back-Pressure Test: Use a manometer with a scale exceeding 40-inch wg. Connect to exhaust line close to engine exhaust manifold. Verify that back pressure at full-rated load is within manufacturer's written allowable limits for the engine.
7. Exhaust Emissions Test: Comply with applicable government test criteria.
8. Voltage and Frequency Transient Stability Tests: Use recording oscilloscope to measure voltage and frequency transients for 50 and 100 percent step-load increases and decreases, and verify that performance is as specified.
9. Harmonic-Content Tests: Measure harmonic content of output voltage under 25 percent and at 100 percent of rated linear load. Verify that harmonic content is within specified limits.
10. Noise Level Tests: Measure A-weighted level of noise emanating from generator-set installation, including engine exhaust and cooling-air intake and discharge, at four locations on the property line, and compare measured levels with required values.

E. Coordinate tests with tests for transfer switches and run them concurrently.

F. Test instruments shall have been calibrated within the last 12 months, traceable to standards of NIST, and adequate for making positive observation of test results. Make calibration records available for examination on request.

G. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.

H. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.

I. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

J. Remove and replace malfunctioning units and retest as specified above.

K. Retest: Correct deficiencies identified by tests and observations and retest until specified requirements are met.

L. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation resistances, time delays, and other values and observations. Attach a label or tag to each tested component indicating satisfactory completion of tests.

M. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each power wiring termination and each bus connection. Remove all access panels so terminations and connections are accessible to portable scanner.

1. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
2. Record of Infrared Scanning: Prepare a certified report that identifies terminations and connections checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain packaged engine generators. Refer to Section "Demonstration and Training."

END OF SECTION

SECTION 26 3600

TRANSFER SWITCHES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes transfer switches rated 600 V and less, including the following:

1. Automatic transfer switches.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, weights, operating characteristics, furnished specialties, and accessories.

B. Shop Drawings: Dimensioned plans, elevations, sections, and details showing minimum clearances, conductor entry provisions, gutter space, installed features and devices, and material lists for each switch specified.

1. Single-Line Diagram: Show connections between transfer switch, bypass/isolation switch, power sources, and load; and show interlocking provisions for each combined transfer switch and bypass/isolation switch.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer and testing agency.

B. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals. In addition to items specified in Section "Operation and Maintenance Data," include the following:

1. Features and operating sequences, both automatic and manual.
2. List of all factory settings of relays; provide relay-setting and calibration instructions, including software, where applicable.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Maintain a service center capable of providing training, parts, and emergency maintenance repairs within a response period of less than eight hours from time of notification.

B. 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.

C. Source Limitations: Obtain automatic transfer switches, bypass/isolation switches, and remote annunciator and control panels through one source from a single manufacturer.

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 ICS 1.

F. Comply with NFPA 70.

G. Comply with NFPA 99.

H. Comply with NFPA 110.

I. Comply with UL 1008 unless requirements of these Specifications are stricter.

1.7 FIELD 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:

1. Notify Owner no fewer than seven days in advance of proposed interruption of electrical service.
2. Do not proceed with interruption of electrical service without Owner's written permission.

1.8 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Section "Cast-in-Place Concrete."

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Contactor Transfer Switches:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Caterpillar; Engine Div.
    b. Emerson; ASCO Power Technologies, LP.
    c. Generac Power Systems, Inc.
    d. GE Zenith Controls.
    e. Kohler Power Systems; Generator Division.
    f. Onan/Cummins Power Generation; Industrial Business Group.
    g. Russelectric, Inc.

B. Transfer Switches Using Molded-Case Switches or Circuit Breakers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Eaton Electrical Inc.; Cutler-Hammer.
    b. GE Zenith Controls.
    c. Hubbell Industrial Controls, Inc.

2.2 GENERAL TRANSFER-SWITCH PRODUCT REQUIREMENTS

A. Indicated Current Ratings: Apply as defined in UL 1008 for continuous loading and total system transfer, including tungsten filament lamp loads not exceeding 30 percent of switch ampere rating, unless otherwise indicated.

B. Tested Fault-Current Closing and Withstand Ratings: Adequate for duty imposed by protective devices at installation locations in Project under the fault conditions indicated, based on testing according to UL 1008.

1. Where transfer switch includes internal fault-current protection, rating of switch and trip unit combination shall exceed indicated fault-current value at installation location.

C. Solid-State Controls: Repetitive accuracy of all settings shall be plus or minus 2 percent or better over an operating temperature range of minus 20 to plus 70 deg C.

D. Resistance to Damage by Voltage Transients: Components shall meet or exceed voltage-surge withstand capability requirements when tested according to IEEE C62.41. Components shall meet or exceed voltage-impulse withstand test of NEMA ICS 1.

E. Electrical Operation: Accomplish by a non-fused, momentarily energized solenoid or electric-motor-operated mechanism, mechanically and electrically interlocked in both directions.

F. Switch Characteristics: Designed for continuous-duty repetitive transfer of full-rated current between active power sources.

1. Limitation: Switches using molded-case switches or circuit breakers or insulated-case circuit-breaker components are not acceptable.
2. Switch Action: Double throw; mechanically held in both directions.
3. Contacts: Silver composition or silver alloy for load-current switching. Retain paragraph below and select appropriate option if four-pole transfer switches are required. See Editing Instruction No. 4 in the Evaluations. Coordinate with Drawings.

G. Neutral Switching. Where four-pole switches are indicated, provide neutral pole switched simultaneously with phase poles.

H. Neutral Terminal: Solid and fully rated, unless otherwise indicated.

I. Oversize Neutral: Ampacity and switch rating of neutral path through units indicated for oversize neutral shall be double the nominal rating of circuit in which switch is installed.

J. Heater: Equip switches exposed to outdoor temperatures and humidity, and other units indicated, with an internal heater. Provide thermostat within enclosure to control heater.

K. Battery Charger: For generator starting batteries.

1. Float type rated 10 A.
2. Ammeter to display charging current.
3. Fused ac inputs and dc outputs.

L. Annunciation, Control, and Programming Interface Components: Devices at transfer switches for communicating with remote programming devices, annunciators, or annunciator and control panels shall have communication capability matched with remote device.

M. Factory Wiring: Train and bundle factory wiring and label, consistent with Shop Drawings, either by color-code or by numbered or lettered wire and cable tape markers at terminations. Color-coding and wire and cable tape markers are specified in Section "Identification for Electrical Systems."

1. Designated Terminals: Pressure type, suitable for types and sizes of field wiring indicated.
2. Power-Terminal Arrangement and Field-Wiring Space: Suitable for top, side, or bottom entrance of feeder conductors as indicated.
3. Control Wiring: Equipped with lugs suitable for connection to terminal strips.

N. Enclosures: General-purpose NEMA 250, Type 1, complying with NEMA ICS 6 and UL 508, unless otherwise indicated.

2.3 AUTOMATIC TRANSFER SWITCHES

A. Comply with Level 1 equipment according to NFPA 110.

B. Switching Arrangement: Double-throw type, incapable of pauses or intermediate position stops during normal functioning, unless otherwise indicated.

C. Manual Switch Operation: Under load, with door closed and with either or both sources energized. Transfer time is same as for electrical operation. Control circuit automatically disconnects from electrical operator during manual operation.

D. Signal-Before-Transfer Contacts: A set of normally open/normally closed dry contacts operates in advance of retransfer to normal source. Interval is adjustable from 1 to 30 seconds.

E. Digital Communication Interface: Matched to capability of remote annunciator or annunciator and control panel.

F. Transfer Switches Based on Molded-Case-Switch Components: Comply with NEMA AB 1, UL 489, and UL 869A.

G. In-Phase Monitor: Factory-wired, internal relay controls transfer so it occurs only when the two sources are synchronized in phase. Relay compares phase relationship and frequency difference between normal and emergency sources and initiates transfer when both sources are within 15 electrical degrees, and only if transfer can be completed within 60 electrical degrees. Transfer is initiated only if both sources are within 2 Hz of nominal frequency and 70 percent or more of nominal voltage.

H. Motor Disconnect and Timing Relay: Controls designate starters so they disconnect motors before transfer and reconnect them selectively at an adjustable time interval after transfer. Control connection to motor starters is through wiring external to automatic transfer switch. Time delay for reconnecting individual motor loads is adjustable between 1 and 60 seconds, and settings are as indicated. Relay contacts handling motor-control circuit inrush and seal currents are rated for actual currents to be encountered.

I. Programmed Neutral Switch Position: Switch operator has a programmed neutral position arranged to provide a midpoint between the two working switch positions, with an intentional, time-controlled pause at midpoint during transfer. Pause is adjustable from 0.5 to 30 seconds minimum and factory set for 0.5 second, unless otherwise indicated. Time delay occurs for both transfer directions. Pause is disabled unless both sources are live.

J. Automatic Transfer-Switch Features:

1. Undervoltage Sensing for Each Phase of Normal Source: Sense low phase-to-ground voltage on each phase. Pickup voltage shall be adjustable from 85 to 100 percent of nominal, and dropout voltage is adjustable from 75 to 98 percent of pickup value. Factory set for pickup at 90 percent and dropout at 85 percent.
2. Adjustable Time Delay: For override of normal-source voltage sensing to delay transfer and engine start signals. Adjustable from zero to six seconds, and factory set for one second.
3. Voltage/Frequency Lockout Relay: Prevent premature transfer to generator. Pickup voltage shall be adjustable from 85 to 100 percent of nominal. Factory set for pickup at 90 percent. Pickup frequency shall be adjustable from 90 to 100 percent of nominal. Factory set for pickup at 95 percent.
4. Time Delay for Retransfer to Normal Source: Adjustable from 0 to 30 minutes, and factory set for 10 minutes to automatically defeat delay on loss of voltage or sustained undervoltage of emergency source, provided normal supply has been restored.
5. Test Switch: Simulate normal-source failure.
6. Switch-Position Pilot Lights: Indicate source to which load is connected.
7. Source-Available Indicating Lights: Supervise sources via transfer-switch normal- and emergency-source sensing circuits.

    a. Normal Power Supervision: Green light with nameplate engraved "Normal Source Available."
    b. Emergency Power Supervision: Red light with nameplate engraved "Emergency Source Available."

8. Unassigned Auxiliary Contacts: Two normally open, single-pole, double-throw contacts for each switch position, rated 10 A at 240-V ac.
9. Transfer Override Switch: Overrides automatic retransfer control so automatic transfer switch will remain connected to emergency power source regardless of condition of normal source. Pilot light indicates override status.
10. Engine Starting Contacts: One isolated and normally closed, and one isolated and normally open; rated 10 A at 32-V dc minimum.
11. Engine Shutdown Contacts: Time delay adjustable from zero to five minutes, and factory set for five minutes. Contacts shall initiate shutdown at remote engine-generator controls after retransfer of load to normal source.

12. Engine-Generator Exerciser: Solid-state, programmable-time switch starts engine generator and transfers load to it from normal source for a preset time, then retransfers and shuts down engine after a preset cool-down period. Initiates exercise cycle at preset intervals adjustable from 7 to 30 days. Running periods are adjustable from 10 to 30 minutes. Factory settings are for 7-day exercise cycle, 20-minute running period, and 5-minute cool-down period. Exerciser features include the following:

    a. Exerciser Transfer Selector Switch: Permits selection of exercise with and without load transfer.
    b. Push-button programming control with digital display of settings.
    c. Integral battery operation of time switch when normal control power is not available.

2.4 REMOTE ANNUNCIATOR AND CONTROL SYSTEM

A. Functional Description: Include the following functions for indicated transfer switches:

1. Indication of sources available, as defined by actual pickup and dropout settings of transfer-switch controls.
2. Indication of switch position.
3. Indication of switch in test mode.
4. Indication of failure of digital communication link.
5. Key-switch or user-code access to control functions of panel.
6. Control of switch-test initiation.
7. Control of switch operation in either direction.
8. Control of time-delay bypass for transfer to normal source.

B. Malfunction of annunciator, annunciation and control panel, or communication link shall not affect functions of automatic transfer switch. In the event of failure of communication link, automatic transfer switch automatically reverts to stand-alone, self-contained operation. Automatic transfer-switch sensing, controlling, or operating function shall not depend on remote panel for proper operation.

C. Remote Annunciation and Control Panel: Solid-state components. Include the following features:

1. Controls and indicating lights grouped together for each transfer switch.
2. Label each indicating light control group. Indicate transfer switch it controls, location of switch, and load it serves.
3. Digital Communication Capability: Matched to that of transfer switches supervised.
4. Mounting: Flush, modular, steel cabinet, unless otherwise indicated.

2.5 SOURCE QUALITY CONTROL

A. Factory test and inspect components, assembled switches, and associated equipment. Ensure proper operation. Check transfer time and voltage, frequency, and time-delay settings for compliance with specified requirements. Perform dielectric strength test complying with NEMA ICS 1.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Design each fastener and support to carry load indicated by seismic requirements and according to seismic-restraint details. See Section "Vibration and Seismic Controls for Electrical Systems."

B. Floor-Mounting Switch: Anchor to floor by bolting.

1. Concrete Bases: 4 inches high, reinforced, with chamfered edges. Extend base no more than 4 inches in all directions beyond the maximum dimensions of switch, unless otherwise indicated or unless required for seismic support. Construct concrete bases according to Section "Hangers and Supports for Electrical Systems."

C. Annunciator and Control Panel Mounting: Flush in wall, unless otherwise indicated.

D. Identify components according to Section "Identification for Electrical Systems."

E. Set field-adjustable intervals and delays, relays, and engine exerciser clock.

3.2 CONNECTIONS

A. Wiring to Remote Components: Match type and number of cables and conductors to control and communication requirements of transfer switches as recommended by manufacturer. Increase raceway sizes at no additional cost to Owner if necessary to accommodate required wiring.

B. Ground equipment according to Section "Grounding and Bonding for Electrical Systems."

C. Connect wiring according to Section "Low-Voltage Electrical Power Conductors and Cables."

3.3 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

C. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. After installing equipment and after electrical circuitry has been energized, test for compliance with requirements.
2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
3. Measure insulation resistance phase-to-phase and phase-to-ground with insulation-resistance tester. Include external annunciation and control circuits. Use test voltages and procedure recommended by manufacturer. Comply with manufacturer's specified minimum resistance.

a. Check for electrical continuity of circuits and for short circuits.

b. Inspect for physical damage, proper installation and connection, and integrity of barriers, covers, and safety features.
c. Verify that manual transfer warnings are properly placed.
d. Perform manual transfer operation.

4. After energizing circuits, demonstrate interlocking sequence and operational function for each switch at least three times.

a. Simulate power failures of normal source to automatic transfer switches and of emergency source with normal source available.
b. Simulate loss of phase-to-ground voltage for each phase of normal source.
c. Verify time-delay settings.
d. Verify pickup and dropout voltages by data readout or inspection of control settings.
e. Test bypass/isolation unit functional modes and related automatic transfer-switch operations.
f. Perform contact-resistance test across main contacts and correct values exceeding 500 microhms and values for 1 pole deviating by more than 50 percent from other poles.
g. Verify proper sequence and correct timing of automatic engine starting, transfer time delay, retransfer time delay on restoration of normal power, and engine cool-down and shutdown.

5. Ground-Fault Tests: Coordinate with testing of ground-fault protective devices for power delivery from both sources.

a. Verify grounding connections and locations and ratings of sensors.

D. Testing Agency's Tests and Inspections:

1. After installing equipment and after electrical circuitry has been energized, test for compliance with requirements.
2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
3. Measure insulation resistance phase-to-phase and phase-to-ground with insulation-resistance tester. Include external annunciation and control circuits. Use test voltages and procedure recommended by manufacturer. Comply with manufacturer's specified minimum resistance.

a. Check for electrical continuity of circuits and for short circuits.
b. Inspect for physical damage, proper installation and connection, and integrity of barriers, covers, and safety features.
c. Verify that manual transfer warnings are properly placed.
d. Perform manual transfer operation.

4. After energizing circuits, demonstrate interlocking sequence and operational function for each switch at least three times.

a. Simulate power failures of normal source to automatic transfer switches and of emergency source with normal source available.
b. Simulate loss of phase-to-ground voltage for each phase of normal source.
c. Verify time-delay settings.
d. Verify pickup and dropout voltages by data readout or inspection of control settings.

e. Test bypass/isolation unit functional modes and related automatic transfer-switch operations.
f. Perform contact-resistance test across main contacts and correct values exceeding 500 microhms and values for 1 pole deviating by more than 50 percent from other poles.
g. Verify proper sequence and correct timing of automatic engine starting, transfer time delay, retransfer time delay on restoration of normal power, and engine cool-down and shutdown.

5. Ground-Fault Tests: Coordinate with testing of ground-fault protective devices for power delivery from both sources.

a. Verify grounding connections and locations and ratings of sensors.

E. Coordinate tests with tests of generator and run them concurrently.

F. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation and contact resistances and time delays. Attach a label or tag to each tested component indicating satisfactory completion of tests.

G. Remove and replace malfunctioning units and retest as specified above.

H. Prepare test and inspection reports.

I. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each switch. Remove all access panels so joints and connections are accessible to portable scanner.

1. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
2. Record of Infrared Scanning: Prepare a certified report that identifies switches checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain transfer switches and related equipment as specified below. Refer to Section "Demonstration and Training."

B. Coordinate this training with that for generator equipment.

END OF SECTION

SECTION 32 3119.13

DECORATIVE METAL GATES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Decorative aluminum louver gates.

1.02 REFERENCE STANDARDS

A. ASTM A276/A276M - Standard Specification for Stainless Steel Bars and Shapes.

B. ASTM B117 - Standard Practice for Operating Salt Spray (Fog) Apparatus.

C. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

D. ASTM D523 - Standard Test Method for Specular Gloss.

E. ASTM D714 - Standard Test Method for Evaluating Degree of Blistering of Paints.

F. ASTM D822/D822M - Standard Practice for Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings.

G. ASTM D1654 - Standard Test Method for Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments.

H. ASTM D2244 - Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates.

I. ASTM D2794 - Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact) .

J. ASTM D3359 - Standard Test Method for Rating Adhesion by Tape Test.

K. ASTM F2408 - Standard Specification for Ornamental Fences Employing Galvanized Steel Tubular Pickets.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.

C. Shop Drawings:
   1. Indicate plan layout, spacing of components, post foundation dimensions, hardware anchorage, gates, and schedule of components.
   2. Foundation details, concrete design mix and reinforcing schedule for anti-ram barrier system.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: Experienced with type of construction involved and materials and techniques specified and approved by fence manufacturer.

1.05 DELIVERY, STORAGE AND HANDLING

A. Store materials in a manner to ensure proper ventilation and drainage. Protect against damage, weather, vandalism and theft.

1.06 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion.

C. Provide five year manufacturer warranty for specified coating performance.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturer:
   1. Ametco Manufacturing Corporation; Product as specified on Drawings: www.ametco.com.
   2. Substitutions: See Section 01 6000 - Product Requirements.

2.02 GATES

A. Gate Assemblies: Complete factory-fabricated system of posts and louvered panels, accessories, fittings, and fasteners; finished with electrodeposition coating, and having the following performance characteristics:
   1. Capable of resisting vertical load, horizontal load and infill performance requirements for fence categories defined in ASTM F2408.

B. Electro-Deposition Coating: Multistage pretreatment/wash with zinc phosphate, followed by epoxy primer and acrylic topcoat.
   1. Total Coating Thickness: 2 mils, minimum.
   2. Color: As selected by Architect from manufacturer's standard range.
   3. Coating Performance: Comply with general requirements of ASTM F2408.
      a. Adhesion: ASTM D3359 (Method B); Class 3B with 90 percent or more of coating remaining in tested area.
      b. Corrosion Resistance: ASTM B117, ASTM D714 and ASTM D1654; 1/8 inch coating loss or medium No.8 blisters after 1,500 hours.
      c. Impact Resistance: ASTM D2794; 60 inch pounds.
      d. Weathering Resistance: ASTM D523, ASTM D822/D822M and ASTM D2244; less than 60 percent loss of gloss.

C. Aluminum: ASTM B221.
   1. Tubular Pickets, Rails and Posts: 6005-T5 alloy.
   2. Extrusions for Posts and Rails (Outer Channel): 6005-T5 alloy.
   3. Extrusions for Pickets and Rail (Inner Slide Channels): 6063-T5 alloy.

D. Fasteners: ASTM A276/A276M, Type 302 stainless steel; finished to match fence components.
   1. Self-drilling hex-head screws.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 INSTALLATION

A. Install gate assemblies in accordance with manufacturer's instructions.

B. Space gate posts according to the manufacturers' drawings, dependent on standard out-to-out gate leaf dimensions and gate hardware selected.
   1. Base type and quantity of gate hinges on the application, weight, height, and number of gate cycles.
   2. Identify the necessary hardware required for the application on the manufacturer's gate drawings.
   3. Provide gate hardware by the manufacturer of the gate and install in compliance with manufacturer's recommendations.

3.03 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch.

B. Maximum Offset From Indicated Position: 1 inch.

C. Minimum Distance from Property Line: 6 inches.

3.04 CLEANING

A. Clean jobsite of excess materials; scatter excess material from post hole excavations uniformly away from posts. Remove excess material if required.

B. Clean fence with mild household detergent and clean water rinse well.

C. Touch up scratched surfaces using materials recommended by manufacturer. Match touched-up paint color to factory-applied finish.

3.05 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair, or replace damaged products before Date of Substantial Completion.

END OF SECTION

VIEW OF LOBBY FROM FRONT DOOR

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Boulder County

SOUTHEAST COUNTY SERVICE HUB

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LAFAYETTE, CO 80026

CONSTRUCTION DOCUMENTS
NOVEMBER 19TH, 2021

sDC PROJECT NO: 2007

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ABBREVIATIONS

@ = AT, THEREFORE
A.L.T. = ALTERNATE
ACT= ACOUSTICAL CEILING TILE
ADJ. = ADJACENT
A.F.F. = ABOVE FINISH FLOOR
ARCH. = ARCHITECT
BLDG. = BUILDING
BLKG. = BLOCKING
B.O. = BOTTOM OF
B.O.D. = BASIS OF DESIGN
BRG. = BEARING
B.S. = BOTH SIDES
BSMT. = BASEMENT
BYND = BEYOND
C.F.C.I. = CONTRACTOR FURNISHED CONTRACTOR INSTALLED
CL = CENTERLINE
CLG. = CEILING
COL. = COLUMN
CONC. = CONCRETE
CONN. = CONNECT(ION)
CONT. = CONTINUOUS
COORD. = COORDINATE
CRT. = CARPET
DBL. = DOUBLE
DET. = DETAIL
DIA. = DIAMETER
DIM. = DIMENSION
DR. = DOOR
DS = DOWNSPOUT
DW = DISHWASHER
EA. = EACH
ELEC. = ELECTRICAL
ELEV. = ELEVATION
EQ. = EQUAL
ESMT. = EASEMENT
E.W. = EACH WAY
(E) or EXST. = EXISTING
EXT. = EXTERIOR
FC = FACE
FD = FLOOR DRAIN
FE = FIRE EXTINGUISHER CABINET
FF = FLUSH FACE
FND = FOUNDATION
FIN. = FINISH
FLR. = FLOOR
FOC = FACE OF CONCRETE
FOF = FACE OF FRAMING
FOM = FACE OF MASONRY
FOS = FACE OF STRUCTURE
FOST = FACE OF STONE
FP = FIREPLACE
FTG = FOOTING
GFI = GROUND FAULT INTERRUPTER
GL = GLASS
GLB = GLU-LAM BEAM
GWB = GYPSUM WALL BOARD
HB = HOSE BIB
HC = HOLLOW CORE
HDR = HEADER
HT = HEIGHT
IBC = INTERNATIONAL BUILDING CODE
IRC = INTERNATIONAL RESIDENTIAL CODE
INSUL. = INSULATION
INT. = INTERIOR
JST = JOIST
LAV = LAVATORY
MAX. = MAXIMUM
MECH. = MECHANICAL
MFR. = MANUFACTURER
MIN. = MINIMUM
MLB = MICRO-LAM BEAM
MTL = METAL
N.I.C. = NOT IN CONTRACT
NTS = NOT TO SCALE
O.C. = ON CENTER
O.D. = OVERFLOW DRAIN
O.F.C.I. = OWNER FURNISHED CONTRACTOR INSTALLED
O.F.O.I = OWNER FURNISHED OWNER INSTALLED
O.H. = OVERHANG
OPP. = OPPOSITE
P = PAINT
PL = PLATE
PLAM = PLASTIC LAMINATE
PLY = PLYWOOD
P.I.P = POURED IN PLACE
P.T. = PRESSURE TREATED
R = RADIUS
RD = ROOF DRAIN
RE: = REFER TO OR REFERENCE
REINF. = REINFORCING
REQ'D. = REQUIRED
RM = ROOM
RO = ROUGH OPENING
SC = SOLID CORE
SF = SQUARE FEET
SHT = SHEET
SHTG = SHEATHING
SPECS. = SPECIFICATIONS
S.O.G. = SLAB ON GRADE
SS = STAINLESS STEEL
SSM = SOLID SURFACE
ST = STAIN
STL = STEEL
STRL. = STRUCTURAL
SUBFLR = SUBFLOOR
SW = SHEAR WALL
T = TREAD
TB = THROUGH BOLT
TBD = TO BE DETERMINED
T.G. = TEMPERED GLASS
T.O. = TOP OF
T.O.C. = TOP OF CONCRETE
T.O.W. = TOP OF WALL
TYP. = TYPICAL
U.O.N. = UNLESS OTHERWISE NOTED
VB = VAPOR BARRIER
VERT. = VERTICAL
V.I.F. = VERIFY IN FIELD
W/ = WITH
W/D = WASHER AND DRYER
WC = WATER CLOSET
WD. = WOOD
WIN. = WINDOW

LEGEND: MATERIALS

CONCRETE
BRICK
CMU
WOOD
STUCCO
GROUT
STEEL
ALUMINUM
RIGID INSULATION
BATT INSULATION
GYPSUM

LEGEND: GRAPHIC SYMBOLS

EXTERIOR ELEVATION REFERENCE
INTERIOR ELEVATION REFERENCE
ENLARGED DETAIL MARKER
BUILDING SECTION
WALL SECTION
NORTH ARROW
WALL/PARTITION TYPE IDENTIFICATION (FLAG INDICATES STARTING POINT OF WALL TYPE, RE: A-001 FOR WALL/PARTION TYPES)
ASSEMBLY TAG (WALL/FLOOR/ROOF TYPE)
ROOM IDENTIFICATION
DOOR WITH TAG
REVISION TAG
SHEET NOTE
KEYNOTE
FINISH TAG
WINDOW TYPE IDENTIFICATION
CASEWORK IDENTIFICATION
GRID MARKER
SPOT ELEVATION
BREAKLINE
LINE ABOVE, BELOW, BEHIND
BUILDING MATCH LINE

VICINITY MAP:

GENERAL NOTES:

1. DO NOT SCALE DRAWINGS. WRITTEN DIMENSIONS SHALL TAKE PRECEDENCE. IF ADDITIONAL DIMENSIONS ARE REQUIRED, CONTACT ARCHITECT.
2. CONTRACTOR TO VERIFY ALL FIELD CONDITIONS AND DIMENSIONS AND LAY OUT PROPOSED WORK PRIOR TO CONSTRUCTION IN NEW WORK AREA. REPORT DISCREPANCIES TO ARCHITECT FOR RESOLUTION.
3. IN THE EVENT OF CONFLICTING OR UNCLEAR INFORMATION, CONTRACTOR SHALL CONTACT ARCHITECT FOR CLARIFICATION DURING THE WORK AFFECTED.
4. SITE SURVEY PROVIDED IS DEEMED TO BE RELIABLE AND ACCURATE. CONTRACTOR TO NOTIFY ARCHITECT AND CIVIL ENGINEER WHEN DISCREPANCIES ARE ENCOUNTERED PRIOR TO OR DURING CONSTRUCTION.
5. ALL WORK SHALL CONFORM TO APPLICABLE CODES. NOTIFY ARCHITECT OF ANY CONDITIONS OR DETAILS WHICH ARE DEEMED TO BE NONCONFORMING.

USING THE KEYNOTE SYSTEM

KEYNOTE SYSTEM IN THIS DRAWING SET IS DESIGNED AS A REFERENCE FOR THE PROJECT MANUAL.

06.02 ARCH WOOD CASEWORK

- **KEYWORD DESCRIPTION**
- **UNIQUE IDENTIFIER**
- **REFERS TO SPECIFICATION DIVISION IN PROJECT MANUAL**

NOTE: KEYWORD DESCRIPTION IS USED IN KEYWORD LEGEND ON PLANS AND ON KEYNOTE TAG ON ELEVATIONS, SECTIONS AND DETAILS

USING THE SHEET NOTES

SHEET NOTE SYSTEM IN THIS DRAWING SET IS DESIGNED TO CONVEY INFORMATION AND DIRECTION NOT SPECIFIC TO THE PROJECT MANUAL.

S02

SHEET NOTES	
NOTE	DESCRIPTION
S 02	ALIGN FINISH FACE

- **DESCRIPTION IN SHEET NOTE LEGEND AT DRAWING MARGIN**
- **UNIQUE IDENTIFIER**
- **REFERS TO TYPE OF SHEET NOTE : D - DEMO NOTE S- GENERAL SHEET NOTE T - TOILET ACCESSORY NOTE**

NOTE: ALL SHEET NOTE DESCRIPTIONS ARE SORTED BY SHEET AND LOCATED IN THE SHEET NOTE LEGEND. SHEET NOTES ARE NOT ALWAYS IN SUCCESSIVE ORDER

SHEET ORGANIZATION

X-000 SHEET TITLE

- **SHEET DESCRIPTION**
- **UNIQUE IDENTIFIER**
- **SHEET TYPE IDENTIFIER**
- **DISCIPLINE IDENTIFIER**

ARCHITECTURE SHEET TYPES:

0	(A-000)	GENERAL - WALL TYPES
1	(A-100)	PLANS / REFLECTED CEILING PLANS
2	(A-200)	EXTERIOR BUILDING ELEVATIONS
3	(A-300)	SECTIONS BUILDING SECTIONS / WALL SECTIONS
4	(A-400)	LARGE-SCALE VIEWS VERTICAL CIRCULATION / ENLARGED PLANS / INTERIOR ELEVATIONS
5	(A-500)	DETAILS
6	(A-600)	SCHEDULES AND DIAGRAMS
7	(A-700)	NOT USED
8	(A-800)	3D VIEWS
9	(A-900)	INTERIORS

DISCIPLINE IDENTIFIER LEGEND:

G	GENERAL
C	CIVIL
AS	LANDSCAPE
S	STRUCTURAL
AD	ARCHITECTURAL DEMOLITION
A	ARCHITECTURAL
A	ARCHITECTURAL INTERIORS
FP	FIRE PROTECTION
P	PLUMBING
M	MECHANICAL
E	ELECTRICAL
FA	FIRE ALARM
TY	SECURITY

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SHEET INDEX

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GENERAL PROJECT INFORMATION

G-001

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CODE SUMMARY

Authorities Having Jurisdiction	City of Lafayette (www.lafayetteco.gov)
Applicable Codes	ACCESSIBILITY GUIDELINES 2009 ICC/ANSI 117.1 2010 (ADA) ADA Standards for Accessible Design by U.S. Dept of Justice INTERNATIONAL BUILDING CODE 2015 (IBC) International Building Code 2015 (IECC) International Energy Conservation Code 2015 (IEBC) International Existing Building Code 2015 (IFC) International Fire Code 2015 (IFGC) International Fuel and Gas Code 2015 (IMC) International Mechanical Code 2015 (IPC) International Plumbing Code NATIONAL FIRE PROTECTION ASSOCIATION 2020 NFPA 70 (NEC) National Electric Code
Project Summary	This project involves the owner taking an existing core and shell building originally designed to be a medical office building and a 'B' occupancy and building out the entirety of the interior for use as offices and client service center for Boulder County government. The project involves adding in an A3 occupancy through the addition of training rooms and large meeting rooms. The existing building is able to accommodate the A3 addition with no modifications and still meet the code requirements. The project also involves the addition of an emergency diesel generator and some other minor site modifications including addition of ramps and stairs and new exterior doors and a monument sign.

INTERNATIONAL BUILDING CODE

CHAPTER 3: Occupancy Classification and Use

Basic Occupancy Groups (IBC Chapter 3): B; A-3

CHAPTER 5: General Building Heights and Areas

	Allowable	Actual
Height (IBC Table 504.3)	75'	36'
Stories (IBC Table 504.4)	3	2
Area (IBC Table 506.2)		
Allowable Area per Floor	35,150 SF	19,948 SF
Total Allowable Area	70,300 SF	38,883 SF
*based on A3 occupancy		
Allowable Area Factor		Actual Area is less than base allowable no need to increase
Frontage Distance		No increase needed
Frontage Increase		No increase needed

Mixed Use (IBC 508): Non-Separated Occupancies (IBC 508.2) (IBC 508.3) (IBC 508.4)

Level	Existing Building Area	Proposed Building Area	Change	Work Area (IEBC)	%
1	19,935	19,935	-	19,935	100%
2	18,948	18,948	-	18,948	100%
TOTAL	38,883	38,883	-	38,883	

CHAPTER 6: Types of Construction

Type of Construction (IBC 602): Type IIB; S

Fire-Resistance Ratings (IBC Table 601)

Rating (Hrs)	Building Element
0	Primary Structural Frame
0	Exterior Bearing Walls
0	Interior Bearing Walls
0	Non-Bearing Interior Walls and Partitions
0	Floor Construction
0	Roof Construction

Fire Resistance Rating: Ext Walls (IBC Table 602)

Rating (Hrs)	Fire Separation Distance
1*	X<5
1*	5≤X<10
0	10≤X<30
0	X≥30

*Rated for exposure to fire from both sides of wall

CHAPTER 7: Fire and Smoke Protection Features

Area of Ext Wall Openings (Table 705.8)

FSD	Allowable Area (based on opening protection) (UP, NS)	(UP, S)	(P)
X<3		NP	
3≤X<5		15%	
5≤X<10		25%	
10≤X<15		45%	
15≤X<20		75%	
20≤X<25		No Limit	
25≤X<30		No Limit	
X≥30		No Limit	

Vertical Openings (IBC 712): Existing two story opening complies with section 712.9

Shaft Enclosures (IBC 713.4)

Rating (Hrs)	# of Connected Stories
1	X<4

*Shaft Enclosures shall have fire resistance rating not less than floor but need not exceed 2 hrs.

CHAPTER 9: Fire Protection and Life Safety Systems

Sprinkler System (IBC 903)	Provided per NFPA 13	Existing core and shell system to be built out. By owner and deferred submittal.
Standpipe System (IBC 905)	Provided per NFPA 14	Existing system
Portable Fire Extinguishers (IBC 906)	Provided per NFPA 10	
Fire Alarm/ Detection Systems (IBC 907)	Provided per NFPA 72	By owner and deferred submittal.

CHAPTER 10: Means of Egress

*refer to life safety plans for occupant loads and measured distances and widths.

Means of Egress Sizing (IBC 1005)

Component Egress Capacity			
Stairways	Occ load	x	0.3"
Other	Occ load	x	0.2"

Number of Exits and Exit Access Doorways (IBC 1006)

Occupancy	Occ Load	# of Exits	Max CPT*
B	0-49	1 exit	100 ft
B	50-500	2 exits	100 ft
A	0-49	1 exit	75 ft
A	50-500	2 exits	100 ft

*Common Path of Travel

Exit Access Travel Distance (IBC 1017)

Occupancy	Maximum Travel Distance
A, E, S-1	250 ft
B	300 ft

Exit Access Stairways/Ramps (IBC 1019): Exit Access Stairways/Ramps shall be enclosed with shaft enclosure.

Applicable Exceptions

1. Serve/connect between two stories not open to other stories.

Corridors (IBC 1020)

Occ.	Occ. Load	Fire Rating (NS)	Fire Rating (S)
A,B,E,F,M,S,U	>30		0 hr

Occupancy	Min Width (in)
Any facility	44
Access to Mech/Plumb/Elec systems/equip	24
Occ load<50	36
Group E w/ Occ Load >100	72

Occupancy	Max Length of Dead End Corridor
B, E, F, I-1, M, R-1, R-2, S, U	50 ft* sprinklered
All others	20 ft*

*Exception: Not limited where corridor length is < 2.5 x the width

Interior Exit Stairways/Ramps (IBC 1023.2)

Enclosures

Rating (Hrs)	# of Connected Stories
1	X<4

*Shaft Enclosures shall have fire resistance rating not less than floor but need not exceed 2 hrs.

Exit Passageway (IBC 1024)

Rating (Hrs)	Notes
1*	Walls/Floors/Ceilings

*Match Fire-Resistance rating of Interior Exit Stairway/Ramp if connected

CHAPTER 11: Accessibility: Existing two entrances are understood by design team to be accessible. Proposed exterior doors will primarily be employee access entry and limited public access entry. These will be accessible as well.

CHAPTER 29: Plumbing Systems

Plumbing Fixture Requirements (IBC Table 2902.1)

Class	Occupant Load	Male WC	Female WC	Male Lav	Female Lav	Drinking Fountains	Service Sinks
A		1 per 125	1 per 65	1 per 200	1 per 200	1 per 500	1
B		1 per 25 (0-50) 1 per 50 (>50)		1 per 40 (0-80) 1 per 80 (>80)		1 per 100	1

Refer to Fixture count table for more information

INTERNATIONAL EXISTING BUILDING CODE

CHAPTER 3: Compliance

Compliance Method (IEBC 301.3): Work Area Compliance Method

Summary: Project to be classified as Level 03 Alteration and to comply with Chapter 7 + 8 + 9
Work area at existing building is~100% of existing building area.

INTERNATIONAL ENERGY CONSERVATION CODE

CHAPTER 4: Commcercial Energy Efficiency

Summary: Only modifications to building envelope is modification of existing storefront system to add an exterior door. Door and replacement glazing units will comply with IECC.

Compliance Path (IECC C401.2): Prescriptive Method (3) — Refer to Drawings

Climate Zone: 5

Buiding Envelope Requirements (IECC C402)

	R-Value Method	U-Factor Method
	Non-swinging Opaque Doors	R-4.75 U-0.31

Fenestration (IECC 402.1.4)

U-Factor Max (C402.4)	
Fixed Fenestration	0.38
Entrance Doors	0.77
Skylights	0.5

SHGC Max (C402.4)	South/East/West	North
Projection Factor <0.2	0.38	0.51
0.2<Projection Factor<0.5	0.46	0.56
Projection Factor >0.5	0.61	0.61
Skylights	0.4	

Maximum Area (IECC 402.4.1)

Maximum Area of Vertical Fenestration	30% gross above grade wall area
Acutal Area of Vertical Fenestration	No Changes to amount of fenestration
Maximum Area of skylight area	3% of gross roof area
Acutal Area of Skylights	0.10%

Minimum Skylight (IECC 402.4.2): Not applicable to this project due to floor area and ceiling height requirements

Air Leakage (IECC 402.5)

Vestibule (IECC 402.5): Exterior door to be added opens into space that is small enough to not require vestibule and is employee entrances and are exempt per exception 2.

Fixture Counts — Proposed

Floor Level	WCs: Male	WCs: Female	WCs: Single user Toilet Room	WCs: All Gender Multi-user	Lavs: Male	Lavs: Female	Lavs: Single user Toilet Room	Lavs: All Gender Multi-user	Drinking Fountains	Service Sinks
1st	2	2	2	2	2	2	2	2	4	1
2nd	2	2	4	-	2	2	4		2	1
Total	**4**	**4**	**6**	**2**	**4**	**4**	**6**	**2**	**4**	**2**
Combined Counts*	**8**	**8**			**8**	**8**			**6**	**2**
Required	**7**	**7**			**5**	**5**			**5**	**2**

*Fixtures in Single User and All Gender Multi-User restrooms added to Male/Female counts equally.
2015 ICC Codes do not account for all gender multi-user design.
Requirements met without counting fixtures at that restroom at lobby.
2021 ICC Codes permit fixtures at at multiple user facilities serving all genders to count towards requirements

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CODE ANALYSIS

G-010

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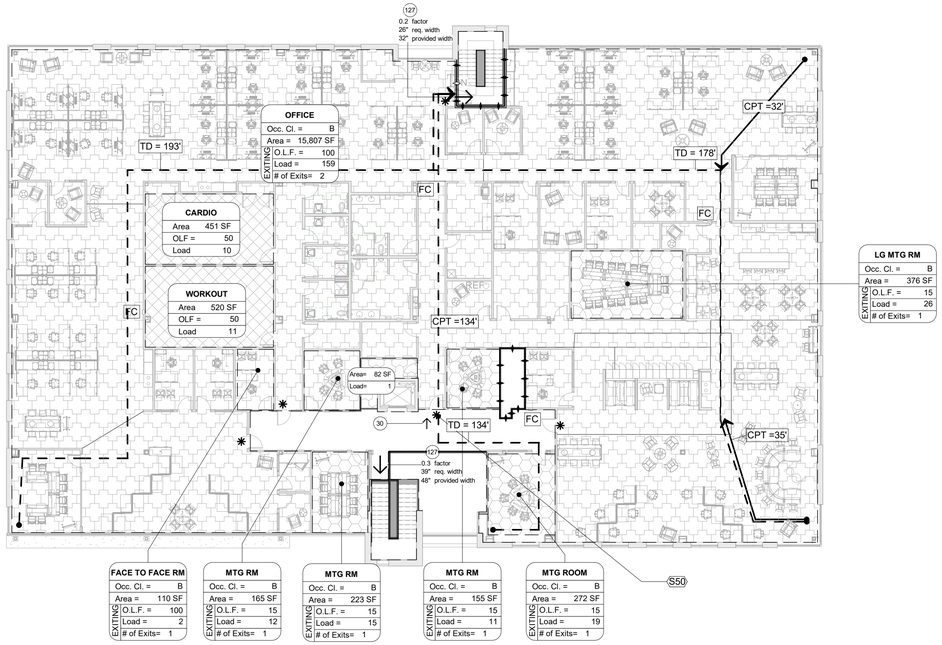
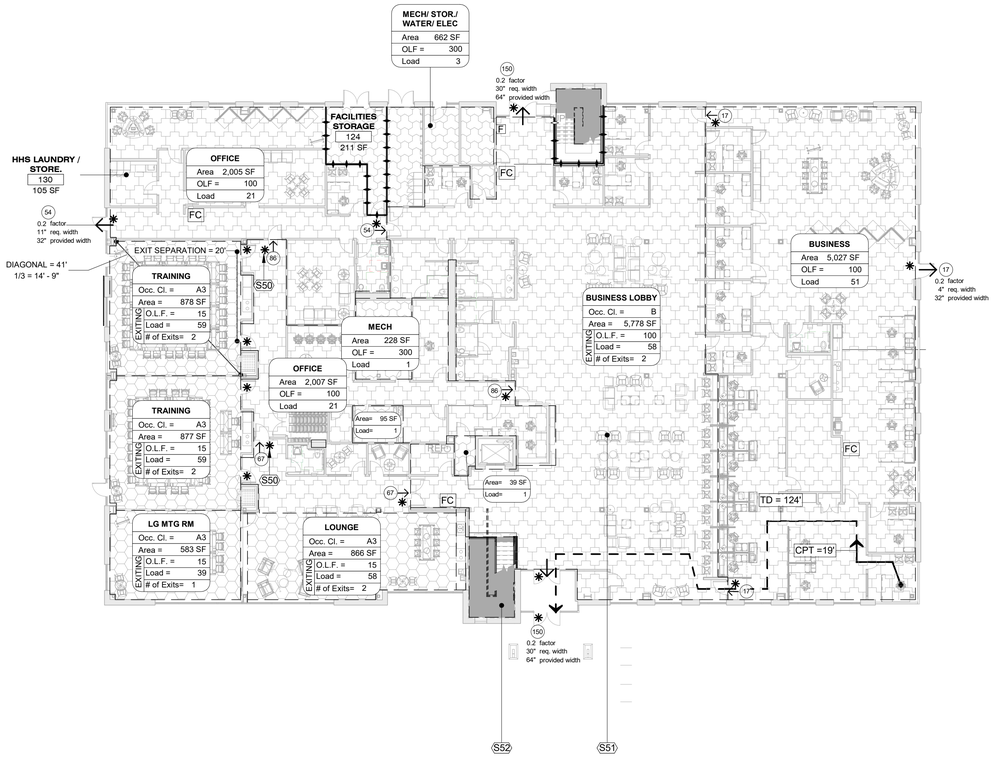
OCCUPANT LOAD

SPACE	OCC. CLASS	O.L.F.	AREA	OCC. LOAD
LEVEL 01				
TRAINING	A3	15	878 SF	59
TRAINING	A3	15	877 SF	59
LG MTG RM	A3	15	583 SF	39
LOUNGE	A3	15	866 SF	58
			3,203 SF	215
MECH/ STOR./ WATER/ ELEC	ACC	300	662 SF	3
MECH	ACC	300	228 SF	1
JC	ACC	300	95 SF	1
MECH	ACC	300	39 SF	1
			1,024 SF	6
BUSINESS LOBBY	B	100	5,778 SF	58
BUSINESS	B	100	5,027 SF	51
OFFICE	B	100	2,005 SF	21
OFFICE	B	100	2,007 SF	21
			14,817 SF	151
LEVEL 02				
ELEV RM	ACC	300	82 SF	1
CARDIO	ACC	50	451 SF	10
WORKOUT	ACC	50	520 SF	11
			1,054 SF	22
OFFICE	B	100	15,807 SF	159
MTG ROOM	B	15	272 SF	19
MTG RM	B	15	223 SF	15
LG MTG RM	B	15	376 SF	26
MTG RM	B	15	155 SF	11
FACE TO FACE RM	B	100	110 SF	2
MTG RM	B	15	165 SF	12
			17,109 SF	244
			37,207 SF	638



2 G-011 LEVEL 02 FIRE AND LIFE SAFETY PLAN

1/16" = 1'-0"



1 G-011 LEVEL 01 FIRE AND LIFE SAFETY PLAN

1/16" = 1'-0"

GENERAL NOTES: CODE PLANS

1. EXISTING FIRE RESISTANT CONSTRUCTION IS TO REMAIN IN ALL AREAS UNDISTURBED BY NEW WORK.

CODE PLAN LEGEND

- ACCESSORY / MECH - OCCUPANT LOAD FACTOR 300 GROSS
- ASSEMBLY ROOM, UNCONCENTRATED - OCCUPANT LOAD FACTOR 7 NET
- ASSEMBLY ROOM - OCCUPANT LOAD FACTOR 15 NET
- BUSINESS AREAS - OCCUPANT LOAD FACTOR 100 GROSS
- EXERCISE ROOM - OCCUPANT LOAD FACTOR 50 GROSS
- EGRESS STAIRS

SYMBOLS

- F FIRE ALARM PANEL, RE: ELEC
- FC FIRE EXTINGUISHER
- EXIT DEVICE
- BUILDING / FLOOR EGRESS
- ROOM/SPACE EGRESS
- 1 — 0.2 factor, 1" req. width, 32" provided width — EGRESS ARROW TAG (WITH OCCUPANT LOAD AND EGRESS WIDTH INFO)
- TD = 1'-0" — PATH OF EGRESS (TRAVEL DISTANCE = TD)
- CPT = 1'-0" — COMMON PATH OF TRAVEL (CPT)
- 1 HR FIRE RATING
- 2 HR FIRE RATING
- 3 HR FIRE RATING
- SCOPE OF WORK LIMITS

NOTE: REFER TO ELECTRICAL AND LIGHTING PLANS FOR LOCATIONS OF EXIT LIGHTING, FIRE ALARMS, STROBES AND PULL STATIONS

SHEET NOTES

NOTE	DESCRIPTION
S50	EGRESS THROUGH CARD ACCESS SECURITY DOOR PROVIDED WITH CRASH BAR; ALARM TO SOUND IF NO KEYCARD PROVIDED
S51	PROVIDE 1 HR RATED ENCLOSURE AT BOTTOM OF MECH SHAFT; INSTALL TIGHT TO UNDERSIDE OF EXISTING DUCTWORK
S52	EXISTING EXIT ACCESS STAIRWAY OPEN TO BOTH FLOORS

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FIRE AND LIFE SAFETY PLANS

G-011

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ABBREVIATIONS

AASHTO	AMERICAN ASSOC. OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS	INCL	INCLUDED
		ID	INSIDE DIAMETER
ABAN	ABANDON	IN	INLET
AC	ASPHALTIC CONCRETE PAVING	INSUL	INSULATION
ADDL	ADDITIONAL	INV	INVERT
ADDM	ADDENDUM	IRR	IRRIGATION
ADJ	ADJUSTABLE		
AL	ALUMINUM	JTS	JOINTS
ALT	ALTERNATE		
AMT	AMOUNT	KO	KNOCKOUT
APPROX	APPROXIMATE	KPL	KICK PLATE
ARCH	ARCHITECT(URAL)	KWY	KEYWAY
ARV	AIR RELIEF VALVE		
ASTM	AMERICAN SOCIETY FOR TESTING AND MATERIALS	L	LEFT OR LITER
		LSCAPE	LANDSCAPE(ING)
ASPH	ASPHALT	LF	LINEAR FOOT
ASSY	ASSEMBLY	LP	LOW POINT OR LIGHT POLE
ASYM	ASYMMETRICAL	LT	LIGHT
AUTO	AUTOMATIC	LWL	LOW WATER LEVEL
AVG	AVERAGE		
AWWA	AMERICAN WATER WORKS ASSOC.	MAINT	MAINTENANCE
		MAN	MANUAL
BC	BACK OF CURB	MATL	MATERIAL
BFV	BUTTERFLY VALVE	MAX	MAXIMUM
BG	FINISHED GRADE ADJACENT TO BOTTOM OF WALL	ME	MATCH EXISTING
BLDG	BUILDING	MECH	MECHANICAL
BLK	BLOCK	MFR	MANUFACTURER
BM	BENCH MARK	MH	MANHOLE
BMP	BEST MANAGEMENT PRACTICE	MIN	MINIMUM
BS	BACKSIGHT	MISC	MISCELLANEOUS
BOR	BOTTOM OF RAMP	MJ	MECHANICAL JOINT
BOS	BOTTOM OF STEP		
BOT	BOTTOM	N	NORTH
BSMT	BASEMENT	NA	NOT APPLICABLE
BVCE	BEGIN VERTICAL CURVE ELEVATION	NIC	NOT IN CONTRACT
BVCS	BEGIN VERTICAL CURVE STATION	NPT	NATIONAL PIPE THREAD
BW	BOTTOM OF WALL	NTS	NOT TO SCALE
CB	CATCH BASIN	OC	ON CENTER
CCW	COUNTER CLOCKWISE	OD	OUTSIDE DIAMETER
CDOT	COLORADO DEPARTMENT OF TRANSPORTATION	OPP	OPPOSITE
CIP	CAST IRON PIPE	OPT	OPTIONAL
CJ	CONSTRUCTION JOINT		
CL	CENTER LINE OR CHAIN LINK	PC	POINT OF CURVATURE
CLR	CLEAR	PCO	PRESSURE CLEAN OUT
CMP	CORRUGATED METAL PIPE	PCR	POINT OF CURVE RETURN
CMU	CONCRETE MASONRY UNIT	PI	POINT OF INTERSECTION
CO	CLEANOUT	PVI	POINT OF VERTICAL INTERSECTION
CONC	CONCRETE	PL	PROPERTY LINE
CONST	CONSTRUCTION	PE	POLYETHYLENE
CONT	CONTINUOUS(ATION)	PREFAB	PREFABRICATED
COR	CORNER	PRELIM	PRELIMINARY
CR	CONCENTRIC REDUCER	PREP	PREPARATION
CTR	CENTER	PROP	PROPOSED
CY	CUBIC YARDS	PRV	PRESSURE REDUCING VALVE OR PRESSURE RELIEF VALVE
DEMO	DEMOLITION	PSF	POUNDS PER SQUARE FOOT
DIA	DIAMETER	PSI	POUNDS PER SQUARE INCH
DIAG	DIAGONAL	PT	POINT OF TANGENCY
DIP	DUCTILE IRON PIPE	PV	PLUG VALVE
DOM	DOMESTIC	PVC	POLYVINYL CHLORIDE OR POINT OF VERTICAL CURVATURE
DN	DOWN		
DR	DRAIN	PVMT	PAVEMENT
DWG	DRAWING		
DWL	DOWEL	QTY	QUANTITY
		R	RIGHT
E	EAST	RAD	RADIUS
EA	EACH	RCP	REINFORCED CONCRETE PIPE
ECC	ECCENTRIC	RD	ROOF DRAIN
EJ	EXPANSION JT	RE	REFERENCE
EL	ELEVATION	RECT	RECTANGULAR
ELB	ELBOW	REINF	REINFORCE (D) (ING) (MENT)
ELEC	ELECTRICAL	REQD	REQUIRED
ENGR	ENGINEER	ROW	RIGHT OF WAY
EOP	EDGE OF PAVEMENT		
EQ	EQUAL	SAN	SANITARY
EQUIP	EQUIPMENT	SD	STORM DRAIN
EQUIV	EQUIVALENT	SECT	SECTION
ESMT	EASEMENT	SPD	STANDARD PROCTOR DENSITY
EST	ESTIMATE	SPEC	SPECIFICATION
EVCE	END VERTICAL CURVE ELEVATION	SQ	SQUARE
EVCS	END VERTICAL CURVE STATION	SQ IN	SQUARE INCH
EW	EACH WAY	SQ FT	SQUARE FOOT
EXP	JT EXPANSION JOINT	SQ YD	SQUARE YARD
EXIST	EXISTING	SS	SANITARY SEWER
		SST	STAINLESS STEEL
FND	FOUNDATION	STA	STATION
FES	FLARED END SECTION	STD	STANDARD
FF	FINISH FLOOR	STL	STEEL
FG	FINISH GRADE	STRUCT	STRUCTURAL
FH	FIRE HYDRANT	SVC	SERVICE
FL	FLOW LINE	SWMP	STORMWATER MANAGEMENT PLAN
FN	FENCE	SYM	SYMMETRICAL
FOC	FACE OF CONCRETE		
FPM	FEET PER MINUTE	TB	THRUST BLOCK
FPS	FEET PER SECOND	TBC	TOP BACK OF CURB
FT	FEET	TBM	TEMPORARY BENCH MARK
FTG	FOOTING OR FITTING	TEMP	TEMPORARY
		TG	FINISHED GRADE ADJACENT TO TOP OF WALL
G	GAS	THK	THICK
GA	GAUGE	TOB	TOP OF BANK
GAL	GALLON	TOC	TOP OF CONCRETE OR TOP OF CURB
GALV	GALVANIZED	TOR	TOP OF RAMP
GCO	GRADE CLEANOUT	TOS	TOP OF STEP
GIP	GALVANIZED IRON PIPE	TOT	TOTAL
GND	GROUND	TW	TOP OF WALL OR CAP OF WALL
GPD	GALLONS PER DAY	TYP	TYPICAL
GPM	GALLONS PER MINUTE		
GR	GRATE	UBC	UNIFORM BUILDING CODE
GRTG	GRATING	UGE	UNDERGROUND ELECTRIC
GSP	GALVANIZED STEEL PIPE	UTIL	UTILITY
GV	GATE VALVE	VERT	VERTICAL
		VC	POINT OF VERTICAL CURVATURE
H	HIGH	VCP	VITRIFIED CLAY PIPE
HB	HOSE BIB		
HE	HORIZONTAL ELLIPTICAL	W	WIDE OR WIDTH
HDWL	HEADWALL	W/	WITH
HNDRL	HAND RAIL	W/O	WITHOUT
HORIZ	HORIZONTAL	WQCV	WATER QUALITY CONTROL VOLUME
HP	HIGH POINT	WSE	WATER SURFACE ELEVATION
HR	HOUR	WW	WASTEWATER
HVAC	HEATING, VENTILATION, AIR CONDITIONING		
HWY	HIGHWAY	X	SECT CROSS SECTION
HWL	HIGH WATER LINE	XFMR	ELECTRICAL TRANSFORMER
HYD	HYDRANT		
		YH	YARD HYDRANT

DESIGN LEGEND

- BENCHMARK
- MANHOLE
- AREA DRAIN
- COMBINATION INLET
- TYPE R INLET
- TYPE 13 FIELD INLET
- FLARED END SECTION W/ RIPRAP
- TEE W/ THRUST BLOCK
- BEND W/ THRUST BLOCK
- END CAP W/ THRUST BLOCK
- GATE VALVE
- REDUCER/INCREASER
- WATER METER
- FIRE HYDRANT
- SD — STORM – 12" AND SMALLER
- STORM – LARGER THAN 12"
- RD — ROOF DRAIN
- TD — TRENCH DRAIN
- UD — UNDERDRAIN
- SS — SANITARY SEWER
- FM — FORCE MAIN
- W — WATER
- NPW — NON POTABLE WATER
- PW — POTABLE WATER
- IRR — IRRIGATION
- IRRIGATION – LARGER THAN 12"
- CATV — CABLE TV
- D — DRAIN
- E — ELECTRIC
- UE — UNDERGROUND ELECTRIC
- OE — OVERHEAD ELECTRIC
- T — TELEPHONE
- FO — FIBER OPTIC
- FUEL — FUEL
- G — GAS
- PVC — PVC PIPE (MISC)

- FENCE
- FLOW LINE OF DITCH OR WASH
- 5.0% — SLOPE ARROW
- +03.54 — PROPOSED SPOT ELEVATION
- +03.5 — EXIST SPOT ELEVATION
- 5220 — EXIST INDEX CONTOUR
- 5221 — EXIST INTERMEDIATE CONTOUR
- 20 — PROPOSED INDEX CONTOUR
- 21 — PROPOSED INTERMEDIATE CONTOUR
- CURB AND GUTTER
- SPILL/CATCH CURB TRANSITION
- SIGN W/ POST
- CURB RAMP
- SIDEWALK CHASE
- SIDEWALK
- CONCRETE PAVING
- HEAVY DUTY CONCRETE PAVING
- HEAVY DUTY ASPHALT PAVING
- LIGHT DUTY ASPHALT PAVING
- GRAVEL
- PROPOSED BUILDING
- BUILDING ACCESS
- RETAINING WALL
- BOULDER/ROCK WALL
- LIMITS OF SAWCUT
- LIMITS OF WORK
- EASEMENT LINE
- PROPERTY LINE
- ADJACENT PROPERTY LINE/ROW
- MATCHLINE

DETAIL TITLE

DETAIL TITLE
SCALE

1 / –

- DETAIL NUMBER IDENTIFICATION
- SHEET WHERE THE SECTION OR ELEVATION IS CUT OR CALLED OUT – INDICATES SAME DRAWING

1 / C1.0

- DETAIL NUMBER IDENTIFICATION
- SHEET WHERE THE DETAIL IS DRAWN – INDICATES SAME DRAWING

SECTION CALLOUT

A / –

- SECTION NUMBER IDENTIFICATION
- SHEET WHERE THE SECTION IS – INDICATES SAME DRAWING

DETAIL MARKER

1 / A

- REVISION CLOUD
- REVISION NUMBER

SURVEY LEGEND

- WATER LINE
- WATER VALVE
- WATER METER
- FIRE HYDRANT
- SANITARY SEWER LINE
- SANITARY SEWER MANHOLE
- STORM DRAINAGE LINE
- STORM DRAINAGE MANHOLE
- CURB INLET
- UNDERGROUND ELECTRICAL LINE
- OVERHEAD ELECTRICAL LINE
- ELECTRICAL POLE
- GUY WIRE
- ELECTRICAL TRANSFORMER
- ELECTRICAL RISER
- ELECTRIC VAULT
- LIGHT POLE
- DECORATIVE LIGHT
- FIBEROPTIC LINE
- TELEPHONE LINE
- TELEPHONE RISER
- GAS LINE
- INDICATION OF ACCESS
- BUILDING

- BENCHMARK AS DESCRIBED
- FOUND MONUMENT
- FOUND MONUMENT
- TEST CP
- UTILITY LOCATED FROM MAP
- AS MEASURED AT TIME OF SURVEY
- CALCULATED FROM RECORD AND AS MEASURED INFORMATION
- PLAT
- RECORDED
- MAILBOX
- CONCRETE
- EDGE OF ASPHALT
- GRAVEL
- FENCE
- GUARDRAIL
- BOLLARD
- SIGN
- CONIFEROUS TREE (TRUNK DIAMETER/DRIP LINE RADIUS)
- DECIDUOUS TREE (TRUNK DIAMETER/DRIP LINE RADIUS)
- BOULDER

NOTE: SHADED ITEMS REPRESENT EXIST FEATURES

Know what's below. Call before you dig.

GENERAL NOTES

1. ALL MATERIALS AND WORKMANSHIP SHALL BE IN CONFORMANCE WITH THE LATEST STANDARDS AND SPECIFICATIONS OF THE CITY OF LAFAYETTE, LAFAYETTE PUBLIC WORKS, XCEL ENERGY, UTILITY DISTRICTS, COLORADO DEPARTMENT OF TRANSPORTATION, LAFAYETTE FIRE PROTECTION REQUIREMENTS, AND APPLICABLE STATE AND LOCAL STANDARDS AND SPECIFICATIONS. THE CONTRACTOR SHALL HAVE IN POSSESSION AT THE JOB SITE AT ALL TIMES ONE (1) SIGNED COPY OF APPROVED PLANS, STANDARDS AND SPECIFICATIONS. CONTRACTOR SHALL CONSTRUCT AND MAINTAIN EMERGENCY ACCESS ROUTES TO THE SITE AND STRUCTURE AT ALL TIMES PER THE APPLICABLE LAFAYETTE FIRE PROTECTION REQUIREMENTS. THE CONTRACTOR SHALL OBTAIN WRITTEN APPROVAL FOR ANY VARIANCE TO THE ABOVE DOCUMENTS. NOTIFY ENGINEER OF ANY CONFLICTING STANDARDS OR SPECIFICATIONS. IN THE EVENT OF ANY CONFLICTING STANDARD OR SPECIFICATION, THE MORE STRINGENT OR HIGHER QUALITY STANDARD, DETAIL OR SPECIFICATION SHALL APPLY.
2. THE CONTRACTOR SHALL OBTAIN, AT HIS OWN EXPENSE, ALL APPLICABLE CODES, LICENSES, STANDARD SPECIFICATIONS, PERMITS, BONDS, ETC., WHICH ARE NECESSARY TO PERFORM THE PROPOSED WORK, INCLUDING, BUT NOT LIMITED TO A LOCAL AND STATE GROUNDWATER DISCHARGE AND COLORADO DEPARTMENT OF HEALTH AND ENVIRONMENT (CDPHE) STORMWATER DISCHARGE PERMIT ASSOCIATED WITH CONSTRUCTION ACTIVITY.
3. THE CONTRACTOR SHALL BE RESPONSIBLE FOR NOTIFYING THE REQUIRED PARTY (OWNER, OWNER'S REPRESENTATIVE, MUNICIPAL/DISTRICT INSPECTOR, GEOTECHNICAL ENGINEER, ENGINEER AND/OR UTILITY OWNER) AT LEAST 48 HOURS PRIOR TO START OF ANY CONSTRUCTION, PRIOR TO BACKFILLING, AND AS REQUIRED BY JURISDICTIONAL AUTHORITY AND/OR PROJECT SPECIFICATIONS. THE CONTRACTOR SHALL CONTINUE WITH NOTIFICATIONS THROUGHOUT THE PROJECT AS REQUIRED BY THE STANDARDS AND SPECIFICATIONS.
4. THE LOCATIONS OF EXISTING UTILITIES ARE SHOWN IN THE APPROXIMATE LOCATION BASED ON INFORMATION BY OTHERS. NOT ALL UTILITIES MAY BE SHOWN. THE CONTRACTOR SHALL DETERMINE THE EXACT SIZE, LOCATION AND TYPE OF ALL EXISTING UTILITIES WHETHER SHOWN OR NOT BEFORE COMMENCING WORK. THE ENGINEER AND/OR OWNER ASSUMES NO RESPONSIBILITY FOR THE ACCURACY OR COMPLETENESS SHOWN ON PLANS. THE CONTRACTOR SHALL BE FULLY AND SOLELY RESPONSIBLE FOR ANY AND ALL DAMAGES AND COSTS WHICH MIGHT OCCUR BY THE CONTRACTOR'S FAILURE TO EXACTLY LOCATE AND PRESERVE ANY AND ALL UTILITIES. THE CONTRACTOR SHALL NOTIFY ALL PUBLIC AND PRIVATE UTILITY COMPANIES AND DETERMINE THE LOCATION OF ALL EXISTING UTILITIES PRIOR TO PROCEEDING WITH GRADING AND CONSTRUCTION. ALL WORK PERFORMED IN THE AREA OF UTILITIES SHALL BE PERFORMED AND INSPECTED ACCORDING TO THE REQUIREMENTS OF THE UTILITY OWNER. LIKEWISE, THE CONTRACTOR SHALL BE RESPONSIBLE FOR LOCATING AND MAPPING ANY EXISTING UTILITY (INCLUDING DEPTH) WHICH MAY CONFLICT WITH THE PROPOSED CONSTRUCTION, AND FOR RELOCATING ENCOUNTERED UTILITIES AS DIRECTED BY THE ENGINEER. CONTRACTOR SHALL CONTACT AND RECEIVE APPROVAL FROM MUNICIPALITY/UTILITY OWNER AND ENGINEER BEFORE RELOCATING ANY ENCOUNTERED UTILITIES. CONTRACTOR RESPONSIBLE FOR SERVICE CONNECTIONS, AND RELOCATING AND RECONNECTING AFFECTED UTILITIES AS COORDINATED WITH UTILITY OWNER AND/OR ENGINEER, INCLUDING NON-MUNICIPAL UTILITIES (TELEPHONE, GAS, CABLE, ETC., WHICH SHALL BE COORDINATED WITH THE UTILITY OWNER). THE CONTRACTOR SHALL IMMEDIATELY CONTACT ENGINEER UPON DISCOVERY OF A UTILITY DISCREPANCY OR CONFLICT. AT LEAST 48 HOURS PRIOR TO CONSTRUCTION, THE CONTRACTOR SHALL NOTIFY THE UTILITY NOTIFICATION CENTER OF COLORADO (1-800-922-1987, WWW.UNCC.ORG). SEE SURVEY UTILITY LOCATION INFORMATION BELOW.
5. THE CONTRACTOR SHALL BE SOLELY AND COMPLETELY RESPONSIBLE FOR CONDITIONS AT AND ADJACENT TO THE JOB SITE, INCLUDING SAFETY OF ALL PERSONS AND PROPERTY DURING THE PERFORMANCE OF THE WORK. THE CONTRACTOR SHALL PREPARE A TRAFFIC CONTROL PLAN FOR OWNER AND/OR CITY APPROVAL AND PROVIDE ALL LIGHTS, SIGNS, BARRICADES, FENCING, FLAGMEN OR OTHER DEVICES NECESSARY TO PROVIDE FOR PUBLIC SAFETY. THIS REQUIREMENT SHALL APPLY CONTINUOUSLY AND NOT BE LIMITED TO NORMAL WORKING HOURS. THE CONTRACTOR AGREES TO COMPLY WITH THE PROVISIONS OF THE TRAFFIC CONTROL PLAN AND THE LATEST EDITION OF THE "MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES," PART VI, FOR CONSTRUCTION SIGNAGE AND TRAFFIC CONTROL. ALL TEMPORARY AND PERMANENT TRAFFIC SIGNS SHALL COMPLY TO THE MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES (MUTCD) WITH REGARD TO SIGN SHAPE, COLOR, SIZE, LETTERING, ETC. UNLESS OTHERWISE SPECIFIED. IF APPLICABLE, PART NUMBERS ON SIGNAGE DETAILS REFER TO MUTCD SIGN NUMBERS.
6. THE CONTRACTOR SHALL BE RESPONSIBLE FOR REMOVING ANY GROUNDWATER ENCOUNTERED DURING THE CONSTRUCTION OF ANY PORTION OF THIS PROJECT. GROUNDWATER SHALL BE PUMPED, PIPED, REMOVED AND DISPOSED OF IN A MANNER WHICH DOES NOT CAUSE FLOODING OF EXISTING STREETS NOR EROSION ON ABUTTING PROPERTIES IN ORDER TO CONSTRUCT THE IMPROVEMENTS SHOWN ON THESE PLANS. GROUNDWATER TO BE PUMPED SHALL BE TESTED, PERMITTED, AND PUMPED PER THE STATE OF COLORADO AND LOCAL GROUNDWATER DISCHARGING PERMIT REQUIREMENTS.
7. RIM AND GRATE ELEVATIONS SHOWN ON PLANS ARE APPROXIMATE ONLY AND ARE NOT TO BE TAKEN AS FINAL ELEVATIONS. THE CONTRACTOR SHALL ADJUST RIMS AND OTHER IMPROVEMENTS TO MATCH FINAL PAVEMENT AND FINISHED GRADE ELEVATIONS.
8. THE EXISTING AND PROPOSED ELEVATIONS OF FLATWORK, SIDEWALKS, CURBS, THRESHOLDS, PAVING, ETC. AS SHOWN HEREON ARE BASED ON EXTRAPOLATION OF FIELD SURVEY DATA, EXISTING CONDITIONS, AND DATA PROVIDED BY OTHERS. AT CRITICAL AREAS AND SITE FEATURES, CONTRACTOR SHALL HAVE FORMWORK INSPECTED AND APPROVED BY OWNER, OWNER'S REPRESENTATIVE, OR ENGINEER PRIOR TO PLACING CONCRETE. MINOR ADJUSTMENTS, AS APPROVED, TO PROPOSED GRADES, INVERTS, ETC. MAY BE REQUIRED TO PREVENT PONDING OR SLOPE NOT IN CONFORMANCE WITH MUNICIPAL STANDARDS. ALL FLATWORK MUST PREVENT PONDING AND PROVIDE POSITIVE DRAINAGE AWAY FROM EXISTING AND PROPOSED BUILDINGS, WALLS, ROOF DRAIN OUTFALLS, ACROSS DRIVES AND WALKS, ETC., TOWARDS THE PROPOSED INTENDED DRAINAGE FEATURES AND CONVEYANCES.
9. FINAL LIMITS OF REQUIRED ASPHALT SAWCUTTING AND PATCHING MAY VARY FROM LIMITS SHOWN ON PLANS. CONTRACTOR TO PROVIDE SAWCUT AND PATCH WORK TO ACHIEVE POSITIVE DRAINAGE AND A SMOOTH TRANSITION TO EXISTING ASPHALT WITHIN SLOPES ACCEPTABLE TO THE ENGINEER AND WITHIN MUNICIPAL STANDARDS. CONTRACTOR SHALL PROVIDE ADDITIONAL SAWCUTTING AND PATCHING AT UTILITY WORK, CONNECTION POINTS TO EXISTING PAVEMENT AND FEATURES, ETC. THAT MAY NOT BE DELINEATED ON PLANS.
10. ANY EXISTING MONITORING WELLS, CLEANOUTS, VALVE BOXES, ETC. TO BE PROTECTED AND TO REMAIN IN SERVICE. IF FEATURES EXIST, EXTEND OR LOWER TO FINAL SURFACE WITH LIKE KIND CAP WITH STANDARD CAST ACCESS LID WITH SAME MARKINGS. IN LANDSCAPED AREAS PROVIDE A CONCRETE COLLAR (18"x18"x6" THICK) AT ALL EXISTING AND PROPOSED MONITORING WELLS, CLEANOUTS, VALVE BOXES, ETC.
11. OWNER TO APPROVE ALL PRIVATE CONCRETE FINISHING, JOINT PATTERNS AND COLORING REQUIREMENTS PRIOR TO CONSTRUCTION. SUBMIT JOINT LAYOUT PLAN TO OWNER FOR APPROVAL PRIOR TO CONSTRUCTION.
12. PIPE LENGTHS AND HORIZONTAL CONTROL POINTS SHOWN ARE FROM CENTER OF STRUCTURES, END OF FLARED END SECTIONS, ETC. SEE STRUCTURE DETAILS FOR EXACT HORIZONTAL CONTROL LOCATION. CONTRACTOR IS RESPONSIBLE FOR ADJUSTING ACTUAL PIPE LENGTHS TO ACCOUNT FOR STRUCTURES AND LENGTH OF FLARED END SECTIONS.
13. ALL SURPLUS MATERIALS, TOOLS, AND TEMPORARY STRUCTURES, FURNISHED BY THE CONTRACTOR, SHALL BE REMOVED FROM THE PROJECT SITE BY THE CONTRACTOR. ALL DEBRIS AND RUBBISH CAUSED BY THE OPERATIONS OF THE CONTRACTOR SHALL BE REMOVED, AND THE AREA OCCUPIED DURING CONSTRUCTION ACTIVITIES SHALL BE RESTORED TO ITS ORIGINAL CONDITION, WITHIN 48 HOURS OF PROJECT COMPLETION, UNLESS OTHERWISE DIRECTED BY THE MUNICIPALITY OR OWNER'S REPRESENTATIVE.
14. THE CONTRACTOR IS REQUIRED TO PROVIDE AND MAINTAIN EROSION AND SEDIMENT CONTROL MEASURES IN ACCORDANCE WITH THE LOCAL JURISDICTION, THE STATE OF COLORADO, MILE HIGH FLOOD DISTRICT "URBAN STORM DRAINAGE CRITERIA MANUAL VOLUME 3", THE M-STANDARD PLANS OF THE COLORADO DEPARTMENT OF TRANSPORTATION, AND THE APPROVED EROSION CONTROL PLAN. JURISDICTIONAL AUTHORITY MAY REQUIRE THE CONTRACTOR TO PROVIDE ADDITIONAL EROSION CONTROL MEASURES AT THE CONTRACTOR'S EXPENSE DUE TO UNFORESEEN EROSION PROBLEMS OR IF THE PLANS DO NOT FUNCTION AS INTENDED. THE CONTRACTOR IS RESPONSIBLE FOR PROHIBITING SILT AND DEBRIS LADEN RUNOFF FROM LEAVING THE SITE, AND FOR KEEPING ALL PUBLIC AREAS FREE OF MUD AND DEBRIS. THE CONTRACTOR IS RESPONSIBLE FOR RE-ESTABLISHING FINAL GRADES AND FOR REMOVING ACCUMULATED SEDIMENTATION FROM ALL AREAS INCLUDING SWALES AND DETENTION/WATER QUALITY AREAS. CONTRACTOR SHALL REMOVE TEMPORARY EROSION CONTROL MEASURES AND REPAIR AREAS AS REQUIRED AFTER VEGETATION IS ESTABLISHED AND ACCEPTED BY OWNER AND MUNICIPALITY.
15. ADA COMPLIANCE: THE CROSS-SLOPE OF ALL WALKS MUST BE LESS THAN 1:48 (2.0%) PERPENDICULAR TO DIRECTION OF TRAVEL. RUNNING SLOPE OF ACCESSIBLE WALKS MUST BE NOT STEEPER THAN 1:20 (5.0%) IN DIRECTION OF TRAVEL. MAXIMUM GRADE OF ACCESSIBLE CURB RAMPS AND RAMPS IS 1:12 (8.3%). CURB RAMPS SHALL PROVIDE A LANDING AT THE TOP AND RAMP RUNS PROVIDE LANDINGS AT THE BOTTOM AND TOP OF EACH RAMP RUN AT A SLOPE NOT TO EXCEED 1:48. RAMPS RUNS EXCEEDING SIX INCHES SHALL INCLUDE HANDRAILS. ACCESSIBLE PARKING SPACES AND ACCESS AISLES SHALL NOT EXCEED 1:48 IN ALL DIRECTIONS. CONTRACTOR SHALL NOTIFY ENGINEER PRIOR TO PLACEMENT OF FLATWORK OF SITE CONDITIONS OR DISCREPANCIES WHICH PREVENT TYPICAL REQUIRED GRADES FROM BEING ACHIEVED. ALL RAMPS, STAIRS, EDGE PROTECTION, AND RAILINGS SHALL BE CONSTRUCTED IN ACCORDANCE WITH CURRENT ADA STANDARDS. ACCESSIBLE CURB RAMPS SHALL CONFORM TO THE CDOT M-STANDARDS (SEE DETAIL M-608-1, ETC). ACCESSIBLE FEATURE WITHIN THE PUBLIC RIGHTS-OF-WAY SHALL BE CONSTRUCTED TO CONFORM TO THE LOCAL AUTHORITY HAVING JURISDICTION REQUIREMENTS.
16. PROTECT ALL TREES AND VEGETATION. PLACE CONSTRUCTION FENCING AT DRIP LINE OF TREES AND PLANTS NEAR THE WORK ZONE. DEEP WATER TREES WEEKLY. HAND EXCAVATION REQUIRED AT ROOT ZONES WHERE PROPOSED PAVING OR UTILITY WORK IS WITHIN DRIPLINE OF TREES.
17. LOCATIONS OF CLEANOUTS, LIGHTS, SIGNAGE, JUNCTION BOXES, AND OTHER SIGNIFICANT SITE FEATURES TO BE STAKED FOR ENGINEER AND OR OWNER APPROVAL PRIOR TO WORK. CLEANOUTS, JUNCTION BOXES, AND ADJACENT GRADES TO BE RAISED ONE-HALF INCH AT ASPHALT/CONCRETE (OR 1" AT LANDSCAPING) TO PROVIDE POSITIVE DRAINAGE AWAY FROM FEATURES.
18. SURVEY INFORMATION: TOPOGRAPHIC INFORMATION WAS PROVIDED BY SURVWEST, LLC. SEE "IMPROVEMENT LOCATION & GRADING CERTIFICATION FOR LOTS 7 & 8, AMENDED FINAL PLAT LAFAYETTE TECH CENTER – FILING NO. 3, CITY OF LAFAYETTE, COUNTY OF BOULDER,STATE OF COLORADO, DATED 11/21/19. THE DATUM IS PER SURVEY. COORDINATE AND VERIFY ALL VERTICAL AND HORIZONTAL DATA SHOWN IN SURVEY AND REPORT ANY IRREGULARITIES OR DISCREPANCIES TO ENGINEER PRIOR TO CONSTRUCTION.
    - 18.1. BASIS OF BEARINGS: PER SURVEY.
    - 18.2. HORIZONTAL CONTROL INFORMATION: ARE BASED ON THE REFERENCED SURVEY.
    - 18.4 SURVEY UTILITY LOCATION INFORMATION PER THE SURVEYOR: SUBSURFACE UTILITIES ARE SHOWN IN APPROXIMATE HORIZONTAL AND VERTICAL LOCATIONS CONSISTENT WITH ASCE 38-02 QUALITY LEVEL "B" (INFORMATION OBTAINED BY THE APPLICATION OF APPROPRIATE SURFACE GEOPHYSICAL METHODS TO DETERMINE THE EXISTENCE AND HORIZONTAL POSITION OF VIRTUALLY ALL UTILITIES WITHIN THE PROJECT LIMITS. THE INFORMATION OBTAINED IN THIS MANNER IS SURVEYED TO PROJECT CONTROL.) AND QUALITY LEVEL "C" (INFORMATION OBTAINED BY SURVEYING AND PLOTTING VISIBLE ABOVE-GROUND UTILITY FEATURES AND BY USING PROFESSIONAL JUDGMENT IN CORRELATING THIS INFORMATION TO QUALITY LEVEL D; INFORMATION DERIVED FROM EXISTING RECORDS OR ORAL RECOLLECTIONS), AND BASED ON FIELD MEASUREMENTS PROVIDED BY THE OWNER AND THE CONTRACTOR. SUBSURFACE UTILITIES ARE NOT DEPICTED TO THE EXTENT SET FORTH IN ASCE 38-02 QUALITY LEVELS "A" (INFORMATION OBTAINED THROUGH THE NONDESTRUCTIVE EXPOSURE OF UNDERGROUND UTILITIES, AND ALSO PROVIDES THE TYPE, SIZE, CONDITION, MATERIAL AND OTHER CHARACTERISTICS OF UNDERGROUND FEATURES.). TO THE EXTENT DEEMED NECESSARY FOR THE PROTECTION OF PERSONS AND PROPERTY, POTHOLING OR OTHER PRECISE MAPPING MAY BE COMPLETED TO CONFIRM THE EXACT LOCATION OF ANY SUBSURFACE UTILITIES. NOTIFY OWNER AND ENGINEER WITH ALL UTILITY INFORMATION PRIOR TO CONSTRUCTION.VISIT HTTPS: //WWW.FHWA.DOT.GOV/PROGRAMADMIN/SUEINDEX.CFM FOR MORE INFORMATION.
19. THE CONTRACTOR AT THE CONTRACTORS EXPENSE SHALL FURNISH THE OWNER AND ENGINEER OF RECORD A COMPLETE SET OF CONSTRUCTION RECORD DRAWINGS ("AS-BUILTS") FOR THE CONSTRUCTED IMPROVEMENTS. THE AS-BUILT SET SHALL SHOW SUFFICIENT DIMENSION TIES TO PERMANENT SURFACE FEATURES OR NORTHING/EASTING POINTS FOR ALL BURIED FACILITIES TO ALLOW FOR FUTURE LOCATING. THE AS-BUILT SET SHALL SHOW AS-BUILT CONTOURS AND ELEVATIONS OF ASPHALT AND CONCRETE FLATWORK, FLOWLINES, GRADE BREAKS, STAIRS, CROSS-SLOPES, HIGH AND LOW POINTS, AND ADDITIONAL ELEVATIONS TO DEMONSTRATE IMPROVEMENTS WERE CONSTRUCTED PER PLANS. THE AS-BUILT SET SHALL SHOW ELEVATIONS OF ALL DETENTION/WATER QUALITY FACILITIES, INCLUDING BUT NOT LIMITED TO BERMS, SPILLWAYS, BASIN BOTTOM, PIPE INVERTS, AND CONTROL STRUCTURE FEATURES (AS SURVEYED AND STAMPED BY A CERTIFIED P.L.S.). THE AS-BUILT SET SHALL ALSO INCLUDE ELEVATIONS OF MANHOLES, PIPES, INLETS, GRATES, AND SIZES OF ALL UTILITIES. THE AS-BUILT SET SHALL SHOW ANY AND ALL VARIATIONS FROM THE APPROVED PLAN. ENGINEER WILL PRODUCE FINAL RECORD DRAWINGS.

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BOULDER COUNTY PUBLIC WORKS
2525 13TH STREET
BOULDER, CO 80304

ARCHITECT / INTERIOR DESIGN
STUDIOTROPE DESIGN COLLECTIVE
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MEP ENGINEER
PCD ENGINEERING
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LONGMONT, CO 80501

STRUCTURAL ENGINEER
ANTHEM STRUCTURAL
2213 CENTRAL AVE
BOULDER, CO 80301

LIGHTING DESIGNER
ENLIGHTEN
12364 W ALAMEDA PARKWAY, SUITE 135
LAKEWOOD, CO 80228

ACOUSTIC ENGINEER
K2 AUDIO
5777 CENTRAL AVE, SUITE 225
BOULDER, CO 80301

FURNITURE
WORKPLACE RESOURCE
1899 WYNKOOP ST
DENVER, CO 80202

CIVIL ENGINEER
JVA CONSULTING ENGINEERS
1319 SPRUCE ST
BOULDER, CO 80302

PROJECT:
SOUTHEAST COUNTY SERVICE HUB
1755 S. PUBLIC RD
LAFAYETTE, CO 80026

PROJECT NO: 2007

ISSUE DATE	PHASE / REV NAME
11-19-2021	CONSTRUCTION DOCUMENTS

LEGEND, NOTES, AND ABBREVIATIONS

C0.1

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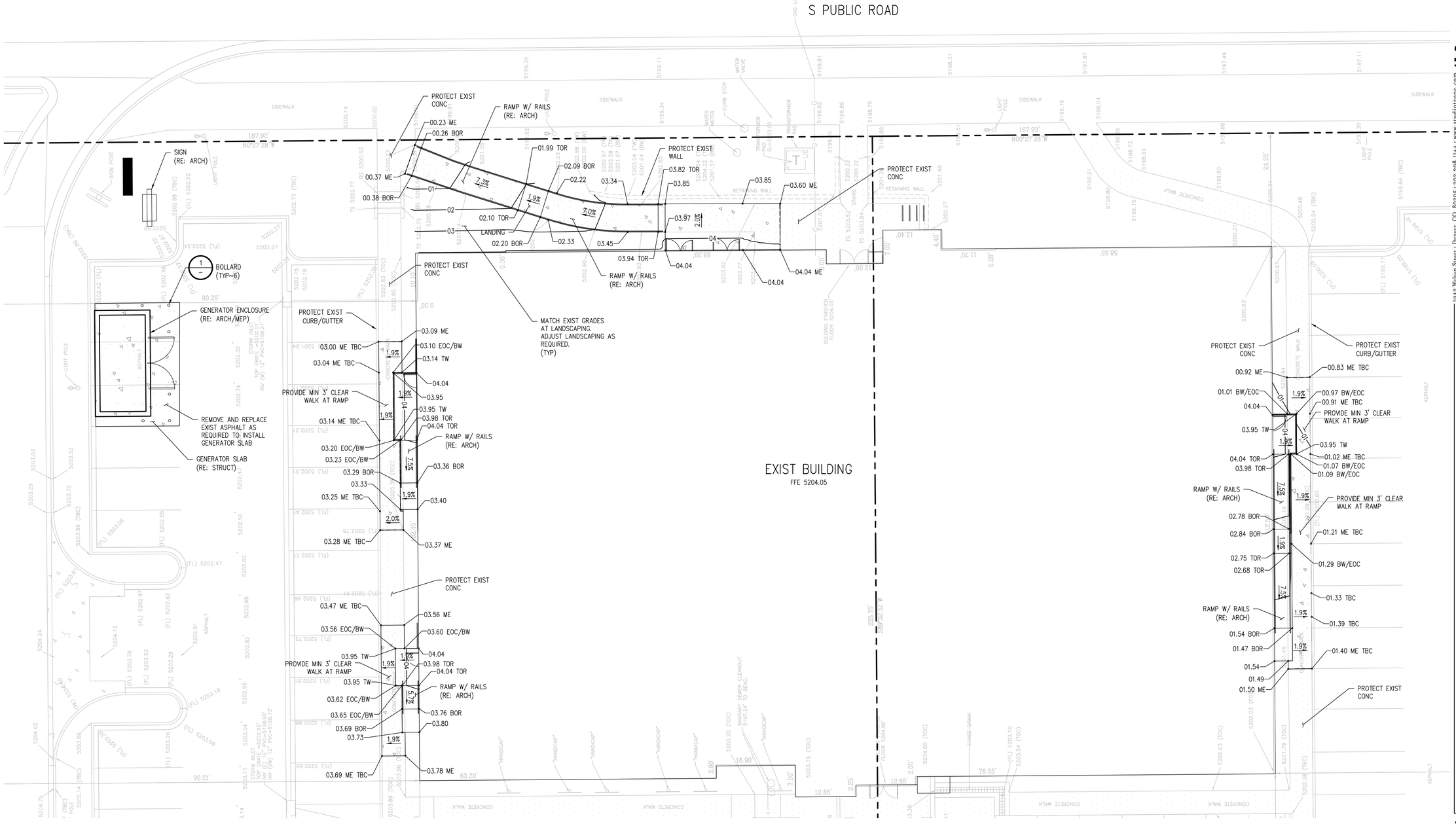
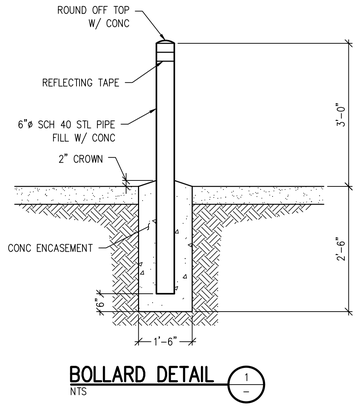




BOLLARD DETAIL

1 / —

NTS

GENERAL NOTES:

1. NO SITE SURVEY HAS BEEN PROVIDED. SITE PLAN IS BASED ON ASBUILTS DRAWINGS FOR THE ORIGINAL 1755 S. PUBLIC ROAD CONSTRUCTION DRAWING PACKAGE.
2. SITE EXISTING TOPOGRAPHIC INFORMATION HAS BEEN PROVIDED. SPOT SHOTS ARE BASED ON ORIGINAL 1755 S. PUBLIC ROAD CONSTRUCTION DRAWING PACKAGE.
3. CONTRACTOR TO VERIFY ALL ELEVATIONS PRIOR TO CONSTRUCTION. CONTRACTOR TO NOTIFY ENGINEER AND ARCHITECT IF DISCREPANCIES ARE FOUND.

GRADING AND DRAINAGE NOTES:

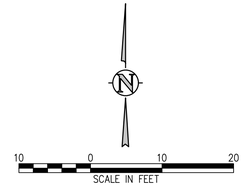
1. CONTRACTOR TO FIELD VERIFY ALL EXISTING UNDERGROUND UTILITIES PRIOR TO CONSTRUCTION. REFER TO GENERAL NOTES FOR UTILITY LOCATION AND PROTECTION.
2. REFER TO HORIZONTAL CONTROL PLAN FOR FURTHER INFORMATION PERTAINING TO CURB & GUTTER, CHASES, AND DRAINAGE PANS.
3. CONTRACTOR IS RESPONSIBLE FOR RESTORING ALL DISTURBED AREAS TO THEIR ORIGINAL CONDITIONS.
4. ALL SPOT ELEVATIONS ARE TO FINISHED GRADE OR FLOWLINE UNLESS OTHERWISE SPECIFIED.
5. IF WALL IS SHOWN, TG DENOTES THE FINISHED GRADE ADJACENT TO THE HIGH SIDE OF THE WALL. BG DENOTES THE FINISHED GRADE ADJACENT TO THE LOW SIDE OF THE WALL. REFER TO ARCH PLANS/DETAILS FOR WALL ELEVATIONS BEYOND THE ADJACENT FINISHED GRADES (EXPOSED WALL, CAP/FOOTER, ETC.)

HORIZONTAL CONTROL NOTES:

1. ALL DIMENSIONS AND RADII ARE TO FACE OF CURB, FACE OF BUILDING AND EDGE OF WALK UNLESS OTHERWISE NOTED.
2. CONTRACTOR TO REPAIR/REPLACE ALL DAMAGE TO EXISTING FLATWORK OR SITE FEATURES NOT INTENDED FOR DEMOLITION.
3. REFER TO GRADING AND DRAINAGE PLAN FOR FURTHER INFORMATION PERTAINING TO CURB & GUTTER, CHASES, AND DRAINAGE PANS.

DEMOLITION NOTES:

1. CONTRACTOR TO FIELD VERIFY ALL EXISTING UNDERGROUND UTILITIES PRIOR TO CONSTRUCTION. REFER TO GENERAL NOTES FOR UTILITY LOCATION AND PROTECTION.
2. ACTUAL LIMITS MAY VARY, CONTRACTOR IS RESPONSIBLE FOR ADJUSTING LIMITS OF DEMOLITION AND CONSTRUCTION AS NECESSARY. COORDINATE DEMOLITION REQUIREMENTS, LIMITS OF DEMOLITION, SALVAGE ITEMS, PROTECTION OF ITEMS TO REMAIN, TREES, FENCING, ETC. WITH OWNER, ARCHITECT, ENGINEER, AND RELEVANT CONSTRUCTION AND PHASING PLANS.
3. IF BUILDING DEMOLITION IS REQUIRED, REFER TO ARCHITECT AND APPLICABLE ENGINEERS FOR DETAILED DEMOLITION INFORMATION.
4. REPLACE EXISTING FLATWORK AT UTILITY TRENCHES AS REQUIRED.
5. ALL SAWCUTTING AND PAVEMENT REMOVAL SHOULD BE TO THE NEAREST JOINT.
6. ALL DRY UTILITY AND ELECTRIC DEMOLITION OR RELOCATION SHOULD BE COORDINATED WITH PROPERTY OWNER, UTILITY OWNER, MECHANICAL ENGINEER, AND ARCHITECT PRIOR TO CONSTRUCTION.
7. ALL NECESSARY EROSION AND SEDIMENTATION CONTROLS MUST BE INSTALLED PRIOR TO CONSTRUCTION.
8. CONTRACTOR TO COMPLY WITH ALL REGULATORY REQUIREMENTS FOR HAZARDOUS MATERIAL REMOVAL AND DISPOSAL.
9. REFER TO GENERAL NOTES FOR TREE PROTECTION. COORDINATE WITH LANDSCAPE ARCHITECT FOR TREE REMOVAL.
10. CONTRACTOR TO MAINTAIN SAFE PEDESTRIAN ACCESS. PROVIDE TEMPORARY ROUTE AND SIGNAGE AS NEEDED.
11. CONTRACTOR TO TAKE NECESSARY PRECAUTIONS TO PROTECT AND MAINTAIN SERVICES DURING CONSTRUCTION.
12. CONTRACTOR TO REPAIR/REPLACE ALL DAMAGE TO EXISTING FLATWORK OR SITE FEATURES NOT INTENDED FOR DEMOLITION.



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CIVIL ENGINEER
JVA CONSULTING ENGINEERS
1319 SPRUCE ST
BOULDER, CO 80302

PROJECT:
SOUTHEAST COUNTY SERVICE HUB
1755 S. PUBLIC RD
LAFAYETTE, CO 80026

PROJECT NO: 2007

#	ISSUE DATE	PHASE / REV NAME
A	11-19-2021	CONSTRUCTION DOCUMENTS

CIVIL SITE PLAN

C1.0

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STRUCTURAL GENERAL NOTES

GOVERNING CODE: 2015 INTERNATIONAL BUILDING CODE (IBC) AND ALL LOCAL AMENDMENTS, EXCEPT AS NOTED

DESIGN LOADS:

RISK CATEGORY:	II, STANDARD		
ROOF LIVE LOADS:			
ROOF LIVE LOAD:	20 PSF		
GROUND SNOW LOAD (P_G):	30 PSF		
FLAT ROOF SNOW LOAD (P_F):	30 PSF		
SNOW EXPOSURE FACTOR (C_E):	1.0		
SNOW LOAD IMPORTANCE FACTOR (I_s):	1.0		
THERMAL FACTOR (C_T):	1.0		
SLOPE FACTOR (C_s):	1.0		
SNOW DRIFTING AND UNBALANCED LOADS:	IN ACCORDANCE WITH ASCE 7-10		
FLOOR LIVE LOADS:			
OFFICE:	50 PSF		
OFFICE PARTITIONS:	15 PSF		
CORRIDORS & PUBLIC SPACES:	100 PSF		
CORRIDORS ABOVE 1ST FLOOR:	80 PSF		
STORAGE AREAS:	125 PSF		
ROOF AND FLOOR DEAD LOADS:			
CORRIDOR DEAD LOAD:	90 PSF		
OFFICE DEAD LOAD:	90 PSF		
ROOF DEAD LOAD:	25 PSF		
ROOFTOP MECHANICAL EQUIPMENT:	SEE PLAN		
WIND LOADS (ASCE 7-10):			
ULTIMATE WIND SPEED, 3-SECOND GUST (V_{ULT}):	105 MPH		
ALLOWABLE STRESS DESIGN WIND SPEED (V_{ASD}):	135 MPH		
INTERNAL PRESSURE COEFFICIENT (GC_{PI}):	±0.18		
WIND EXPOSURE:	C		
SEISMIC LOADS:			
OCCUPANCY RISK CATEGORY:	II, STANDARD		
SEISMIC IMPORTANCE FACTOR (I_E):	1.0		
SPECTRAL RESPONSE ACCELERATION COEFFICIENTS			
SHORT PERIOD	S_S: 0.187G	S_{DS}:	0.199G
ONE SECOND	S_1: 0.059G	S_{D1}:	0.094G
SOILS SITE CLASS:	D		
SEISMIC DESIGN CATEGORY:	B		

FOUNDATION DESIGN:

REFER TO SOILS REPORT NO.17-1-775 BY KUMAR & ASSOCIATES INC., DATED12/29/2017.
FOUNDATION DESIGN IS IN ACCORDANCE WITH RECOMMENDATIONS CONTAINED IN SOILS INVESTIGATION REPORT NUMBER 17-1-775 PREPARED BY KUMAR & ASSOCIATES INCC. DATED 12/29/2017
SOIL CONDITIONS SHALL BE VERIFIED BY THE GEOTECHNICAL ENGINEER PRIOR TO PLACEMENT OF FORMWORK OR CONCRETE. IF DIFFERENT SOIL CONDITIONS EXIST THE STRUCTURAL ENGINEER SHALL BE NOTIFIED TO RE-EVALUATE THE FOUNDATION DESIGN AT ADDITIONAL EXPENSE TO THE OWNER.
SLOPE FINAL GRADES DOWN AND AWAY FROM FOUNDATION WALLS A MINIMUM OF 12 INCHES IN FIRST 10 FEET.

FOOTINGS:
FOOTINGS, SELECTED BY THE OWNER SHALL BEAR ON THE NATURAL UNDISTURBED SOILS OR APPROVED COMPACTED STRUCTURAL FILL.
EXTERIOR FOOTINGS SHALL BEAR BELOW FROST DEPTH; MINIMUM FROST DEPTH SHALL BE 3'-6" BELOW ADJACENT EXTERIOR FINISHED GRADE.
DESIGN OF FOOTINGS IS BASED ON:
MAXIMUM ALLOWABLE BEARING PRESSURE: 3500 PSF
MINIMUM DEAD LOAD PRESSURE: 1000 PSF

EARTH RETAINING STRUCTURES:
EARTH EQUIVALENT FLUID LATERAL PRESSURE:
PASSIVE RESISTING: 175 PCF
COEFFICIENT OF SLIDING FRICTION: 0.30

REINFORCED CONCRETE:

CONCRETE DESIGN IS BASED ON THE AMERICAN CONCRETE INSTITUTE “BUILDING CODE REQUIREMENTS FOR REINFORCED CONCRETE” (ACI 318) AND SHALL BE CONSTRUCTED IN ACCORDANCE WITH THE "STANDARD SPECIFICATIONS FOR STRUCTURAL CONCRETE" (ACI 301).
STRUCTURAL CONCRETE SHALL HAVE THE FOLLOWING PROPERTIES (NORMAL WEIGHT CONCRETE UNLESS NOTED OTHERWISE):
MINIMUM 28 DAY COMPRESSIVE STRENGTH (F'_C) AS FOLLOWS:

CEMENT TYPE:	I/II
MAXIMUM AGGREGATE SIZE:	3/4"
FOOTINGS:	3,500 PSI (MAX W/ C RATIO 0.52); ENTRAINED AIR 1.5% (± 1.5%); SLUMP 5 INCHES (± 1")
STEM WALLS:	3,500 PSI (MAX W/ C RATIO 0.52); ENTRAINED AIR 5.0% (± 1.5%); SLUMP 4 INCHES (± 1")
EXTERIOR SLABS-ON-GRADE (EXCLUDES FLATWORK):	3,500 PSI (MAX W/ C RATIO 0.45); ENTRAINED AIR 6.0% (± 1.5%); SLUMP 4 INCHES (± 1")
INTERIOR SLABS-ON-GRADE:	3,500 PSI (MAX W/ C RATIO 0.50); ENTRAINED AIR 3.0% (± 1.5%); SLUMP 4 INCHES (± 1")

REINFORCING STEEL SHALL BE FABRICATED AND PLACED IN ACCORDANCE WITH ACI 315 “DETAILS AND DETAILING OF CONCRETE REINFORCEMENT.”
WHEN COLD WEATHER CONDITIONS EXIST, PLACE AND CURE CONCRETE IN ACCORDANCE WITH ACI 306.
WELDED WIRE FABRIC SHALL CONFORM TO ASTM A185.
DEFORMED REINFORCEMENT SHALL BE DOMESTIC NEW BILLET STEEL CONFORMING TO ASTM A615, GRADE 60 INCLUDING STIRRUPS AND TIES, EXCEPT THAT REINFORCING WHICH IS REQUIRED TO BE WELDED SHALL CONFORM TO ASTM A706.
EPOXY COATED REINFORCING BARS SHALL CONFORM TO ASTM A775.
ZINC COATED (GALVANIZED) REINFORCING BARS SHALL CONFORM TO ASTM A767.
UNLESS OTHERWISE NOTED ON THE STRUCTURAL DRAWINGS, LAP BARS 50 DIAMETERS (50*BAR DIAMETER MINIMUM).
REINFORCING AT ALL ABUTTING CONCRETE (INCLUDING FOOTINGS) SHALL BE CONTINUOUS THROUGH OR AROUND ALL CORNERS AND INTERSECTIONS <u>OR</u> USE MATCHING CORNER BARS OF EQUAL SIZE AND SPACING TO REINFORCING IN THE ABUTTING MEMBERS.
INSTALL (2) #5 BARS (MINIMUM) AROUND ALL SIDES OF ALL OPENINGS IN CONCRETE AND EXTEND 2'-0" PAST EDGES OF OPENINGS, UNLESS OTHERWISE NOTED.
IN CONTINUOUS MEMBERS, SPLICE TOP BARS AT MID-SPAN BETWEEN SUPPORTS AND SPLICE BOTTOM BARS OVER SUPPORTS.
FORM INTERMITTENT SHEAR KEYS AT ALL CONSTRUCTION JOINTS AND AS SHOWN ON THE STRUCTURAL DRAWINGS.
UNLESS OTHERWISE NOTED ON THE DRAWINGS, MINIMUM CONCRETE COVER OVER REINFORCING SHALL BE AS FOLLOWS:
UNFORMED SURFACE CAST AGAINST AND PERMANENTLY EXPOSED TO EARTH: 3”
FORMED SURFACE EXPOSED TO EARTH OR WEATHER:
#6 THROUGH #18 BARS 2”
#5 BAR, W31 OR D31 WIRE, AND SMALLER 1-1/2”
FORMED SURFACE NOT EXPOSED TO WEATHER OR IN CONTACT WITH GROUND:
SLABS, WALLS, JOISTS: #11 BARS AND SMALLER 3/4”
BEAMS AND COLUMNS:
PRIMARY REINFORCEMENT 1-1/2”
STIRRUPS, TIES, SPIRALS 1-1/2”
INSTALL CHAIRS, BOLSTERS, ADDITIONAL REINFORCEMENT, AND ACCESSORIES NECESSARY TO SUPPORT REINFORCEMENT AT POSITION SHOWN ON DRAWINGS. SUPPORT OF REINFORCEMENT ON WOOD, BRICK, OR OTHER UNACCEPTABLE MATERIALS SHALL NOT BE PERMITTED.
KEEP REINFORCEMENT CLEAN AND FREE OF DIRT AND OIL. OIL FORMS PRIOR TO PLACING REINFORCEMENT.
FIBER ADMIXTURE SHALL BE 100% VIRGIN POLYPROPYLENE, FIBRILLATED FIBERS, TYPE 111 4.1.3, PERFORMANCE LEVEL ONE, PER ASTM C1116.
PROPERLY PLACE, ACCURATELY POSITION AND MAINTAIN SECURELY IN PLACE ALL EMBEDDED ITEMS PRIOR TO AND DURING CONCRETE PLACEMENT.
ANCHOR BOLTS AND RODS FOR BEAM AND COLUMN-BEARING PLATES SHALL BE PLACED WITH SETTING TEMPLATES.
UNLESS OTHERWISE SHOWN IN THE ARCHITECTURAL DRAWINGS, PROVIDE 3/4" CHAMFERS AT ALL COLUMN, WALL, SLAB OR BEAM EDGES THAT ARE EXPOSED TO VIEW IN THE FINISHED STRUCTURE.

STRUCTURAL MASONRY:

DESIGN IS BASED ON ACI 530/ASCE 5-05/TMS 402-05, “BUILDING CODE REQUIREMENTS FOR MASONRY STRUCTURES,” ALLOWABLE STRESS DESIGN.
MASONRY WORK SHALL CONFORM TO ACI 530.1/ASCE 6-05/TMS 602-05 "SPECIFICATION FOR MASONRY STRUCTURES".
COMPRESSIVE STRENGTH OF MASONRY ASSEMBLY USED FOR DESIGN IS 2000 PSI (F'M = 2000 PSI), BASED ON NET-BEDDED AREA.
EXCEPT AT MASONRY LINTELS USING STANDARD LINTEL UNITS, BOND BEAM UNITS SHALL BE PRODUCED FROM STANDARD VERTICALLY VOIDED UNITS WITH PRE-CUT KNOCKOUT CROSS WALLS.
HOLLOW LOAD-BEARING CONCRETE MASONRY UNITS (CMU) SHALL BE LIGHTWEIGHT, 85 TO 105 PCF DENSITY, CONFORMING TO ASTM C90, WITH A MINIMUM COMPRESSIVE STRENGTH OF 1,900 PSI BASED ON AVERAGE NET AREA.
FACING BRICK SHALL CONFORM TO ASTM C216 GRADE SW.
BUILDING BRICK SHALL CONFORM TO ASTM C62 GRADE SW.
HOLLOW BRICK SHALL CONFORM TO ASTM C652, GRADE SW.
MORTAR SHALL BE TYPE "S" CONFORMING TO ASTM C270. MORTAR SHALL NOT BE SUBSTITUTED FOR GROUT.
MASONRY CEMENT SHALL NOT BE USED UNLESS PART OF A PRE-PACKAGED MORTAR OR GROUT MIX APPROVED BY THE STRUCTURAL ENGINEER.
PROVIDE FULL SHOVED MORTAR IN ALL HEAD AND BED JOINTS.
ADMIXTURES SHALL NOT BE USED UNLESS APPROVED BY THE ARCHITECT AND/OR STRUCTURAL ENGINEER.
GROUT USED IN MASONRY WALLS AND BLOCK CELLS SHALL BE COARSE GROUT, AS DEFINED BY ASTM C476, WITH A MINIMUM CUBE STRENGTH = 2,000 PSI OR 3,000 PSI CONCRETE USING 3/8" DIAMETER AGGREGATE AND PLACED BY VIBRATING UNLESS AN APPROVED SELF-CONSOLIDATING MIX IS USED.
'LOW-LIFT' GROUTING SHALL NOT EXCEED 5 FEET IN HEIGHT UNLESS ACI 530.1 'HIGH-LIFT' GROUTING PROCEDURES ARE REVIEWED AND APPROVED BY THE ARCHITECT AND STRUCTURAL ENGINEER.
VERTICALLY SPACE CONTINUOUS HORIZONTAL JOINT REINFORCING AT 16" MAXIMUM IN ALL CMU WALLS. JOINT REINFORCING SHALL BE WELDED TYPE WITH 9 GAGE SIDE RODS AND 9 GAGE TRUSSED OR LADDER CROSS RODS. IN EXTERIOR WALLS, JOINT REINFORCEMENT SHALL BE STAINLESS STEEL OR HOT-DIP GALVANIZED. ALL OTHER JOINT REINFORCEMENT SHALL BE MILL GALVANIZED, HOT-DIP GALVANIZED, OR STAINLESS STEEL. HORIZONTAL JOINT REINFORCING SHALL BE LAPPED NO LESS THAN 6" ALL SPLICES.
WIRE TIES FOR VENEER SHALL BE 9 GAGE DIAMETER FOR CAVITY WIDTHS 2” OR LESS. WHERE NOMINAL CAVITY WIDTH EXCEEDS 2 INCHES, VENEER TIES SHALL BE 1/4” DIAMETER. TIES SHALL BE SPACED A MAXIMUM OF 16” IN EACH DIRECTION.
REINFORCING BARS SHALL BE AS FOR REINFORCED CONCRETE EXCEPT AS NOTED. UNLESS OTHERWISE NOTED ON THE STRUCTURAL DRAWINGS, LAP BARS 50 DIAMETERS (50*BAR DIAMETER MINIMUM) AT SPLICES. REINFORCEMENT SHALL BE SECURED AGAINST DISPLACEMENT PRIOR TO GROUTING BY WIRE BAR LOCATORS OR OTHER SUITABLE DEVICES AT INTERVALS NOT EXCEEDING 200 BAR DIAMETERS OR 10 FEET.
REINFORCE AND FULLY GROUT VERTICAL CELLS AT CORNERS, ENDS OF WALLS, JAMBS OF OPENINGS, EACH SIDE OF VERTICAL CONTROL JOINTS, AND AT SPACING SHOWN ON DRAWINGS. VERTICAL REINFORCING BARS SHALL HAVE A MINIMUM CLEARANCE OF 3/4" FROM MASONRY.
FOUNDATION DOWELS SHALL MATCH VERTICAL REINFORCING, UNLESS OTHERWISE NOTED ON THE DRAWINGS.
WHERE NOTED ON THE DRAWINGS, PROVIDE CLEARANCE BETWEEN MASONRY AND STRUCTURAL ELEMENTS, OR WRAP STEEL WITH POLYETHYLENE FILM.
LOCATE VERTICAL CONTROL JOINTS IN ALL MASONRY WALLS AS SHOWN ON THE ARCHITECTURAL DRAWINGS, STRUCTURAL DRAWINGS, OR SPACED HORIZONTALLY AT 25'-0" MAXIMUM SPACING WHERE NOT SHOWN.
COLD WEATHER CONSTRUCTION SHALL CONFORM TO GUIDE SPECIFICATIONS FROM THE INTERNATIONAL MASONRY INDUSTRY ALL-WEATHER COUNCIL (IMIAWC), LATEST VERSION.

LOOSE LINTELS:

UNLESS NOTED OTHERWISE, PROVIDE LOOSE LINTELS AS FOLLOWS: (ONE ANGLE FOR EACH 4” OF WALL THICKNESS TO BEAR 4” MINIMUM EACH END)

OPENING	ANGLE
0'-8" TO 4'-0"	L3 1/2X3 1/2X1/4
4'-1" TO 5'-4"	L5X3 1/2X1/4 (LLV)
5'-5" TO 10'-0"	L6X3 1/2X5/16 (LLV)

STRUCTURAL STEEL:

STRUCTURAL STEEL SHALL BE DETAILED, FABRICATED AND ERECTED IN ACCORDANCE WITH THE “SPECIFICATION FOR STRUCTURAL STEEL BUILDINGS” (AISC 360) AND THE “CODE OF STANDARD PRACTICE FOR STEEL BUILDINGS AND BRIDGES” (AISC 303) BY THE AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC).
ALL STRUCTURAL STEEL SHALL CONFORM TO THE ASTM STANDARDS AND GRADES INDICATED BELOW, UNLESS NOTED OTHERWISE ON THE DRAWINGS OR DETAILS.

STRUCTURAL STEEL WIDE FLANGE BEAMS AND WTS:	ASTM A992, 50 KSI YIELD
OTHER ROLLED SHAPES, INCLUDING PLATES, CHANNELS, AND ANGLES:	ASTM A36, 36 KSI YIELD.
HOLLOW STRUCTURAL SECTION (HSS) RECTANGULAR SHAPES:	ASTM A500, GRADE B, 46 KSI YIELD
HSS ROUND SHAPES:	ASTM A500, GRADE B, 42 KSI YIELD
PIPE SHAPES:	ASTM A53, GRADE B, 35 KSI YIELD.

UNLESS OTHERWISE NOTED, FRAMED BEAM CONNECTIONS SHALL BE BEARING-TYPE WITH 3/4” DIAMETER, SNUG TIGHT, ASTM A325 BOLTS, DETAILED IN CONFORMANCE WITH THE STRUCTURAL DRAWINGS AND THE “STEEL CONSTRUCTION MANUAL” BY THE AISC, 14TH EDITION. INSTALL BOLTS IN ACCORDANCE WITH AISC'S “SPECIFICATION FOR STRUCTURAL JOINTS USING ASTM A325 OR A490 BOLTS,”.
ALL BEAMS SHALL HAVE FULL DEPTH WEB STIFFENERS EACH SIDE OF WEBS ABOVE AND BELOW COLUMNS (1/4" PLATE OR AS NOTED).
ANCHOR RODS SHALL CONFORM TO ASTM F1554, GRADE 55 AS NOTED ON THE STRUCTURAL DRAWINGS WITH WELDABILITY SUPPLEMENT S1.
HEADED ANCHOR STUDS (HAS) SHALL CONFORM TO ASTM A108 AND SHALL BE CONNECTED TO STRUCTURAL STEEL WITH EQUIPMENT APPROVED BY THE STUD MANUFACTURER ACCORDING TO THE STUD MANUFACTURER'S RECOMMENDATIONS.
WELDING SHALL BE DONE BY A CERTIFIED WELDER IN ACCORDANCE WITH THE AISC DOCUMENTS LISTED ABOVE, THE AMERICAN WELDING SOCIETY (AWS) D1.1:
2006 STRUCTURAL WELDING CODE, AND THE RECOMMENDATIONS FOR USE OF E70XX ELECTRODES. WHERE NOT SPECIFICALLY NOTED, MINIMUM WELD SHALL BE 3/16” FILLET BY LENGTH OF CONTACT EDGE.
ALL POST-INSTALLED ANCHORS SHALL HAVE CURRENT INTERNATIONAL CODE COUNCIL EVALUATION SERVICE (ICC-ES) REPORTS AND SHALL BE INSTALLED IN ACCORDANCE WITH THE MANUFACTURER'S REQUIREMENTS.
EXPANSION ANCHORS SHALL BE APPROVED “WEDGE” TYPE UNLESS SPECIFICALLY NOTED TO BE “SLEEVE” TYPE AS NOTED ON THE STRUCTURAL DRAWINGS.
CHEMICAL ANCHORS SHALL BE APPROVED EPOXY OR SIMILAR ADHESIVE TYPE AS APPROPRIATE FOR INSTALLATION IN SOLID AND NON-SOLID BASE MATERIALS.
GROUT BENEATH COLUMN BASE AND BEAM BEARING PLATES SHALL HAVE A MINIMUM 28-DAY, COMPRESSIVE STRENGTH OF 7,500 PSI AND SHALL BE NON-SHRINK, NON-METALLIC, AND TESTED IN ACCORDANCE WITH ASTM C1107.

STEEL DECKING:

STEEL ROOF, NON-COMPOSITE FLOOR (OR 'FORM'), AND COMPOSITE FLOOR DECK SHALL BE MANUFACTURED AND ERECTED IN ACCORDANCE WITH THE STANDARD DECK SPECIFICATIONS AND THE “MANUAL OF CONSTRUCTION WITH STEEL DECK” (SDI NO. MOC1) AS PREPARED BY THE STEEL DECK INSTITUTE (SDI).
ROOF DECK SHALL BE CONNECTED TO SUPPORTING MEMBERS AND INTERCONNECTED TO DEVELOP THE DIAPHRAGM SHEARS AND NET UPLIFT PRESSURES DUE TO LATERAL FORCES AS NOTED ON THE STRUCTURAL DRAWINGS.
NON-COMPOSITE AND COMPOSITE FLOOR DECK SHALL BE CONNECTED TO SUPPORTING MEMBERS AND INTERCONNECTED AS REQUIRED TO SATISFY SDI MINIMUM REQUIREMENTS EXCEPT AS NOTED ON THE STRUCTURAL DRAWINGS.
WELDING PATTERNS, SCREW PATTERNS, AND DETAILS SHALL BE INDICATED ON THE DECK SUPPLIER'S SHOP DRAWINGS.

LIGHT GAUGE STRUCTURAL STEEL FRAMING:

MEMBER FORMING SHALL CONFORM TO AMERICAN IRON AND STEEL INSTITUTE (AISI) NORTH AMERICAN SPECIFICATION FOR THE DESIGN OF COLD-FORMED STEEL STRUCTURAL MEMBERS (NAS-01), INCLUDING 2004 SUPPLEMENT.
ALL STRUCTURAL FRAMING (STUDS, JOISTS, TRACK, RUNNERS, BRACING, AND BRIDGING) SHALL BE GALVANIZED G-60 SHEET STEEL CONFORMING TO ASTM A1003.
STUDS, TRACKS, AND JOISTS SHALL BE 33 KSI YIELD UNLESS NOTED AS 50 KSI FOR 54 MILS AND HEAVIER.
SUBCONTRACTOR SHALL PROVIDE BRIDGING AND BLOCKING AT A MAXIMUM OF 6 FOOT SPACING OR AS REQUIRED FOR STABILITY AND STIFFNESS OF THE FINAL ASSEMBLY WHEREVER SHEATHING DOES NOT PROVIDE ADEQUATE BRACING.
WHERE PUNCHOUTS ARE WITHIN 8” OF MEMBER ENDS, INSTALL UNPUNCHED STIFFENERS OF EQUAL STRENGTH AND GAUGE WITH 4-#10 SCREWS EACH EDGE TO THE STIFFENED MEMBER.
PARALLEL MEMBERS IN CONTACT SHALL BE CONNECTED WITH #10 SCREWS @ 16” MAXIMUM ALONG EACH CONTACT EDGE IN THE FIELD OF THE MEMBER UNLESS NOTED OTHERWISE ON DRAWINGS.
THE STEEL STUD MANUFACTURERS ASSOCIATION (SSMA) PRODUCT IDENTIFICATION CODES ARE USED TO LABEL MEMBERS ON THE DRAWINGS: [MEMBER DEPTH IN 1/100 INCHES][STYLE][FLANGE WIDTH IN 1/100 INCHES]-[MATERIAL THICKNESS IN MILS] [(YIELD STRENGTH IF >33KSI) KSI]

STYLE	SECTION	MATERIAL THICKNESS (MILS)	REFERENCE ONLY GAUGE NO.
S	STUD OR JOIST	33	20 - STRUCTURAL
T	TRACK	43	18
U	CHANNEL	54	16
F	FURRING CHANNEL	68	14

SHOP DRAWINGS:

THE STRUCTURAL DRAWINGS ARE COPYRIGHTED AND SHALL NOT BE COPIED FOR USE AS ERECTION PLANS OR SHOP DETAILS. USE OF ANTHEM'S ELECTRONIC FILES AS THE BASIS FOR SHOP DRAWINGS REQUIRES PRIOR APPROVAL BY ANTHEM, A SIGNED RELEASE OF LIABILITY BY THE GENERAL CONTRACTOR AND/OR HIS SUBCONTRACTORS, AND DELETION OF ANTHEM'S NAME AND LOGO FROM ALL SHEETS SO USED.
THE GENERAL CONTRACTOR SHALL SUBMIT IN WRITING ANY REQUESTS TO MODIFY THE STRUCTURAL DRAWINGS OR PROJECT SPECIFICATIONS.
ALL SHOP AND ERECTION DRAWINGS SHALL BE CHECKED AND STAMPED (AFTER HAVING BEEN CHECKED) BY THE GENERAL CONTRACTOR PRIOR TO SUBMISSION FOR STRUCTURAL ENGINEER'S REVIEW; SHOP DRAWING SUBMITTALS NOT CHECKED BY THE GENERAL CONTRACTOR PRIOR TO SUBMISSION TO THE STRUCTURAL ENGINEER WILL BE RETURNED WITHOUT REVIEW.
FURNISH TWO (2) PRINTS OF SHOP AND ERECTION DRAWINGS TO THE STRUCTURAL ENGINEER FOR REVIEW PRIOR TO FABRICATION FOR:
REINFORCING STEEL,
STRUCTURAL STEEL,
STEEL FORM, FLOOR, AND ROOF DECK,
SUBMIT IN A TIMELY MANNER TO PERMIT 10 WORKING DAYS FOR REVIEW BY THE STRUCTURAL ENGINEER.
SHOP DRAWINGS SUBMITTED FOR REVIEW DO NOT CONSTITUTE “REQUEST FOR CHANGE IN WRITING" UNLESS SPECIFIC SUGGESTED CHANGES ARE CLEARLY MARKED. IN ANY EVENT, CHANGES MADE BY MEANS OF THE SHOP DRAWING SUBMITTAL PROCESS BECOME THE RESPONSIBILITY OF THE ONE INITIATING THE CHANGE.

FIELD VERIFICATION OF EXISTING CONDITIONS:

THE GENERAL CONTRACTOR SHALL THOROUGHLY INSPECT AND SURVEY THE EXISTING STRUCTURE TO VERIFY CONDITIONS THAT AFFECT THE WORK SHOWN ON THE DRAWINGS.
THE GENERAL CONTRACTOR SHALL REPORT ANY VARIATIONS OR DISCREPANCIES TO THE ARCHITECT AND STRUCTURAL ENGINEER BEFORE PROCEEDING.

STRUCTURAL ERECTION AND BRACING REQUIREMENTS:

THE STRUCTURAL DRAWINGS ILLUSTRATE AND DESCRIBE THE COMPLETED STRUCTURE WITH ELEMENTS IN THEIR FINAL POSITIONS, PROPERLY SUPPORTED, CONNECTED, AND/OR BRACED.
THE STRUCTURAL DRAWINGS ILLUSTRATE TYPICAL AND REPRESENTATIVE DETAILS TO ASSIST THE GENERAL CONTRACTOR. DETAILS SHOWN APPLY AT ALL SIMILAR CONDITIONS UNLESS OTHERWISE INDICATED. ALTHOUGH DUE DILIGENCE HAS BEEN APPLIED TO MAKE THE DRAWINGS AS COMPLETE AS POSSIBLE, NOT EVERY DETAIL IS ILLUSTRATED AND NOT EVERY EXCEPTIONAL CONDITION IS ADDRESSED.
ALL PROPRIETARY CONNECTIONS AND ELEMENTS SHALL BE INSTALLED IN ACCORDANCE WITH THE MANUFACTURERS' RECOMMENDATIONS.
ALL WORK SHALL BE ACCOMPLISHED IN A WORKMANLIKE MANNER AND IN ACCORDANCE WITH THE APPLICABLE CODES AND LOCAL ORDINANCES.
THE GENERAL CONTRACTOR IS RESPONSIBLE FOR COORDINATION OF ALL WORK, INCLUDING LAYOUT AND DIMENSION VERIFICATION, MATERIALS COORDINATION, SHOP DRAWING REVIEW, AND THE WORK OF SUBCONTRACTORS. ANY DISCREPANCIES OR OMISSIONS DISCOVERED IN THE COURSE OF THE WORK SHALL BE IMMEDIATELY REPORTED TO THE ARCHITECT AND STRUCTURAL ENGINEER FOR RESOLUTION. CONTINUATION OF WORK WITHOUT NOTIFICATION OF DISCREPANCIES RELIEVES THE ARCHITECT AND STRUCTURAL ENGINEER FROM ALL CONSEQUENCES.
UNLESS OTHERWISE SPECIFICALLY INDICATED, THE STRUCTURAL DRAWINGS DO NOT DESCRIBE METHODS OF CONSTRUCTION.
THE GENERAL CONTRACTOR, IN THE PROPER SEQUENCE, SHALL PERFORM OR SUPERVISE ALL WORK NECESSARY TO ACHIEVE THE FINAL COMPLETED STRUCTURE, AND TO PROTECT THE STRUCTURE, WORKMEN, AND OTHERS DURING CONSTRUCTION. SUCH WORK SHALL INCLUDE, BUT NOT BE LIMITED TO TEMPORARY BRACING, SHORING FOR CONSTRUCTION EQUIPMENT, SHORING FOR EXCAVATION, FORMWORK, SCAFFOLDING, SAFETY DEVICES AND PROGRAMS OF ALL KINDS, SUPPORT AND BRACING FOR CRANES AND OTHER ERECTION EQUIPMENT.
DO NOT BACKFILL AGAINST BASEMENT OR RETAINING WALLS UNTIL SUPPORTING SLABS AND FLOOR FRAMING ARE IN PLACE AND SECURELY ANCHORED, UNLESS ADEQUATE TEMPORARY BRACING IS INSTALLED.
TEMPORARY BRACING SHALL REMAIN IN PLACE UNTIL ALL FLOORS, WALLS, ROOFS AND ANY OTHER SUPPORTING ELEMENTS ARE IN PLACE.
THE ARCHITECT AND STRUCTURAL ENGINEER BEAR NO RESPONSIBILITY FOR THE ABOVE ITEMS, AND OBSERVATION VISITS TO THE SITE DO NOT IN ANY WAY INCLUDE INSPECTIONS OF THESE ITEMS.
THESE PLANS HAVE BEEN ENGINEERED FOR CONSTRUCTION AT ONE SPECIFIC BUILDING SITE. BUILDER ASSUMES ALL RESPONSIBILITY FOR USE OF THESE PLANS AT ANY OTHER BUILDING SITE. PLANS SHALL NOT BE USED FOR CONSTRUCTION AT ANY OTHER BUILDING SITE WITHOUT SPECIFIC REVIEW BY THE ENGINEER.

PRECAUTIONARY NOTES ON STRUCTURAL BEHAVIOR:

INTERIOR ARCHITECTURAL FINISH DETAILING MUST ACCOMMODATE THE RELATIVE DIFFERENTIAL MOVEMENTS OF SUPPORTING STRUCTURAL ELEMENTS.
WHERE THE ROOF FRAMING ELEMENT SPANS ARE LONG, APPLIED LOADING WILL NATURALLY CAUSE SUBSTANTIAL DEFLECTION. INTERIOR ELEMENTS HUNG FROM THE ROOF STRUCTURE WILL DEFLECT WITH THE ROOF.
THE FLOOR IS A FLOATING CONCRETE SLAB-ON-GRADE AND MAY EXPERIENCE MOVEMENTS INDEPENDENT OF THE STRUCTURAL FOUNDATIONS. INTERIOR ELEMENTS SUPPORTED ON THE SLAB-ON-GRADE FLOOR WILL MOVE WITH THE FLOOR. INTERIOR ELEMENTS SUPPORTED ON FOUNDATIONS AND COLUMNS WILL NOT EXPERIENCE SIMILAR OR MEASURABLE MOVEMENTS.
EXTERIOR/PERIMETER WALL ASSEMBLIES HUNG FROM THE EDGE OF THE BUILDING STRUCTURE WILL BE DIRECTLY AFFECTED (TO SOME DEGREE) BY CHANGES IN EXTERNAL TEMPERATURE AND FLOOR DEFLECTION.
EXTERIOR/PERIMETER AND INTERIOR ARCHITECTURAL FINISH DETAILS SHOULD ALLOW FOR RELATIVE MOVEMENTS BETWEEN ELEMENTS WITH DIFFERENT SUPPORT CONDITIONS.
THE FOUNDATION DESIGN SHOWN ASSUMES THAT THE OWNER/BUILDER IS AWARE OF THE PRESENCE OF EXPANSIVE SOILS, AND THAT HE HAS READ THE PREVIOUSLY REFERENCED SOILS REPORT. USE OF THESE PLANS IS INDICATION THAT THE OWNER/BUILDER ACCEPTS THE RISKS ASSOCIATED WITH BUILDING ON THIS SITE, ESPECIALLY THOSE RELATED TO SLAB ON GRADE CONSTRUCTION IN FINISHED AREAS. ANTHEM, LLC WILL NOT BE HELD LIABLE FOR DAMAGES CAUSED BY SLAB MOVEMENT.

DEFERRED SUBMITTALS:

PORTIONS OF THE STRUCTURE HAVE ELEMENTS OF PROPRIETARY DESIGN AND FABRICATION, WHICH SHALL BE SUBMITTED BY THE SUPPLIER FOR APPROVAL AFTER AWARD OF CONTRACT.
THESE ITEMS SHALL CONFORM TO THE LOAD, CAPACITY, SIZE, GEOMETRY, CONNECTION, AND SUPPORT CRITERIA NOTED ON THE STRUCTURAL DRAWINGS.
SHOP DRAWINGS AND CALCULATIONS SHALL BE PREPARED BY AN ENGINEER REGISTERED IN THE STATE OF <COLORADO>.
FINAL SHOP DRAWING SUBMITTALS SHALL BE STAMPED AND SIGNED.
FURNISH DEFERRED SUBMITTALS FOR:
SUPPLIER ENGINEERED EQUIPMENT-MOUNTED ROOF SCREENS
SUBMITTALS WILL BE REVIEWED BY THE STRUCTURAL ENGINEER OF RECORD FOR COMPLIANCE WITH THE SPECIFIED DESIGN REQUIREMENTS, STAMPED AS “REVIEWED,” AND FORWARDED TO THE LOCAL BUILDING AUTHORITY FOR REVIEW AS REQUIRED.
FINAL ISSUE OF THE BUILDING PERMIT MAY, AT THE APPROVAL AUTHORITY'S OPTION, BE CONTINGENT ON ITS APPROVAL OF THE DEFERRED SUBMITTAL DOCUMENTS.
DEFERRED SUBMITTAL ITEMS SHALL NOT BE INSTALLED UNTIL THEIR DESIGN CALCULATIONS AND DRAWINGS HAVE BEEN REVIEWED BY THE ARCHITECT, STRUCTURAL ENGINEER, AND/OR LOCAL BUILDING AUTHORITY AS REQUIRED.

LETTERS OF CONSTRUCTION COMPLIANCE:

THE GENERAL CONTRACTOR SHALL DETERMINE FROM THE LOCAL BUILDING AUTHORITY, AT THE TIME THE BUILDING PERMIT IS OBTAINED, WHETHER ANY LETTERS OF CONSTRUCTION COMPLIANCE WILL BE REQUESTED FROM THE STRUCTURAL ENGINEER.
THE CONTRACTOR SHALL NOTIFY THE STRUCTURAL ENGINEER OF ALL SUCH REQUIREMENTS IN WRITING PRIOR TO THE START OF CONSTRUCTION.
TWO DAY ADVANCE NOTICE SHALL BE GIVEN WHEN REQUESTING SITE VISITS NECESSARY AS THE BASIS FOR THE COMPLIANCE LETTER.
THE GENERAL CONTRACTOR SHALL PROVIDE COPIES OF ALL THIRD-PARTY TESTING AND INSPECTION REPORTS TO THE ARCHITECT AND STRUCTURAL ENGINEER A MINIMUM OF ONE WEEK PRIOR TO THE DATE THAT THE COMPLIANCE LETTER IS NEEDED.

SPECIAL INSPECTIONS (VALID FOR IBC 2012 & 2015):

THE FOLLOWING SPECIAL INSPECTIONS AND TESTING SHALL BE PERFORMED BY A QUALIFIED SPECIAL INSPECTOR, RETAINED BY THE OWNER, IN ACCORDANCE WITH THE FOLLOWING SECTIONS OF IBC CHAPTER 17:
SECTION 1705 SPECIAL INSPECTIONS AND THE FOLLOWING SUB-SECTIONS:
1705.2 STEEL CONSTRUCTION INCLUDING 1705.2.1 STRUCTURAL STEEL, 1705.2.2 STEEL CONSTRUCTION OTHER THAN STRUCTURAL STEEL
1705.3 CONCRETE CONSTRUCTION
1705.4 MASONRY CONSTRUCTION, LEVEL II SPECIAL INSPECTION
1705.6 SOILS
THE SPECIAL INSPECTOR SHALL BE A QUALIFIED PERSON WHO SHALL DEMONSTRATE COMPETENCE, TO THE SATISFACTION OF THE BUILDING OFFICIAL, FOR INSPECTION OF THE PARTICULAR TYPE OF CONSTRUCTION OR OPERATION REQUIRING SPECIAL INSPECTION.
DUTIES AND RESPONSIBILITIES OF THE SPECIAL INSPECTOR SHALL BE TO INSPECT AND/OR TEST THE WORK OUTLINED ABOVE AND WITHIN THE STATEMENT OF SPECIAL INSPECTIONS IN ACCORDANCE WITH CHAPTER 17 OF THE IBC FOR CONFORMANCE WITH THE APPROVED CONSTRUCTION DOCUMENTS. ALL DISCREPANCIES SHALL BE BROUGHT TO THE IMMEDIATE ATTENTION OF THE CONTRACTOR FOR CORRECTION.
PER SECTION 1704.2.4 THE SPECIAL INSPECTOR SHALL FURNISH REGULAR REPORTS TO THE BUILDING OFFICIAL AND THE STRUCTURAL ENGINEER. PROGRESS REPORTS FOR CONTINUOUS INSPECTION SHALL BE FURNISHED WEEKLY.
INDIVIDUAL REPORTS OF PERIODIC INSPECTIONS SHALL BE FURNISHED WITHIN ONE WEEK OF INSPECTION DATES. THE REPORTS SHALL NOTE UNCORRECTED DEFICIENCIES, CORRECTION OF PREVIOUSLY REPORTED DEFICIENCIES, AND CHANGES TO THE APPROVED CONSTRUCTION DOCUMENTS AUTHORIZED BY THE STRUCTURAL ENGINEER OF RECORD.
THE SPECIAL INSPECTOR SHALL SUBMIT A FINAL SIGNED REPORT WITHIN 10 DAYS OF THE FINAL SPECIAL INSPECTION STATING WHETHER THE WORK REQUIRING SPECIAL INSPECTION WAS, TO THE BEST OF THE INSPECTOR'S KNOWLEDGE, IN CONFORMANCE WITH THE APPROVED CONSTRUCTION DOCUMENTS AND THE APPLICABLE WORKMANSHIP PROVISIONS OF THE IBC. WORK NOT IN CONFORMANCE SHALL BE NOTED IN THE REPORT.
THE CONTRACTOR SHALL SUBMIT A STATEMENT OF RESPONSIBILITY TO THE BUILDING OFFICIAL AND THE OWNER PRIOR TO THE COMMENCEMENT OF WORK ON A MAIN WIND- OR SEISMIC-FORCE-RESISTING SYSTEM, DESIGNATED SEISMIC SYSTEM OR A WIND- OR SEISMIC-RESISTING COMPONENT LISTED IN THE STATEMENT OF SPECIAL INSPECTIONS PER SECTION 1704.2.3.
EXCEPT AS NOTED, THE SPECIAL INSPECTIONS OUTLINED ABOVE ARE IN ADDITION TO, AND BEYOND THE SCOPE OF, PERIODIC STRUCTURAL OBSERVATIONS AS DEFINED IN SECTION 1704.5. STRUCTURAL OBSERVATIONS ARE INCLUDED IN THE STRUCTURAL ENGINEERING DESIGN AND CONSTRUCTION ADMINISTRATION SERVICES PROVIDED BY THE STRUCTURAL ENGINEER.

LEGEND

Symbol	Description	Symbol	Description
XXXX	Indicates column type <u>above</u> level shown		CMU
C	Indicates column continuous through level shown		Concrete
XX'-XX"	Indicates top of concrete slab or wood subfloor elevation		Earth fill
	Indicates step in floor elevation		Porous fill (i.e. gravel)
	Indicates direction of slope		Structural wall above framing
FD	Indicates floor drain		Indicates steel deck or concrete slab span direction
(XX'-XX") {XX'-XX"}	Indicates top of footing or pier elevation Indicates minimum pier penetration into bedrock	[XX'-XX"]	Indicates top of steel beam elevation
FXX	Continuous spread footing. See schedule for size and reinforcing		Indicates location of bend in bent beam
FX.X	Isolated pad footing. See schedule for size and reinforcing	BPX	Indicates Baseplate
TC=XX'-XX" BC=XX'-XX"	Indicates top of concrete elevation Indicates bottom of concrete elevation		Indicates shoring
STEP BC	Indicates step in bottom of concrete elevation	(E)	Indicates 'existing'
TL=XX'-XX"	Indicates top of concrete ledge elevation	(N)	Indicates 'new'
PKT XxYxZ XX'-XX"	Indicates beam pocket in concrete wall (X=width, Y=height, Z=ledge depth in inches) with bottom of pocket elevation	(R)	Indicates 'to be removed'
	Indicates step in top of concrete wall or ledge elevation. Arrow points toward lower elevation		

ABBREVIATIONS KEY

AB	ANCHOR BOLT
ADDL	ADDITIONAL
AFF	ABOVE FINISH FLOOR
ALT	ALTERNATE
ARCH	ARCHITECT
AVG	AVERAGE
BC	BOTTOM OF CONCRETE
BLKG	BLOCKING
BM	BEAM
BOT	BOTTOM
BP	BEAM POCKET
BRG	BEARING
BS	BOTH SIDES
BTWN	BETWEEN
CANT	CANTIILEVER
CFS	COLD FORM STEEL
CIP	CAST IN PLACE
CJ	CONTROL JOINT, CONSTRUCTION JOINT
CL	CENTER LINE
CLR	CLEAR (ANCE)
CMU	CONCRETE MASONRY UNIT
COL	COLUMN
CONC	CONCRETE
CONN	CONNECTION
CONST	CONSTRUCTION
CONT	CONTINUOUS, CONTINUE
D	DEPTH
DEMO	DEMOLITION
DIA or Ø	DIAMETER
DIM	DIMENSION
DTL	DETAIL
DWG	DRAWING
DWL	DOWEL
(E)	EXISTING
EA	EACH
EF	EACH FACE
EJ	EXPANSION JOINT
ELEV	ELEVATION
EO	EDGE OF
EOR	ENGINEER OF RECORD
EW	EACH WAY
EXP	EXPANSION
EXT	EXTERIOR
FDN	FOUNDATION
FLR	FLOOR
FO	FACE OF
FS	FOR SIDE
FTG	FOOTING

GA	GUAGE
GB	GRADE BEAM
GC	GENERAL CONTRACTOR, CONSTRUCTION
GEN	GENERAL
GL	GLUE LAMINATED, GLU-LAM
GW	GRADE WALL
GYP	GYPSUM
HAS	HEADED ANCHOR STUD
HDG	HOT DIP GALVANIZED
HDR	HEADER
HGR	HANGER
HK	HOOK
HORIZ	HORIZONTAL
IF	INSIDE FACE
INT	INTERIOR
145	
JNT	JOINT
JST	JOIST
K	KIP (1000 POUNDS)
KLF	1000 POUNDS PER LINEAL FOOT
L	LENGTH
LAT	LATERAL
LLH	LONG LEG HORIZONTAL
LLV	LONG LEG VERTICAL
LONG	LONGITUDINAL
LSL	LAMINATED STRAND LUMBER
LSV	LONG SIDE VERTICAL
LVL	LAMINATED VENEER LUMBER
LW	LIGHT WEIGHT
MAS	MASONRY
MATL	MATERIAL
MAX	MAXIMUM
MECH	MECHANICAL
MFR	MANUFACTURER
MIN	MINIMUM, MINUTE
MISC	MISCELLANEOUS
MTL	METAL
(N)	NEW CONSTRUCTION
No.	NUMBER
NOM	NOMINAL
NS	NEAR SIDE
NTS	NOT TO SCALE
NW	NORMAL WEIGHT
OC	ON CENTER
OF	OUTSIDE FACE
OH	OVERHEAD

OPNG	OPENING
OPP	OPPOSITE HAND
P.T.	POST TENSIONED
PAF	POWDER ACTUACTED FASTENER
PC	PRECAST
PE	PRE-ENGINEERED
PERP	PERPENDICULAR
PJP	PARTIAL JOINT PENETRATION
PL	PLATE
PLF	POIUNDS PER LINEAL FOOT
PSL	PARALLEL STRAND LUMBER
PT	PRESSURE TREATED/POST-TENSIONING
QTY	QUANTITY
RE	REFERENCE, REFER TO
REINF	REINFORCE (MENT), REINFORCING
REQ	REQUIRED
RET	RETAINING WALL
RO	ROUGH OPENING
SC	SLIP CRITICAL
SCHED	SCHEDULE
SCL	STRUCTURAL COMPOSITE LUMBER
SHTG	SHEATHING
SIM	SIMILAR
SIP	STRUCTURAL INSULATED PANEL
SOG	SLAB ON GRADE
SP	SPACING, SPACE
SPEC	SPECIFICATION
STD	STANDARD
STIFF	STIFFENER
STL	STEEL
SUBFLR	SUBFLOOR
T&B	TOP AND BOTTOM
T&G	TONGUE AND GROOVE
TC	TOP OF CONCRETE
THK	THICK (NESS)
TL	TRANSFER LOAD
TO	TOP OF
TRANS	TRANVERSE
TYP	TYPICAL
UNO	UNLESS NOTED OTHERWISE
VERT	VERTICAL
VIF	VERIFY IN FIELD
W	WIDTH
WP	WORK POINT
WWF	WELDED WIRE FABRIC

SHEET LIST

Sheet Number	Sheet Name
S0.01	STRUCTURAL COVER SHEET
S1.01	FOUNDATION PLAN
S1.02	2ND FLOOR FRAMING PLAN
S1.03	ROOF FRAMING PLAN
S4.01	ELEVATIONS, BLOWN-UP PLANS
S5.01	DETAILS
S5.02	DETAILS

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STRUCTURAL COVER SHEET

S0.01

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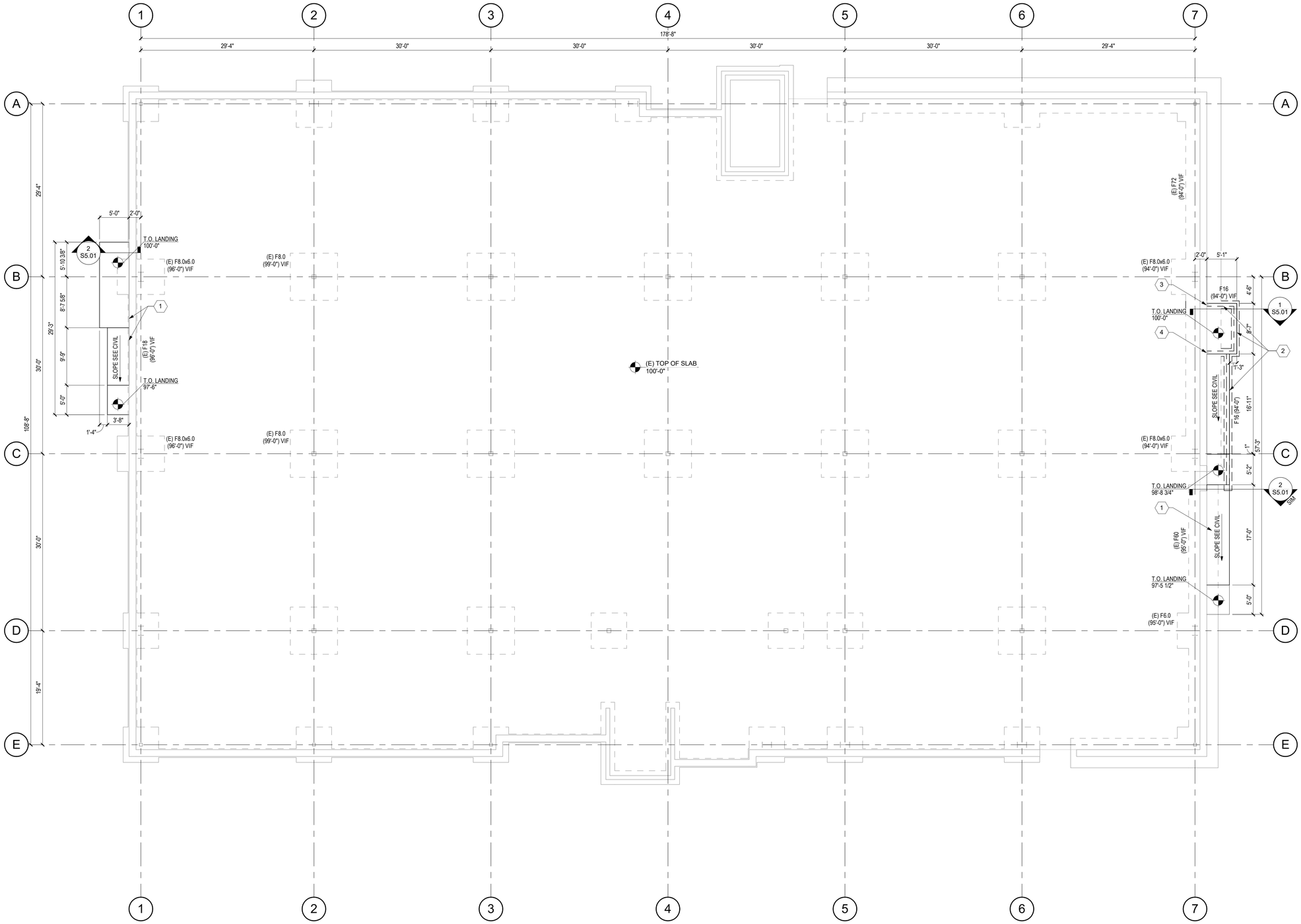

FOUNDATION PLAN

1/8" = 1'-0"

True North

FOUNDATION PLAN NOTES:

1. SEE S0.01 FOR GENERAL STRUCTURAL NOTES, ABBREVIATIONS KEY AND LEGEND
2. REFER TO ARCHITECTURAL DRAWINGS FOR ADDITIONAL INFORMATION AND DIMENSIONS
3. ALL INFORMATION, DIMENSIONS, ELEVATIONS, ETC SHALL BE CONSIDERED APPROXIMATE AND SHALL BE FIELD VERIFIED BY THE CONTRACTOR PRIOR TO ORDERING OR FABRICATING MATERIAL
4. REPORT ALL DISCREPANCIES TO GENERAL CONTRACTOR AND ENGINEER.
5. REMODELING, RETROFIT, RENOVATION AND REHABILITATION OF AN EXISTING STRUCTURE REQUIRES THAT CETIAN ASSUMPTIONS BE MADE REGARDING EXISTING CONDITIONS. THE CONTRACTOR MUST IMMEDIATELY NOTIFY THE STRUCTURAL ENGINEER IF ANY EXISTING CONDITION DEVIATES FROM THOSE INDICATED ON THE CONTRACT DOCUMENTS

FOUNDATION KEYNOTE SCHEDULE

X	DESCRIPTION
1	(N) 4" THICK CONCRETE LANDING & STAIRS ON GRADE. REINFORCE W/ #4 @ 18" EACH WAY. CENTERED IN SLAB DEPTH. PROVIDE TURNED DOWN EDGE TO FROST DEPTH AT PERIMETER
2	8" THICK CONCRETE WALL, REINFORCE W/ #4 @ 18" EACH WAY, CENTERED IN WALL, TYP
3	(2) #4 x 2'-0" EPOXY DOWELS W/ 4" EMBEDMENT INTO (E) CONCRETE FOOTING
4	(3) #4 x 2'-0" EPOXY DOWELS W/ 4" EMBEDMENT INTO (E) CONCRETE STEMWALL. ONE DOWEL TOP, MID-HEIGHT & BOTTOM OF WALL

CONCRETE FOOTING SCHEDULE (ISO PADS)

TAG	LENGTH	WIDTH	THICKNESS	REINFORCEMENT
(E) F6.0	6'-0"	6'-0"	1'-0"	(8) #5 BOTTOM
(E) F6.0x8.0	6'-0"	8'-0"	1'-0"	(11) #5 BOTTOM
(E) F8.0	8'-0"	8'-0"	1'-0"	(11) #5 BOTTOM

CONCRETE FOOTING SCHEDULE (CONT)

TAG	WIDTH	THICKNESS	REINFORCEMENT
(E) F18	1'-6"	1'-0"	(3) #5 BOTTOM LONGITUDINAL
(E) F28	2'-4"	1'-0"	(3) #5 BOTTOM LONGITUDINAL & #5 @ 12" O.C. BOTTOM, TRANSVERSE
(E) F60	5'-0"	1'-0"	(5) #5 BOTTOM LONGITUDINAL & #5 @ 12" O.C. BOTTOM, TRANSVERSE
(E) F72	6'-0"	1'-0"	(6) #5 BOTTOM LONGITUDINAL & #5 @ 12" O.C. BOTTOM, TRANSVERSE
F16	1'-4"	1'-0"	(3) #5 BOTTOM LONGITUDINAL

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FOUNDATION PLAN

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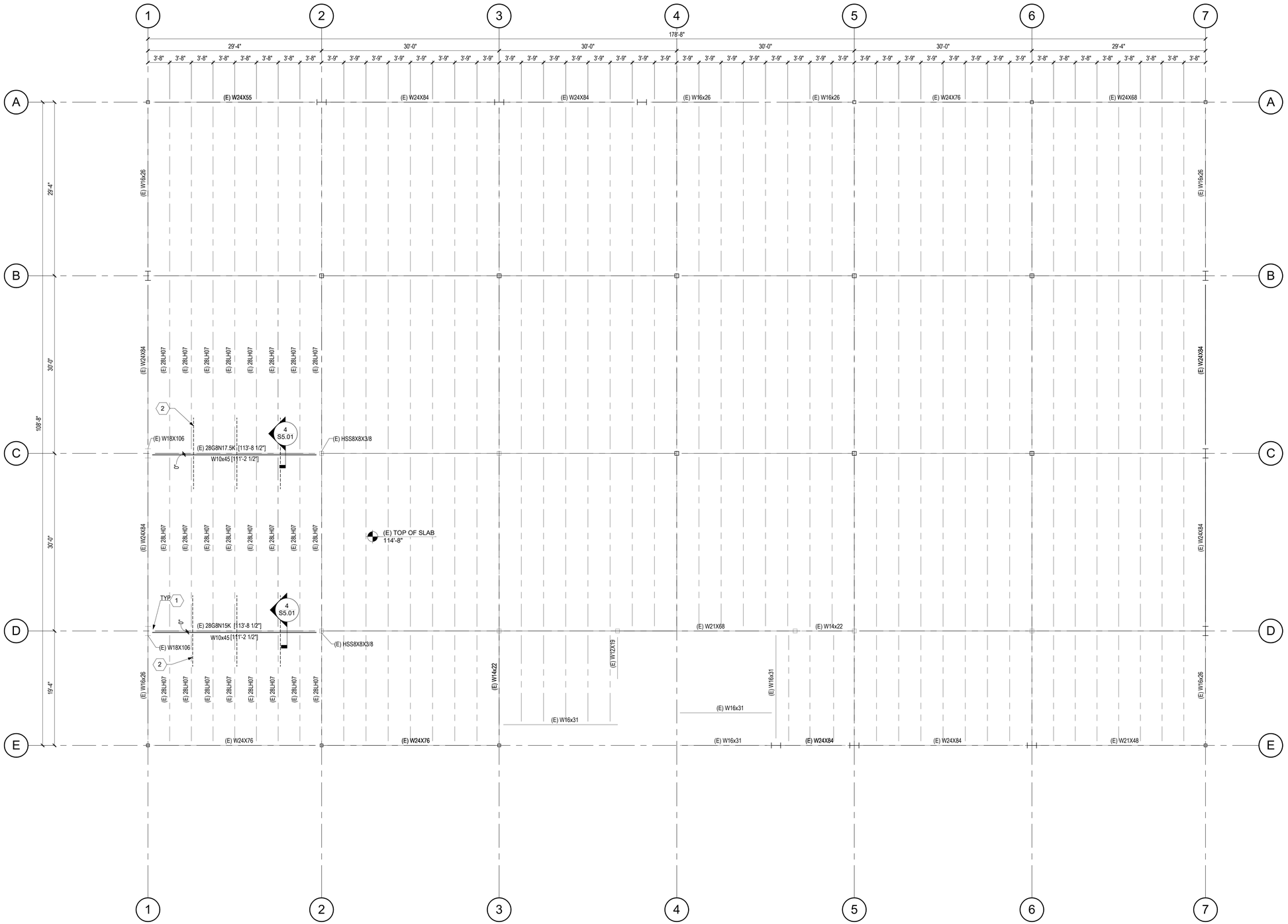

2ND FLOOR FRAMING PLAN

1/8" = 1'-0"

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SECOND FLOOR FRAMING PLAN NOTES:

1. SEE S0.01 FOR GENERAL STRUCTURAL NOTES, ABBREVIATIONS KEY AND LEGEND
2. REFER TO ARCHITECTURAL DRAWINGS FOR ADDITIONAL INFORMATION AND DIMENSIONS
3. ALL INFORMATION, DIMENSIONS, ELEVATIONS, ETC SHALL BE CONSIDERED APPROXIMATE AND SHALL BE FIELD VERIFIED BY THE CONTRACTOR PRIOR TO ORDERING OR FABRICATING MATERIAL
4. REPORT ALL DISCREPANCIES TO GENERAL CONTRACTOR AND ENGINEER
5. REMODELING, RETROFIT, RENOVATION AND REHABILITATION OF AN EXISTING STRUCTURE REQUIRES THAT CETIAN ASSUMPTIONS BE MADE REGARDING EXISTING CONDITIONS. THE CONTRACTOR MUST IMMEDIATELY NOTIFY THE STRUCTURAL ENGINEER IF ANY EXISTING CONDITION DEVIATES FROM THOSE INDICATED ON THE CONTRACT DOCUMENTS

SECOND FLOOR FRAMING KEYNOTE SCHEDULE

X	DESCRIPTION
1	CONNECT (N) OPERABLE PARTITION SUPPORT BEAM TO (E) COLUMNS PER 3/S5.01, TYPICAL
2	L3x3x3/16 KICKERS, EACH SIDE. LOCATE AT QUARTER-POINTS OF NEW BEAM SPAN

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2ND FLOOR FRAMING PLAN

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ROOF FRAMING PLAN

1/8" = 1'-0"

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ROOF LEVEL PLAN NOTES:

1. SEE S0.01 FOR GENERAL STRUCTURAL NOTES, ABBREVIATIONS KEY AND LEGEND
2. SEE S5.01 FOR TYPICAL DETAILS
3. TOP OF STEEL ELEVATION = BOTTOM OF (E) DECK ELEVATIONS AT NEW STEEL BEAMS AT RTU
4. REFER TO ARCHITECTURAL DRAWINGS FOR ADDITIONAL INFORMATION AND DIMENSIONS.
5. ALL INFORMATION, DIMENSIONS, ELEVATIONS, ETC SHALL BE CONSIDERED APPROXIMATE AND SHALL BE FIELD VERIFIED BY THE CONTRACTOR PRIOR TO ORDERING OR FABRICATING MATERIAL
6. REPORT ALL DISCREPANCIES TO GENERAL CONTRACTOR AND ENGINEER
7. REMODELING, RETROFIT, RENOVATION AND REHABILITATION OF AN EXISTING STRUCTURE REQUIRES THAT CERTAIN ASSUMPTIONS BE MADE REGARDING EXISTING CONDITIONS. THE CONTRACTOR MUST IMMEDIATELY NOTIFY THE STRUCTURAL ENGINEER IF ANY EXISTING CONDITION DEVIATES FROM THOSE INDICATED ON THE CONTRACT DOCUMENTS

ROOF KEYNOTE SCHEUDLE

X	DESCRIPTION
1	REMOVE (E) JOIST & REPLACE W/ (N) STEEL BEAM, AS SHOWN
2	CHILLER-MOUNTED SCREEN, WT=500LBS MAX, BY OTHERS, SEE ARCH
3	SHEAR PLATE CONNECTION PER 2/S5.01, TYP
4	CONTRACTOR TO COORDINATE FINAL DIMENSIONS W/ RTU MANUFACTURER CURB REQUIREMENTS
5	CONTRACTOR TO COORDINATE FINAL DIMENSIONS W/ CHILLER MANUFACTURER MOUNTING REQUIREMENTS
6	RTU-MOUNTED SCREEN, WT=2500LBS MAX, BY OTHERS, SEE ARCH
7	(N) SUPPLY/RETURN DUCTS THROUGH (E) ROOF DECK, PROVIDE ROOF FRAMING SUPPORT FRAMES PER 7/S5.01
8	REINFORCE GIRDER W/ NEW ANGLE STRUT PER 6/S5.01
9	NEW ROOF PENETRATIONS FOR SONOTUBE SKYLIGHTS, SEE ARCH. INSTALL NEW ROOF OPENING SUPPORT FRAMES PER 7/S5.01
10	WELD (E) 1 1/2" x 22 GAGE ROOF DECK TO TOP FLANGE OF (N) BEAM FRAMING W/ 5/8"Ø PUDDLE WELDS IN 36/7 PATTERN

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ROOF FRAMING PLAN

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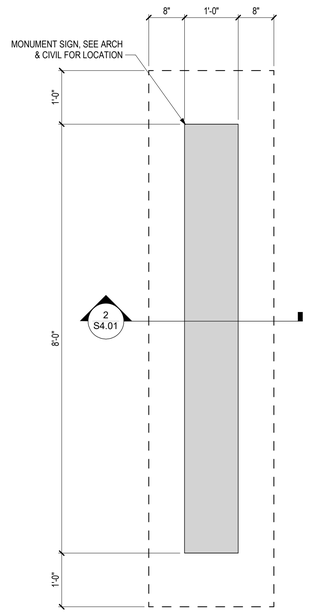
GENERATOR ENCLOSURE & MONUMENT SIGN FOUNDATION PLAN

1/4" = 1'-0"

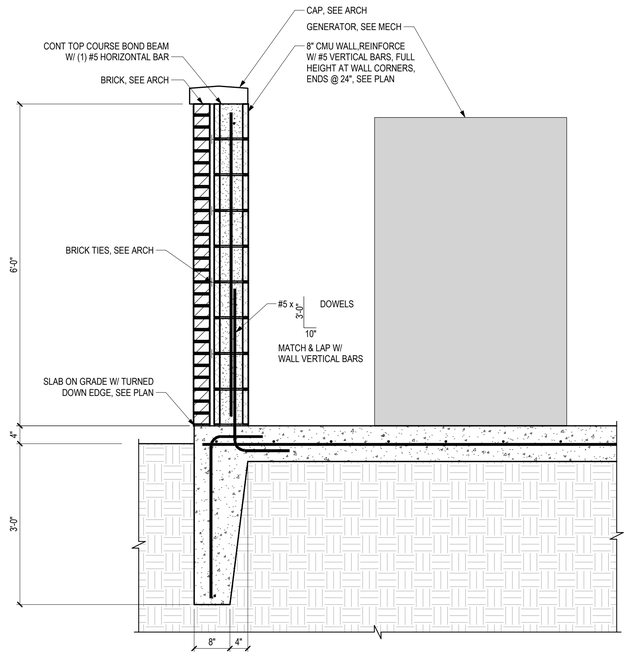
True North

FOUNDATION PLAN NOTES:

1. SEE S0.01 FOR GENERAL STRUCTURAL NOTES, ABBREVIATIONS KEY AND LEGEND.
2. SEE S5.01 FOR TYPICAL FOUNDATION DETAILS
3. VIF (E) CONDITIONS PRIOR TO NEW CONSTRUCTION AND NOTIFY ANTHEM OF ANY DISCREPANCIES
4. SEE ARCHITECTURAL DRAWINGS FOR LOCATIONS OF RAMPS, SLAB SLOPES, STEPPED SLABS, AND PARTITION WALLS. SLAB ELEVATIONS SHOWN ARE APPROXIMATE.
5. REFER TO ARCHITECTURAL DRAWINGS FOR ADDITIONAL INFORMATION AND DIMENSIONS.
6. **CONCRETE SLAB ON GRADE (UNO):** 8" THICK CONCRETE SLAB ON PREPARED SUB-GRADE PER SOILS REPORT. REINFORCE WITH #4 @12" EACH WAY AT MID-DEPTH.

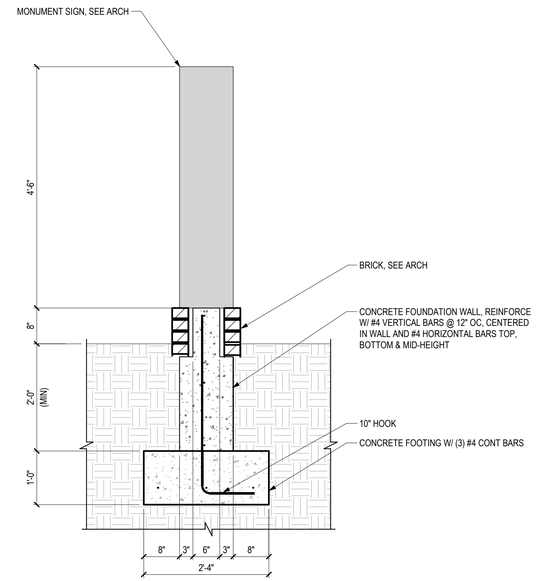


PLAN VIEW



1 TYPICAL GENERATOR ENCLOSURE SECTION

3/4" = 1'-0"



2 MONUMENT SIGN SECTION

3/4" = 1'-0"

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ELEVATIONS, BLOWN-UP PLANS

S4.01

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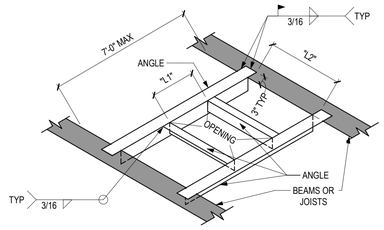
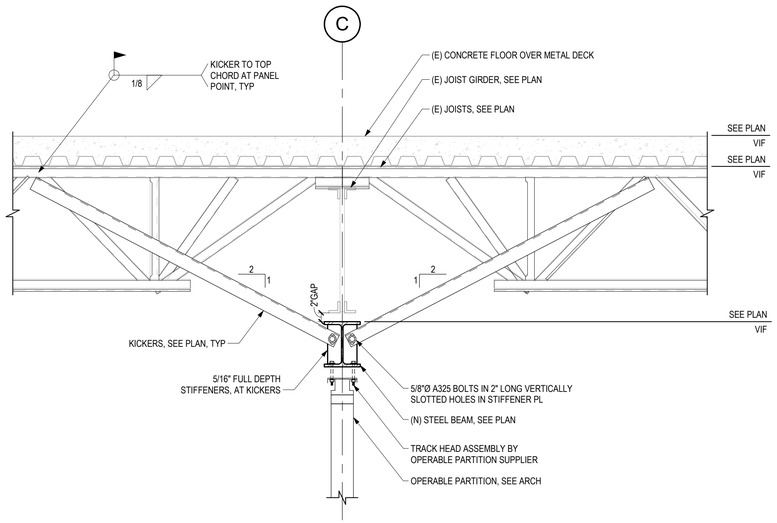


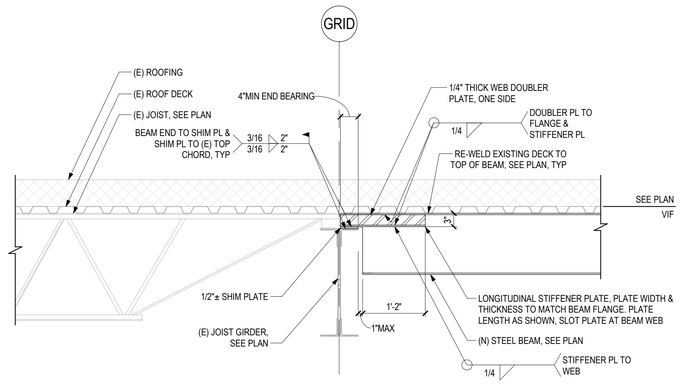
ROOF FRAMED OPENING SCHEDULE		
"L1" OR "L2" (USE LARGER VALUE)	ANGLE SIZES	REMARKS
UP TO 1'-0	NONE REQ'D	
UP TO 3'-0	3 1/2x3 1/2x1/4	
UP TO 5'-0	5x3x1/4 (L.L.V.)	
UP TO 7'-0	6x4x5/16 (L.L.V.)	

NOTES:
1. USE ABOVE FRAMING AT ALL FLOOR & ROOF OPENINGS WHERE EITHER "L1" OR "L2" EXCEEDS 1'-0 , UNLESS NOTED OTHERWISE.
2. VERIFY WITH ARCHITECTURAL AND MECHANICAL DRAWINGS FOR SIZE AND LOCATION OF ALL OPENINGS.

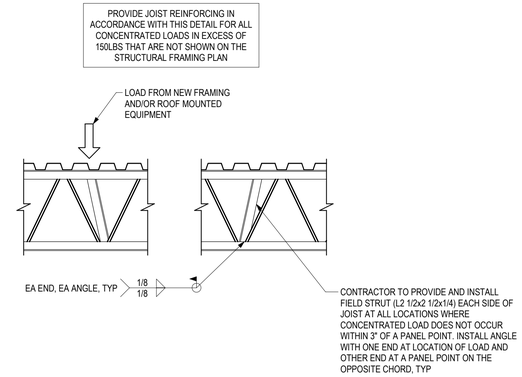
7 TYPICAL FRAMED ROOF OPENINGS
3/4" = 1'-0"



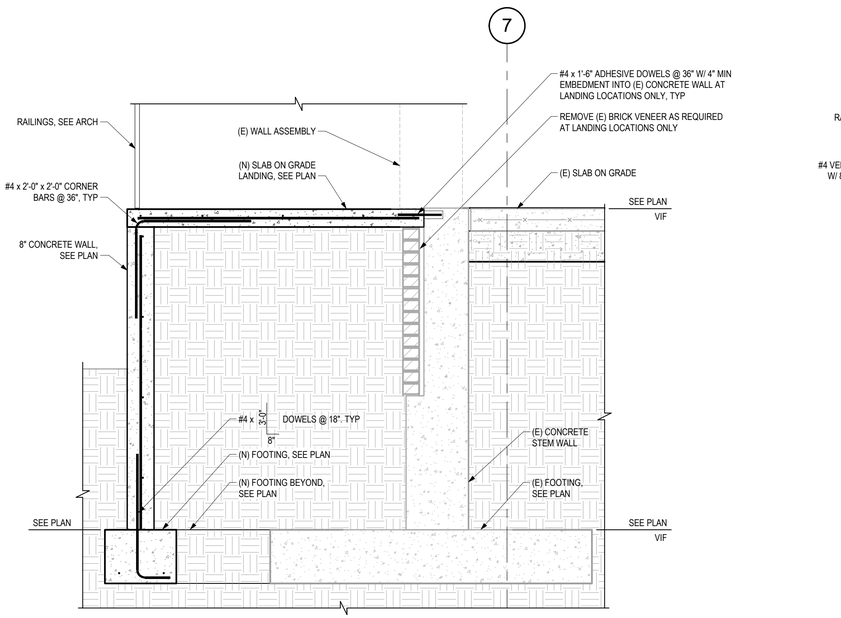
4 TYPICAL OPERABLE PARTITION SECTION
3/4" = 1'-0"



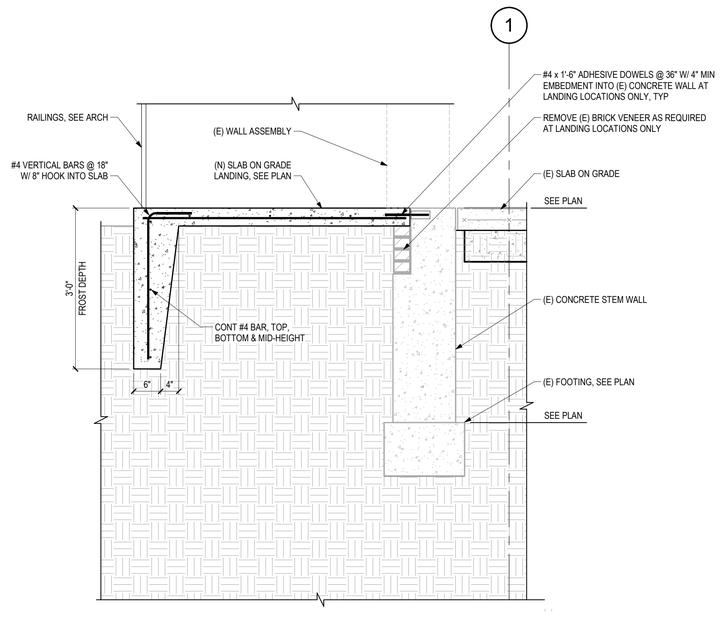
5 TYPICAL WIDE FLANGE BEAM COPE DETAIL
3/4" = 1'-0"



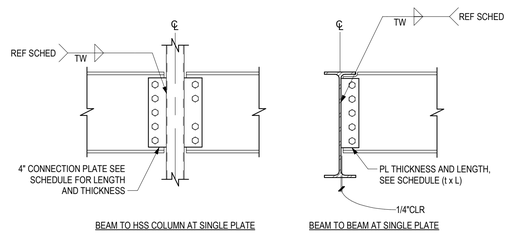
6 JOIST REINFORCEMENT
3/4" = 1'-0"



1 NEW LANDING SECTION - DEEP
3/4" = 1'-0"



2 NEW LANDING SECTION - SHALLOW
3/4" = 1'-0"



SINGLE PLATE CONNECTION SCHEDULE				
BEAM SIZE	SHEAR PL (t x L)	MIN WELD SIZE, tw	HOLES: STD OR SSLT 3/4"Ø A325N BOLTS	MAX CAPACITY (KIPS, UNFACTORED)
W8 TO W12	1/4" x 5 1/2"	3/16"	2	16.3K
W12 TO W16	1/4" x 8 1/2"	3/16"	3	25.6K
W16 TO W21	5/16" x 11 1/2"	1/4"	4	41.5K
W18 TO W27	5/16" x 14 1/2"	1/4"	5	54.1K
W21 TO W30	5/16" x 17 1/2"	1/4"	6	59.3K
W24 TO W33	5/16" x 20 1/2"	1/4"	7	72.1K
W27 TO W36	5/16" x 23 1/2"	1/4"	8	84.7K

NOTES:
1. CONNECTION DESIGNED FOR 1 1/2" COPE TOP AND BOTTOM.
2. ALLOWABLE CAPACITES ARE IN KIPS (SERVICE LEVEL - UNFACTORED).
3. CAPACITIES BASED ON GRADE 50 BEAMS, A325N BOLTS, AND A36 ANGLES.
4. HOLES:
   A. STD = 13/16"Ø
   B. OVS = 15/16"Ø
   C. SSLT = 13/16"Ø x 1"
5. ALL INFORMATION SHOWN IN THE SCHEDULE ABOVE IS TO BE USED AS A MINIMUM REQUIREMENT FOR ALL CONNECTIONS.
6. ALTERNATE CONNECTION DETAILS ARE ACCEPTABLE PROVIDED SIGNED AND SEALED SHOP DRAWINGS AND CALCULATIONS ARE SUBMITTED, AND ALL CONNECTION DESIGNS ARE PERFORMED UNDER THE DIRECT SUPERVISION OF A PROFESSIONAL ENGINEER REGISTERED IN THE STATE WHERE THE PROJECT IS LOCATED.

3 TYPICAL SHEAR TAB CONNECTION DETAIL
3/4" = 1'-0"

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DETAILS

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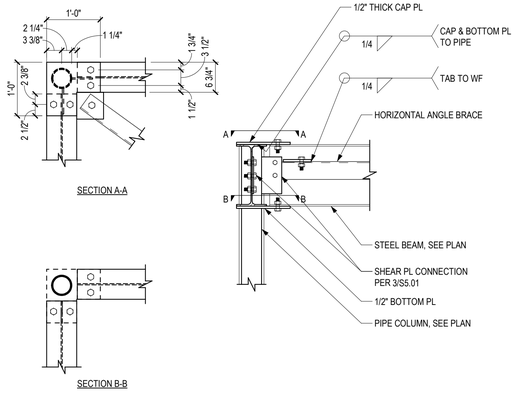
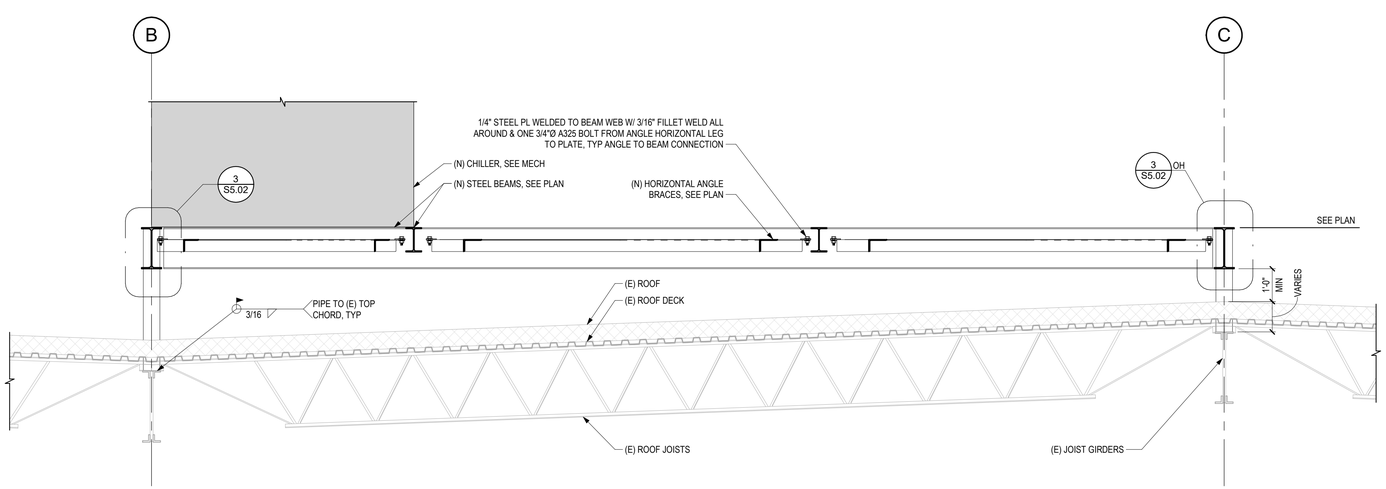
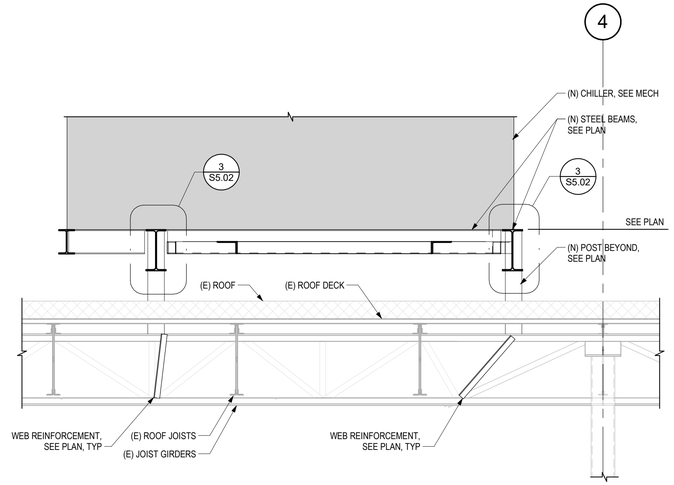


3 TYPICAL FRAME CONNECTION DETAIL
3/4" = 1'-0"



1 CHILLER PLATFORM SECTION 1
1/2" = 1'-0"



2 CHILLER PLATFORM SECTION 2
1/2" = 1'-0"

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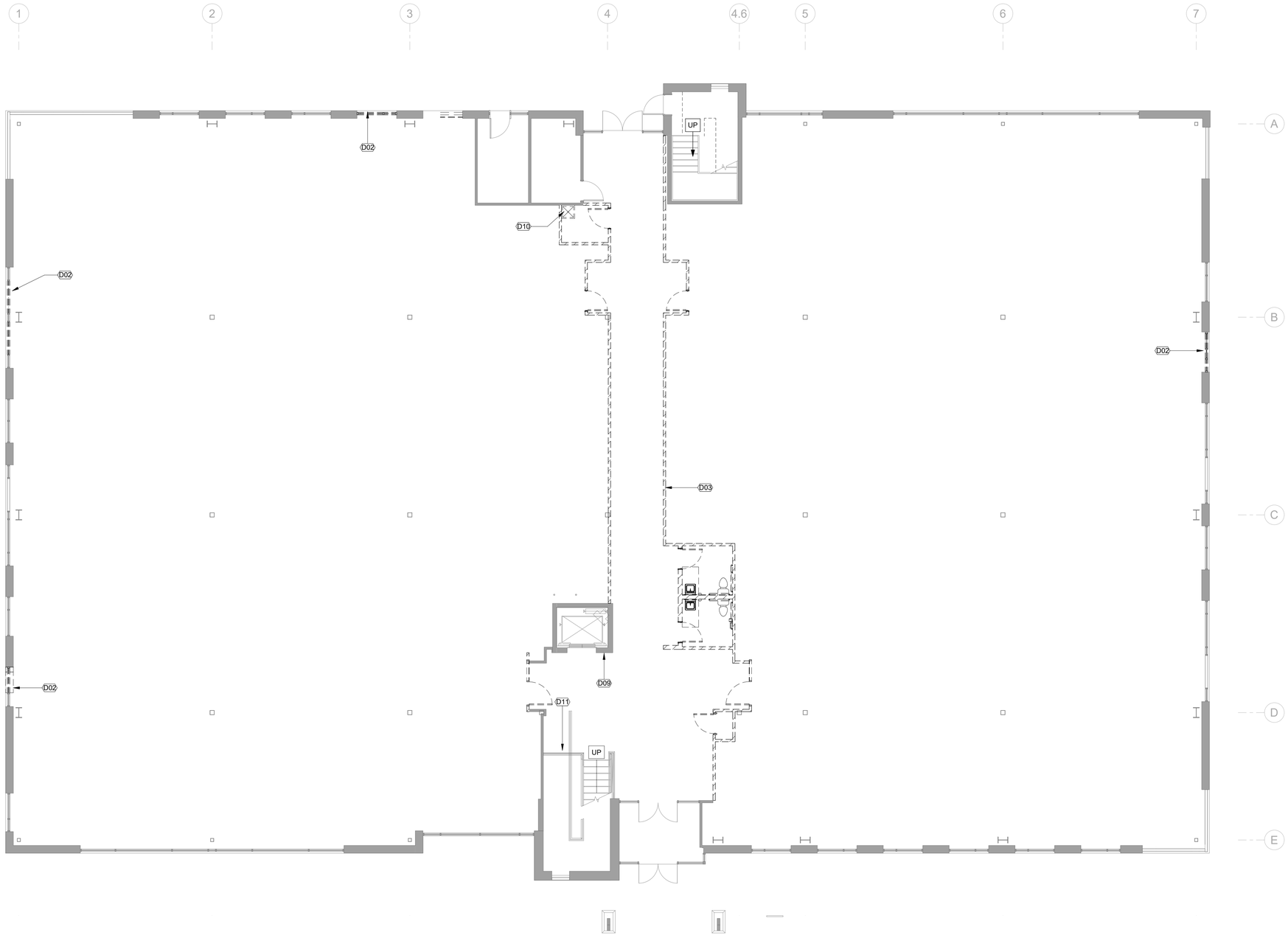

1 AD-101 LEVEL 01 DEMOLITION FLOOR PLAN
1/8" = 1'-0"

GENERAL NOTES: DEMOLITION PLANS

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12. REFER TO DOOR SCHEDULE FOR LOCATION OF (E) DOORS TO BE REMOVED AND RE-INSTALLED.

DEMOLITION LEGEND

- EXISTING WALL ASSEMBLY TO DEMOLISH
- EXISTING WALL ASSEMBLY TO REMAIN
- EXISTING CONC FLOOR STRUCTURE TO DEMOLISH

DEMO NOTES	
NOTE	DESCRIPTION
D02	REMOVE (E) GLAZING UNITS AND MULLION SECTIONS AS NEEDED FOR PROPOSED DOOR
D03	DEMOLISH (E) CORRIDOR WALLS AND RESTROOMS AS INDICATED
D09	REMOVE EXISTING WOOD PANELING
D10	DEMOLISH (E) JANITOR'S SINK
D11	REMOVE (E) HORIZONTAL CABLE RAILING AT GUARDRAILS

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LEVEL 01 DEMOLITION FLOOR PLAN

AD-101

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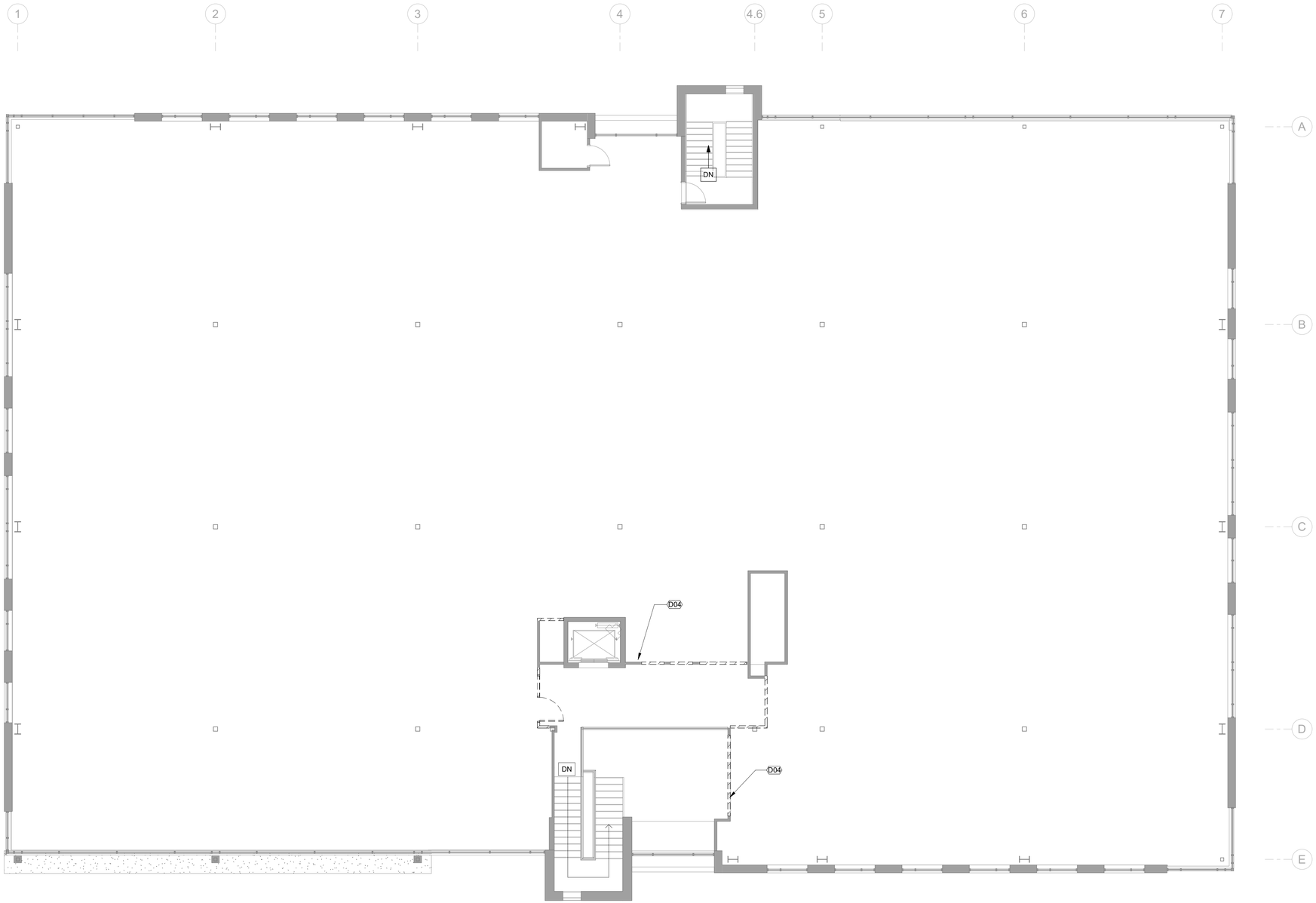

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- EXISTING CONC FLOOR STRUCTURE TO DEMOLISH

DEMO NOTES	
NOTE	DESCRIPTION
D04	ADD OPENINGS AT (E) WALL, RE: FLOORPLANS

1 AD-102 LEVEL 02 DEMOLITION FLOOR PLAN

1/8" = 1'-0"

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LEVEL 02 DEMOLITION FLOOR PLAN

AD-102

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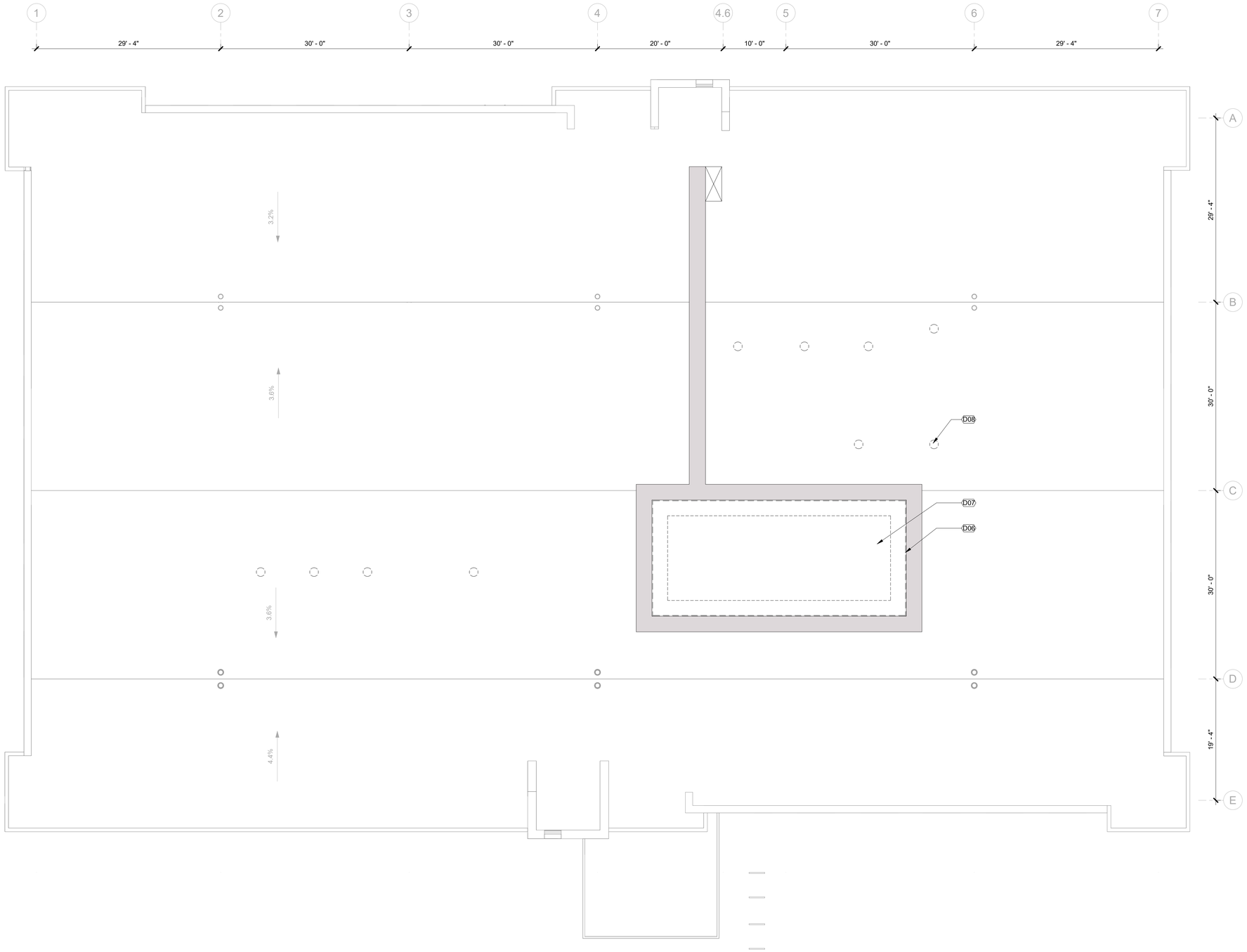

1 AD-103 DEMOLITION ROOF PLAN
1/8" = 1'-0"

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DEMOLITION LEGEND

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- EXISTING WALL ASSEMBLY TO REMAIN
- EXISTING CONC FLOOR STRUCTURE TO DEMOLISH

DEMO NOTES

NOTE	DESCRIPTION
D06	REMOVE (E) MECH RTU SCREENING
D07	REMOVE (E) MECH RTU
D08	DEMOLISH PORTIONS OF (E) ROOF DECK ASSEMBLY FOR INSTALLATION OF TUBULAR DAYLIGHTING DEVICES

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DEMOLITION ROOF PLAN

AD-103

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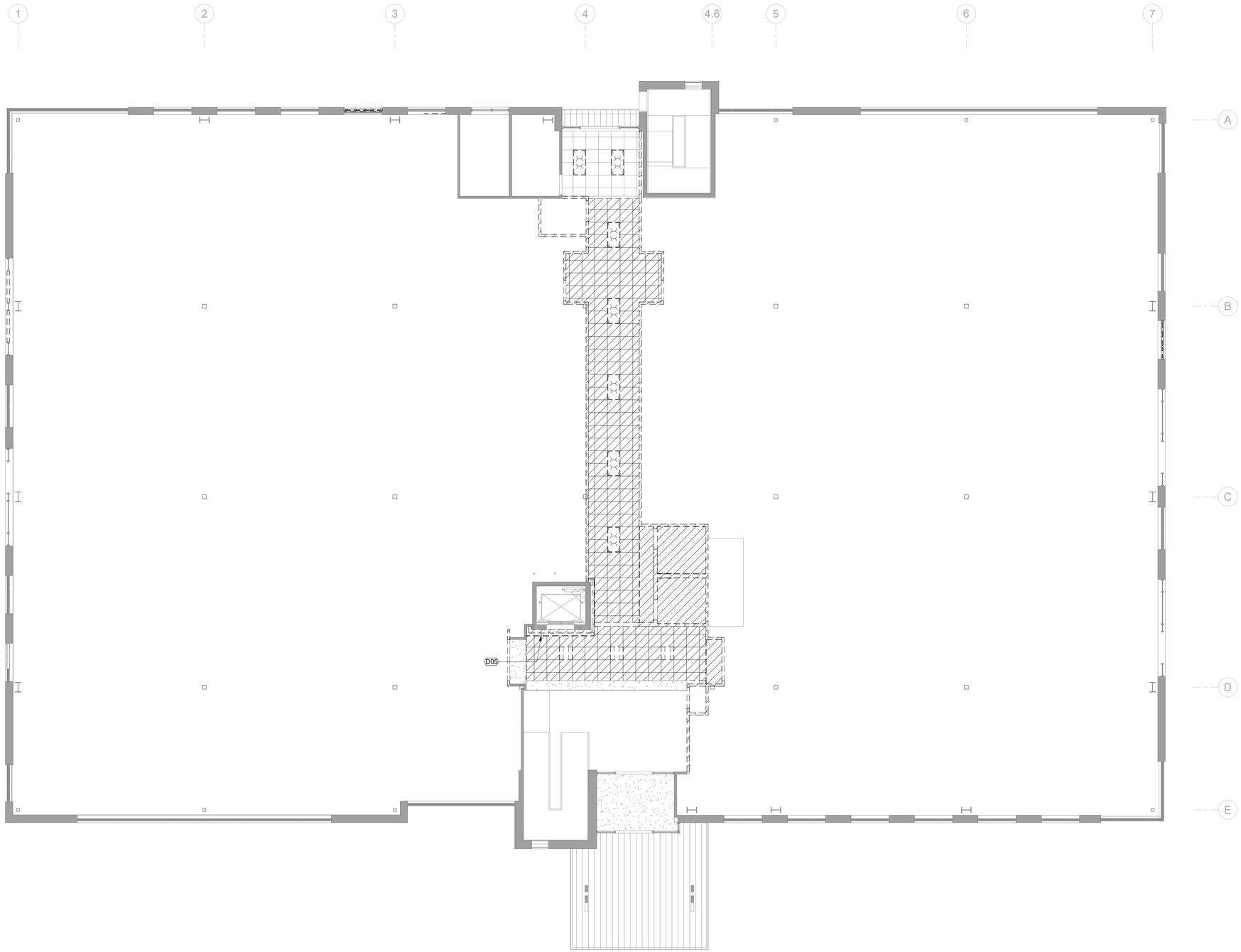

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DEMOLITION LEGEND - REFLECTED CEILING PLAN

- EXISTING WALL ASSEMBLY TO DEMOLISH
- EXISTING WALL ASSEMBLY TO REMAIN
- EXISTING CONC FLOOR STRUCTURE TO DEMOLISH
- DEMOLISH EXISTING ACT CEILING
- DEMOLISH EXISTING GWB CEILING
- EXISTING GWB CEILING TO REMAIN
- (E) OPEN TO STRUCTURE
- EXISTING ACT CEILING TO REMAIN

DEMO NOTES

NOTE	DESCRIPTION
D05	DEMOLISH (E) GYP BULKHEADS AND COVE LIGHTING AT ELEVATORS

1 AD-111 LEVEL 01 DEMOLITION REFLECTED FLOOR PLAN
1/8" = 1'-0"

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LEVEL 01 REFLECTED DEMOLITION FLOOR PLAN

AD-111

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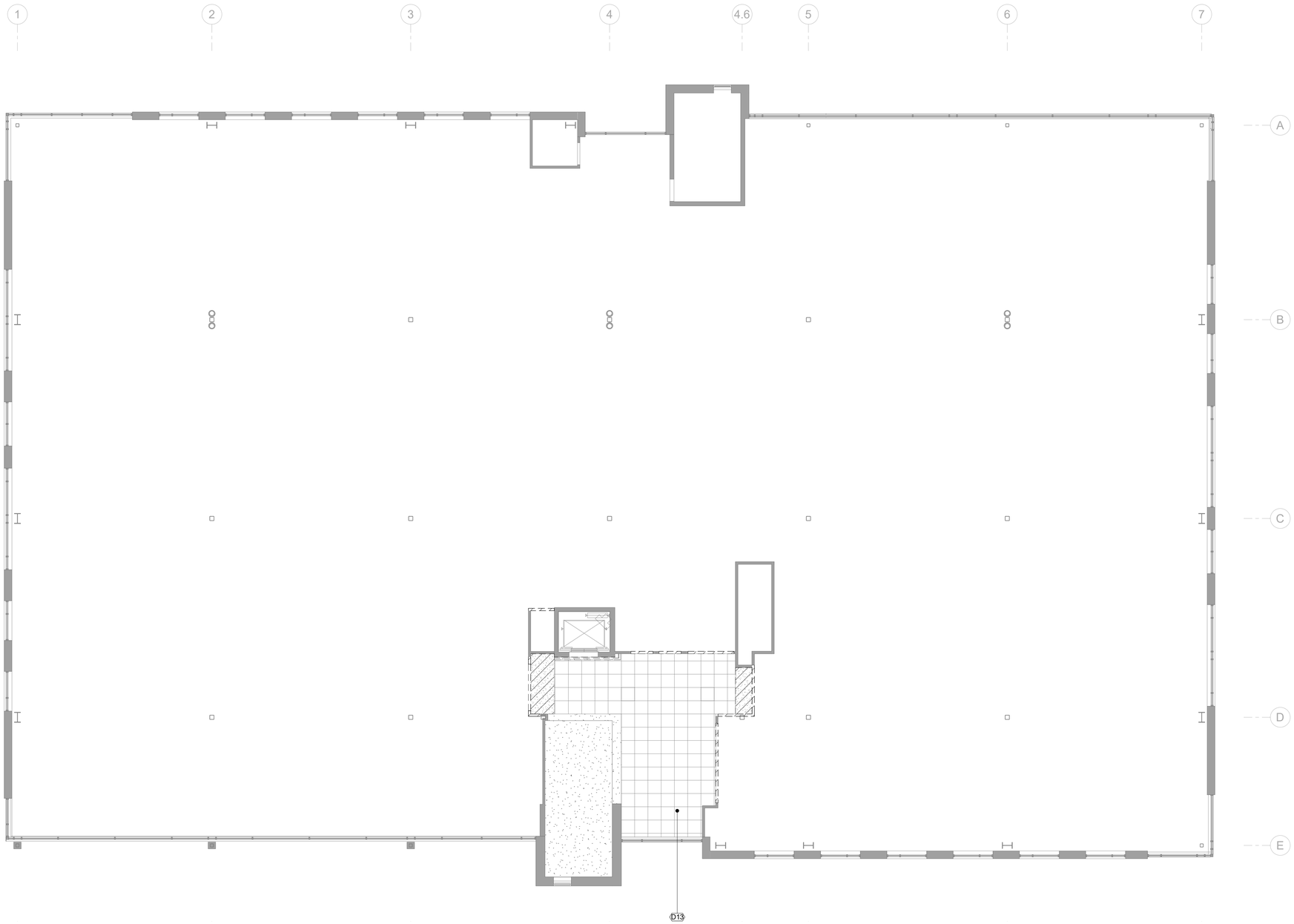

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- DEMOLISH EXISTING ACT CEILING
- DEMOLISH EXISTING GWB CEILING
- EXISTING GWB CEILING TO REMAIN
- (E) OPEN TO STRUCTURE
- EXISTING ACT CEILING TO REMAIN

DEMO NOTES

NOTE	DESCRIPTION
D13	REMOVE (E) CEILING TILES AND LIGHT FIXTURES. (E) SUSPENDED GRID SYSTEM TO REMAIN IN PLACE

1 AD-112 LEVEL 02 DEMOLITION REFLECTED FLOOR PLAN
1/8" = 1'-0"

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PROJECT NO: 2007

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LEVEL 02 REFLECTED DEMOLITION FLOOR PLAN

AD-112

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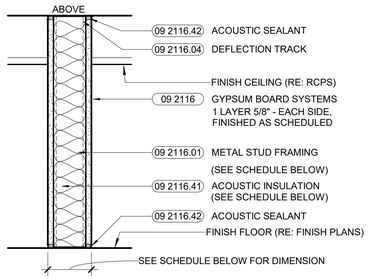
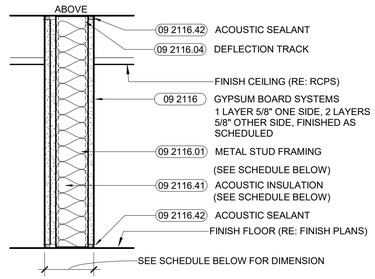


TYPE	STUD SIZE	PARTITION THICKNESS	CAVITY FILL	STC	NOTES
		2 7/8"			
A1-4	3 5/8"	4 7/8"	3"	45	N/A
A1-6	6"	7 1/4"	5 1/2"	N/A	N/A

A1 ACOUSTIC PARTITION

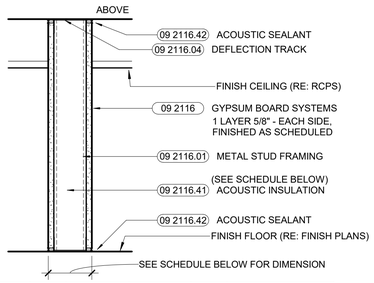
1 1/2" = 1'-0"



TYPE	STUD SIZE	PARTITION THICKNESS	CAVITY FILL	STC	NOTES
A3-4	3 5/8"	5 1/2"	3"	50	N/A

A3 ACOUSTIC PARTITION

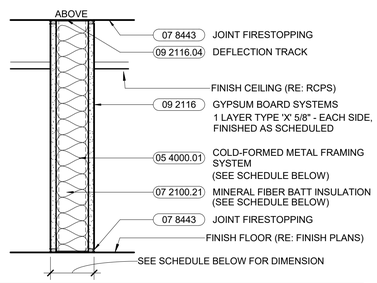
1 1/2" = 1'-0"



TYPE	STUD SIZE	PARTITION THICKNESS	CAVITY FILL	STC	NOTES
P1-3	2 1/2"	3 3/4"	NONE	N/A	N/A
P1-4	3 5/8"	4 7/8"	NONE	N/A	N/A
P1-6	6"	7 1/4"	NONE	N/A	N/A

P1 NON-RATED PARTITION

1 1/2" = 1'-0"

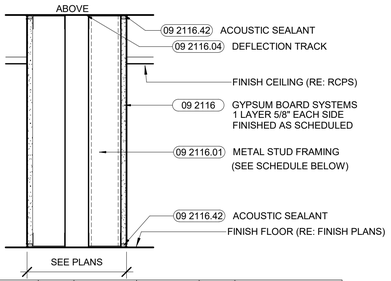


TYPE	STUD SIZE	PARTITION THICKNESS	CAVITY FILL	STC	NOTES
P1-4R	3 5/8"	4 7/8"	3"	N/A	N/A

P1R 1 HR RATED PARTITION

1 1/2" = 1'-0"

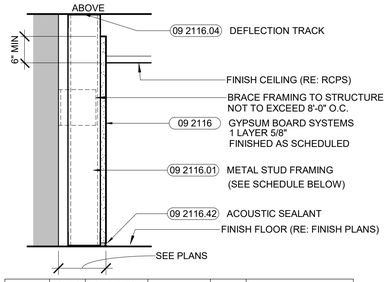
UL 419 BASIS OF DESIGN



TYPE	STUD SIZE	PARTITION THICKNESS	CAVITY FILL	STC	NOTES
C1-3	2 1/2"	SEE PLAN	NONE	N/A	N/A

C1 NON-RATED PARTITION - CHASE

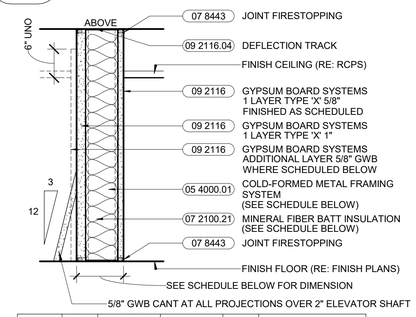
1 1/2" = 1'-0"



TYPE	STUD SIZE	PARTITION THICKNESS	CAVITY FILL	STC	NOTES
F1-1	7/8"	SEE PLAN	NONE	N/A	N/A
F1-2	1 1/2"	SEE PLAN	NONE	N/A	N/A
F1-3	2 1/2"	SEE PLAN	NONE	N/A	N/A
F1-4	3 5/8"	SEE PLAN	NONE	N/A	N/A

F1 FURRING PARTITION

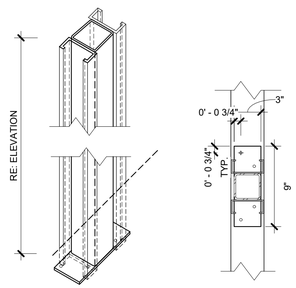
1 1/2" = 1'-0"



TYPE	STUD SIZE	PARTITION THICKNESS	CAVITY FILL	STC	NOTES
S1R-2	2 1/2" CH	4 1/8"	1 1/2"	42	1

S1R 1 HR RATED PARTITION

1 1/2" = 1'-0"



PLAN VIEW

PARTIAL HEIGHT PARTITION HSS STEEL SUPPORT

IN WALL STEEL REINFORCEMENT: 3 x 3 HSS POSTS @ 5'-0" O.C. WITH 3" x 9" x 1/4" WELDED BASEPLATE WITH (4) 5/16" DIA. ANCHOR BOLTS EACH POST

BASE PLATE TO ATTACH TO CONCRETE BELOW RAISED FLOOR; RE: DIEWALL DETAILS ON SHEET A-520 FOR ASSEMBLY

GENERAL NOTES - WALL/PARTITION TYPES

1. PROVIDE TILE BACKER BOARD AT TOILET ROOMS, SHOWERS, LOCKER AREAS, AND WHERE REQUIRED BY SPECIFICATION IN LIEU OF GYP. BD.
2. EXTEND FIRE RATED WALLS, INCLUDING SHEATHING, TO UNDERSIDE OF STRUCTURE ABOVE.
3. SOUND SEAL HEAD, SILL, AND ALL PENETRATIONS IN ACOUSTICAL WALLS WITH STC RATINGS OF 45 AND MORE.
4. PROVIDE TYPE 'X' GYPSUM BOARD AT FIRE RATED WALLS.
5. GYPSUM ASSOCIATION (GA) FILE #S BASED ON GA-600-2015: GYPSUM FIRE RESISTANCE DESIGN MANUAL.
6. PER GA GENERAL NOTE #15, GREATER STUD SIZES THAN THOSE TESTED ARE PERMITTED.
7. MASON TO COORDINATE WITH ELECTRICIAN TO PLACE CONDUIT INSIDE OF CMU WALLS.

NOTE: SEAL ALL OPENINGS, GAPS, PENETRATIONS, AND JOINTS IN PARTITION TYPES AS FOLLOWS:

FIRE RATED PARTITIONS OR BARRIERS AND SMOKE BARRIERS:
SEAL IN ACCORDANCE WITH THE REQUIREMENTS SPECIFIED IN THE DIVISION 07 SPECIFICATION SECTIONS FOR PENETRATION FIRESTOP SYSTEMS AND FIRE RESISTIVE JOINT SYSTEMS. REFER TO CODE COMPLIANCE DRAWINGS FOR LOCATIONS.

REFER TO UL DESIGN NUMBER PROVIDED FOR DETAILED CONSTRUCTION REQUIREMENTS.

SMOKE PARTITIONS (PARTITIONS DESIGNED TO RESIST THE PASSAGE OF SMOKE):
SEAL COMPLETELY WITH ELASTOMERIC SEALANT. FOR THE LOCATION AND EXTENT REFER TO CODE COMPLIANCE DRAWINGS.

STC-RATED ASSEMBLIES/SOUND RATED PARTITIONS (ALL PARTITIONS INDICATED WITH SOUND ATTENUATION BLANKET):

1. STC RATINGS ARE BASED ON 25 GAUGE (0.0179" BASE METAL THICKNESS) MAXIMUM STUDS SPACED AT 16 INCHES ON CENTER. THICKER BASE METAL OR CLOSER STUD SPACING WILL REDUCE THE STC RATING.
2. STAGGER LAYERS OF DRYWALL ON OPPOSITE SIDES OF THE WALL BY AT LEAST 16 INCHES TO OFFSET SEAMS.
3. STAGGER LAYERS OF DRYWALL ON SAME SIDE OF THE WALL BY AT LEAST FOUR INCHES TO OFFSET SEAMS.
4. MAINTAIN A ¼ INCH GAP BETWEEN THE DRYWALL AND THE FLOOR, FILL WITH ACOUSTICAL JOINT SEALANT.
5. MAINTAIN A ¼ INCH GAP BETWEEN THE DRYWALL AND THE CEILING, FILL WITH ACOUSTICAL JOINT SEALANT.
6. FILL ANY DRYWALL SEAM GREATER THAN ⅛ INCH WITH ACOUSTICAL JOINT SEALANT.
7. FILL EACH INDIVIDUAL LAYER OF DRYWALL GAP WITH ACOUSTICAL JOINT
8. SEALANT BEFORE THE NEXT LAYER OF DRYWALL IS INSTALLED.

OTHER LOCATIONS: SEAL AS INDICATED AND REQUIRED ELSEWHERE BY THE CONTRACT DOCUMENTS.

FOR ALL NON-RATED PARTITIONS, CLOSE THE VOID BETWEEN PARTITION AND UNDERSIDE OF FLOOR OR ROOF DECK WITH MINERAL WOOL (SAFING INSULATION) AND PROVIDE 1/2" DEEP NON-SAG ACOUSTICAL JOINT SEALANT, BEADED.

PARTITION SHEET KEYED NOTES

1. STC IS BASED ON 20 GAUGE (0.033" BASE METAL THICKNESS) MAXIMUM STUDS.
2. STC IS BASED ON CEILING WITH MINIMUM 35 CAC.
3. NON-RATED SOUND PARTITION, USE ACOUSTICAL JOINT SEALANT IN LIEU OF FIRE RESISTIVE JOINT SEALANT.
4. PROVIDE ADDITIONAL LAYER OF 5/8" GWB ON LINER SIDE OF SHAFT PARTITION. ADDITIONAL LAYER TO EXTEND MIN 6" ABOVE FINISHED CEILING UNO.
5. PROVIDE PRAY FOAM INSULATION AT PERIMETER OF EXISTING EXTERIOR

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WALL AND PARTITION TYPES

A-001

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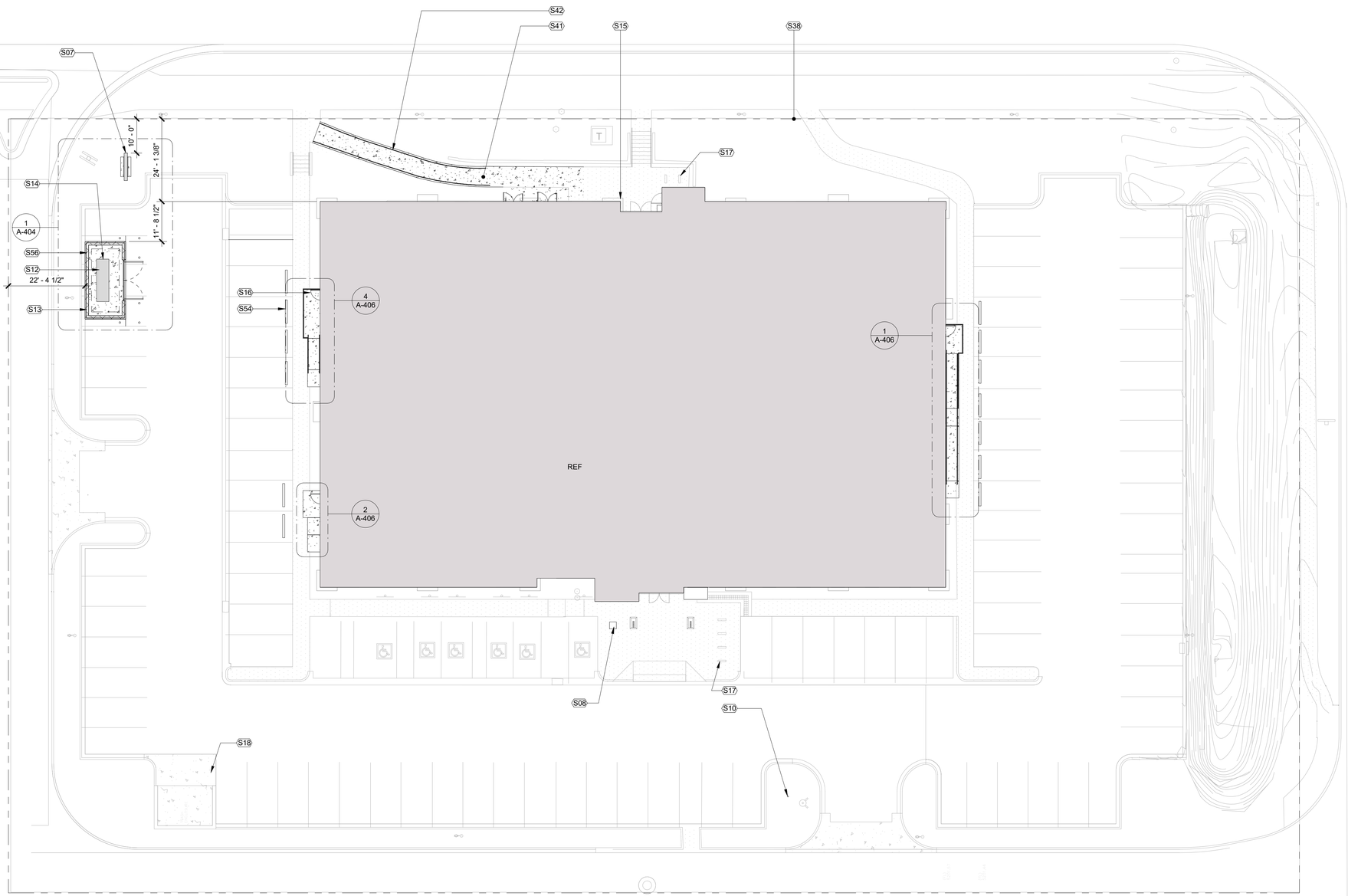

1 A-100 ARCHITECTURAL SITE PLAN
1/16" = 1'-0"

GENERAL NOTES: SITE PLAN

1. DO NOT SCALE DRAWINGS. WRITTEN DIMENSIONS SHALL TAKE PRECEDENCE. IF ADDITIONAL DIMENSIONS ARE REQUIRED, CONTACT ARCHITECT.
2. CONTRACTOR TO VERIFY ALL FIELD CONDITIONS AND DIMENSIONS AND LAY OUT PROPOSED WORK PRIOR TO CONSTRUCTION IN NEW WORK AREA. REPORT DISCREPANCIES TO ARCHITECT FOR RESOLUTION.
3. IN THE EVENT OF CONFLICTING OR UNCLEAR INFORMATION, CONTRACTOR SHALL CONTACT ARCHITECT FOR CLARIFICATION.
4. ALL WORK SHALL CONFORM TO APPLICABLE CODES. NOTIFY ARCHITECT OF ANY CONDITIONS OR DETAILS WHICH ARE DEEMED TO BE NONCONFORMING.
5. COORDINATE WITH ALL OTHER DRAWINGS AND SPECIFICATIONS FOR ADDITIONAL SCOPE.
6. DIRECTIONS WHERE NOTED ARE ALWAYS IN REFERENCE TO PLAN NORTH.
7. EXISTING SITE ELEMENTS TO REMAIN AS IS U.N.O.
8. MAINTAIN ACCESSIBLE GRADES (2% MAX CROSS SLOPE, 5% MAX RUNNING SLOPE) AT APPROACHES TO BUILDING ENTRANCES IF SITE ELEMENTS ARE DISTURBED.

SCOPE NOTES

1. PROPOSED GENERATOR WILL REQUIRE 3 PARKING SPACES TO BE REMOVED. ADDITIONAL PARKING IS PROVIDED TO PARKING LOT TO THE WEST AND OWNER HAS PARKING AGREEMENT IN PLACE.

SHEET NOTES

NOTE	DESCRIPTION
S07	MONUMENT SIGN; PROVIDE CONCRETE FOUNDATION WITH BRICK VENEER, FABRICATED SIGN TO MOUNT ON FOUNDATION. RE: ARTBOOK FOR PRECEDENT IMAGERY.
S08	EXTERIOR CURB MOUNTED DROP BOX
S10	CONCORD AMERICAN FLAGPOLE, XTREME SERIES, WIRE HALYARD, SINGLE REVOLVING DOWNLIGHT, SATIN FINISH
S12	ELEC. EMERGENCY GENERATOR; RE: ELEC DWGS
S13	ENCLOSURE AROUND GENERATOR; 8" CMU WALL WITH BRICK VENEER
S14	REPAIR AND REPLACE SITE ELEMENTS/LANDSCAPING DISTURBED BY GENERATOR INSTALLATION
S15	LOCATION OF (E) ELEC. TRANSFORMER AND ELEC CABINET
S16	CONCRETE RAMP/STAIR/LANDING AT DOORS; RECONFIGURE LANDSCAPING AS REQUIRED
S17	(E) BIKE RACKS TO REMAIN
S18	(E) TRASH ENCLOSURE TO REMAIN
S38	PROPERTY LINE
S41	PORTION OF EXISTING RAMP/SIDEWALK TO BE DEMOLISHED AND REINSTALLED, RE: CIVIL
S42	INSTALL HANDRAILS AT BOTH SIDES OF RAMP; RE: A-406 FOR SIM DETAILS
S54	INSTALL PARKING BLOCKS AT ALL PARKING STALLS WITH REDUCED WIDTH SIDEWALK DUE TO RAMPS/LANDINGS
S56	ADDITION OF GENERATOR ENCLOSURE REDUCES # OF PARKING SPACES BY THREE (3)

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ARCHITECTURAL SITE PLAN

A-100

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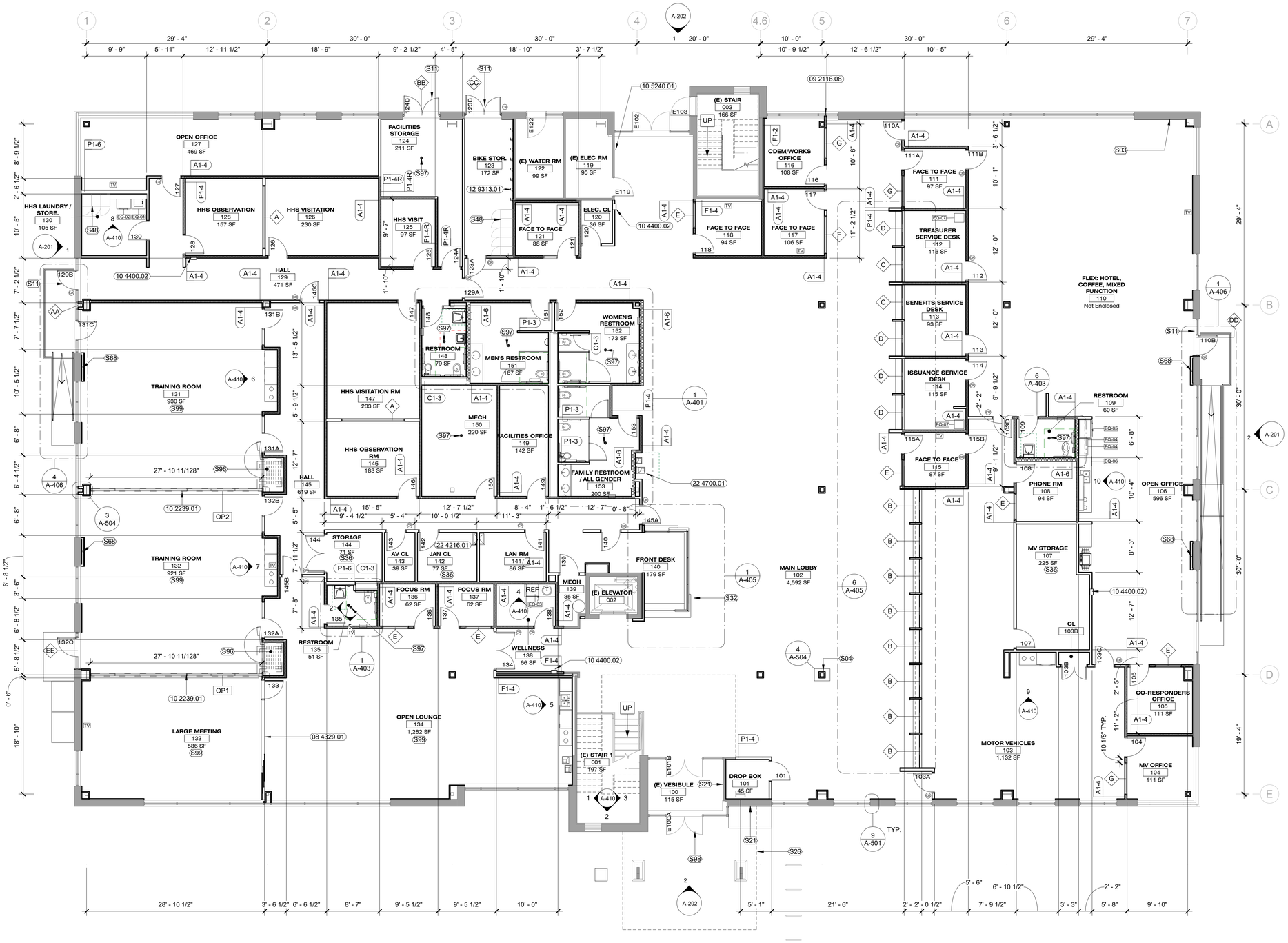

GENERAL NOTES: FLOOR PLAN

1. DO NOT SCALE DRAWINGS. WRITTEN DIMENSIONS SHALL TAKE PRECEDENCE. IF ADDITIONAL DIMENSIONS ARE REQUIRED, CONTACT ARCHITECT.
2. CONTRACTOR TO VERIFY ALL FIELD CONDITIONS AND DIMENSIONS AND LAY OUT PROPOSED WORK PRIOR TO CONSTRUCTION IN NEW WORK AREA. REPORT DISCREPANCIES TO ARCHITECT FOR RESOLUTION.
3. ALL DIMENSIONS ARE SHOWN TO FACE OF DRYWALL FOR NEW PARTITIONS. FINISH MATERIAL SUCH AS TILE OR FRP IS NOT ACCOUNTED FOR IN GIVEN DIMENSIONS.
4. IN THE EVENT OF CONFLICTING OR UNCLEAR INFORMATION, CONTRACTOR SHALL CONTACT ARCHITECT FOR CLARIFICATION.
5. ALL WORK SHALL CONFORM TO APPLICABLE CODES. NOTIFY ARCHITECT OF ANY CONDITIONS OR DETAILS WHICH ARE DEEMED TO BE NONCONFORMING.
6. COORDINATE WITH ALL OTHER DRAWINGS AND SPECIFICATIONS FOR ADDITIONAL SCOPE.
7. FOR ALL EXISTING SURFACES TO REMAIN THAT HAVE BEEN IDENTIFIED TO RECEIVE NEW PAINT: SCRAPE, SPACKLE, PATCH, CLEAN, OR OTHERWISE PREPARE SURFACE TO RECEIVE PAINT WITHOUT NOTICEABLE IMPERFECTION.
8. REFER TO ROOM FINISH SCHEDULE FOR FLOOR AND WALL FINISHES
9. REFER TO FINISH PLAN FOR EXTENT OF NEW FLOORING.
10. DIRECTIONS WHERE NOTED ARE ALWAYS IN REFERENCE TO PLAN NORTH.
11. SEE SHEET A-001 FOR WALL AND PARTITION TYPES. PARTITION ARE TYPE P1-4 UON
12. DOOR FRAMES ARE TO BE LOCATED 4" FROM ADJACENT WALL, UON.
13. COORDINATE FINAL FLOOR BOX LOCATIONS WITH FURNITURE PLAN BY OWNER.
14. ALIGN PARTITIONS WITH EXISTING MULLIONS, WINDOWS, AND PARTITIONS THROUGHOUT. NOTIFY IF DIMENSIONS DO NOT MATCH FIELD CONDITIONS, NOTIFY ARCHITECT.

FLOOR PLAN LEGEND

- WALL ASSEMBLY
- EXISTING WALL ASSEMBLY
- OVERHEAD LINE
- TV FLATSCREEN LOCATION, PROVIDE ELEC. AND DATA CONNECTIONS
- CARD READER LOCATION

SHEET NOTES

NOTE	DESCRIPTION
S03	(E) EXT. WALL ASSEMBLY IS UNFINISHED; INSTALL 5/8" GYP BOARD AT INTERIOR AND FINISH PER FINISH NARRATIVE; TYPICAL FOR ENTIRE BUILDING; MAINTAIN (E) BATT INSULATION, REPAIR AS NEEDED
S04	WRAP ALL (E) EXPOSED STEEL COLUMNS WITH GYP BOARD, TYP. THROUGHOUT BUILDING
S11	REMOVE (E) GLAZING UNITS AND MULLIONS TO INSTALL DOORS AT (E) STOREFRONT UNIT; RE: A-605 AND A-600
S21	THROUGH WALL DROP SLOT, LOCKABLE PUBLIC SIDE
S26	(E) AWNING ABOVE
S32	BUILT IN CASEWORK
S36	OFOI STORAGE SHELVING
S48	PROVIDE LOCKERS; TWO TIER, RE: SPEC
S68	EXISTING ROOF DRAIN
S96	CONFIRM DIMENSIONS OF CLOSET FOR OPERABLE PARTITION WITH MANUFACTURER
S97	FLOOR DRAIN; RE: PLUMB
S98	(E) AUTOMATIC DOOR OPERATORS TO REMAIN
S99	PROVIDE HORIZONTAL REVEAL CHANNEL SCREED (FRY REGLET OR SIM.) AT DRYWALL AT 32" A.F.F. AT ALL WALLS IN THIS ROOM

KEYNOTE LEGEND

KEYNOTE	DESCRIPTION
08 4329.01	SLIDING DOOR ASSEMBLIES
09 2116.08	RESILIENT PARTITION SOUND ISOLATION SEAL; TYP. AT ALL METAL FRAMED WALL ASSEMBLIES SEALING AT STOREFRONT WINDOWS
10 2239.01	FOLDING PANEL PARTITION
10 4400.02	FIRE EXTINGUISHER CABINET ASSEMBLY
10 5240.01	FIRE DEPARTMENT KNOX BOX
12 9313.01	BICYCLE RACK UNIT
22 4216.01	MOP SINK WITH MOP HANGER. RE: SPECIFICATION
22 4700.01	DRINKING FOUNTAIN, RE:PLUMBING

1 A-101 LEVEL 01 FLOOR PLAN
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LEVEL 01 FLOOR PLAN

A-101

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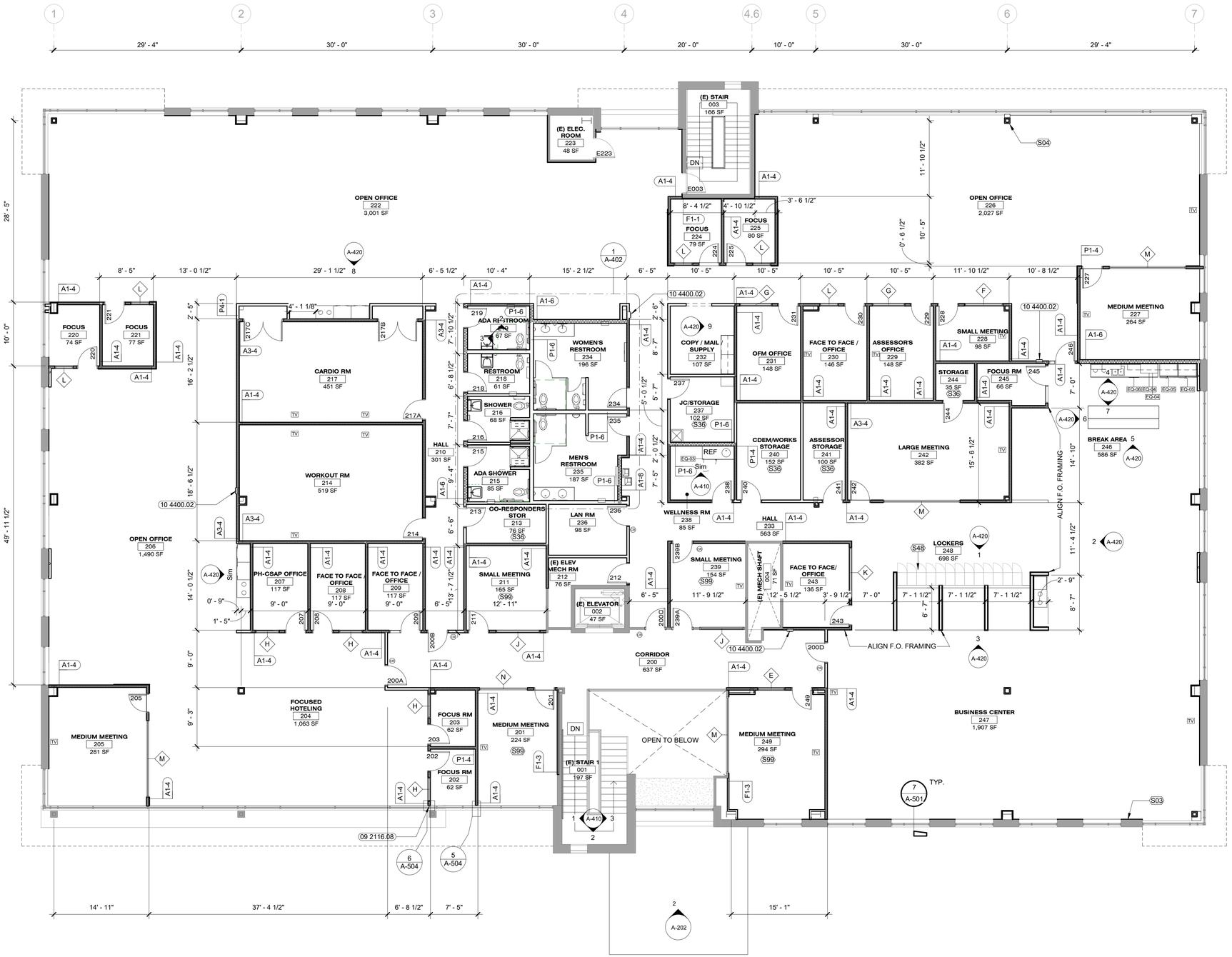

1 A-102 LEVEL 02 FLOOR PLAN
1/8" = 1'-0"

GENERAL NOTES: FLOOR PLAN

1. DO NOT SCALE DRAWINGS. WRITTEN DIMENSIONS SHALL TAKE PRECEDENCE. IF ADDITIONAL DIMENSIONS ARE REQUIRED, CONTACT ARCHITECT.
2. CONTRACTOR TO VERIFY ALL FIELD CONDITIONS AND DIMENSIONS AND LAY OUT PROPOSED WORK PRIOR TO CONSTRUCTION IN NEW WORK AREA. REPORT DISCREPANCIES TO ARCHITECT FOR RESOLUTION.
3. ALL DIMENSIONS ARE SHOWN TO FACE OF DRYWALL FOR NEW PARTITIONS. FINISH MATERIAL SUCH AS TILE OR FRP IS NOT ACCOUNTED FOR IN GIVEN DIMENSIONS.
4. IN THE EVENT OF CONFLICTING OR UNCLEAR INFORMATION, CONTRACTOR SHALL CONTACT ARCHITECT FOR CLARIFICATION.
5. ALL WORK SHALL CONFORM TO APPLICABLE CODES. NOTIFY ARCHITECT OF ANY CONDITIONS OR DETAILS WHICH ARE DEEMED TO BE NONCONFORMING.
6. COORDINATE WITH ALL OTHER DRAWINGS AND SPECIFICATIONS FOR ADDITIONAL SCOPE.
7. FOR ALL EXISTING SURFACES TO REMAIN THAT HAVE BEEN IDENTIFIED TO RECEIVE NEW PAINT: SCRAPE, SPACKLE, PATCH, CLEAN, OR OTHERWISE PREPARE SURFACE TO RECEIVE PAINT WITHOUT NOTICEABLE IMPERFECTION.
8. REFER TO ROOM FINISH SCHEDULE FOR FLOOR AND WALL FINISHES
9. REFER TO FINISH PLAN FOR EXTENT OF NEW FLOORING.
10. DIRECTIONS WHERE NOTED ARE ALWAYS IN REFERENCE TO PLAN NORTH.
11. SEE SHEET A-001 FOR WALL AND PARTITION TYPES. PARTITION ARE TYPE P1-4 UON
12. DOOR FRAMES ARE TO BE LOCATED 4" FROM ADJACENT WALL UON.
13. COORDINATE FINAL FLOOR BOX LOCATIONS WITH FURNITURE PLAN BY OWNER.
14. ALIGN PARTITIONS WITH EXISTING MULLIONS, WINDOWS, AND PARTITIONS THROUGHOUT. NOTIFY IF DIMENSIONS DO NOT MATCH FIELD CONDITIONS, NOTIFY ARCHITECT.

FLOOR PLAN LEGEND

- WALL ASSEMBLY
- EXISTING WALL ASSEMBLY
- OVERHEAD LINE
- TV FLATSCREEN LOCATION, PROVIDE ELEC. AND DATA CONNECTIONS
- CR CARD READER LOCATION

SHEET NOTES

NOTE	DESCRIPTION
S03	(E) EXT. WALL ASSEMBLY IS UNFINISHED; INSTALL 5/8" GYP BOARD AT INTERIOR AND FINISH PER FINISH NARRATIVE; TYPICAL FOR ENTIRE BUILDING; MAINTAIN (E) BATT INSULATION, REPAIR AS NEEDED
S04	WRAP ALL (E) EXPOSED STEEL COLUMNS WITH GYP BOARD, TYP. THROUGHOUT BUILDING
S36	OFOI STORAGE SHELVING
S48	PROVIDE LOCKERS; TWO TIER, RE: SPEC
S99	PROVIDE HORIZONTAL REVEAL CHANNEL SCREED (FRY REGLET OR SIM.) AT DRYWALL AT 32" A.F.F. AT ALL WALLS IN THIS ROOM

KEYNOTE LEGEND

KEYNOTE	DESCRIPTION
09 2116.08	RESILIENT PARTITION SOUND ISOLATION SEAL; TYP. AT ALL METAL FRAMED WALL ASSEMBLIES SEALING AT STOREFRONT WINDOWS
10 4400.02	FIRE EXTINGUISHER CABINET ASSEMBLY

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LEVEL 02 FLOOR PLAN

A-102

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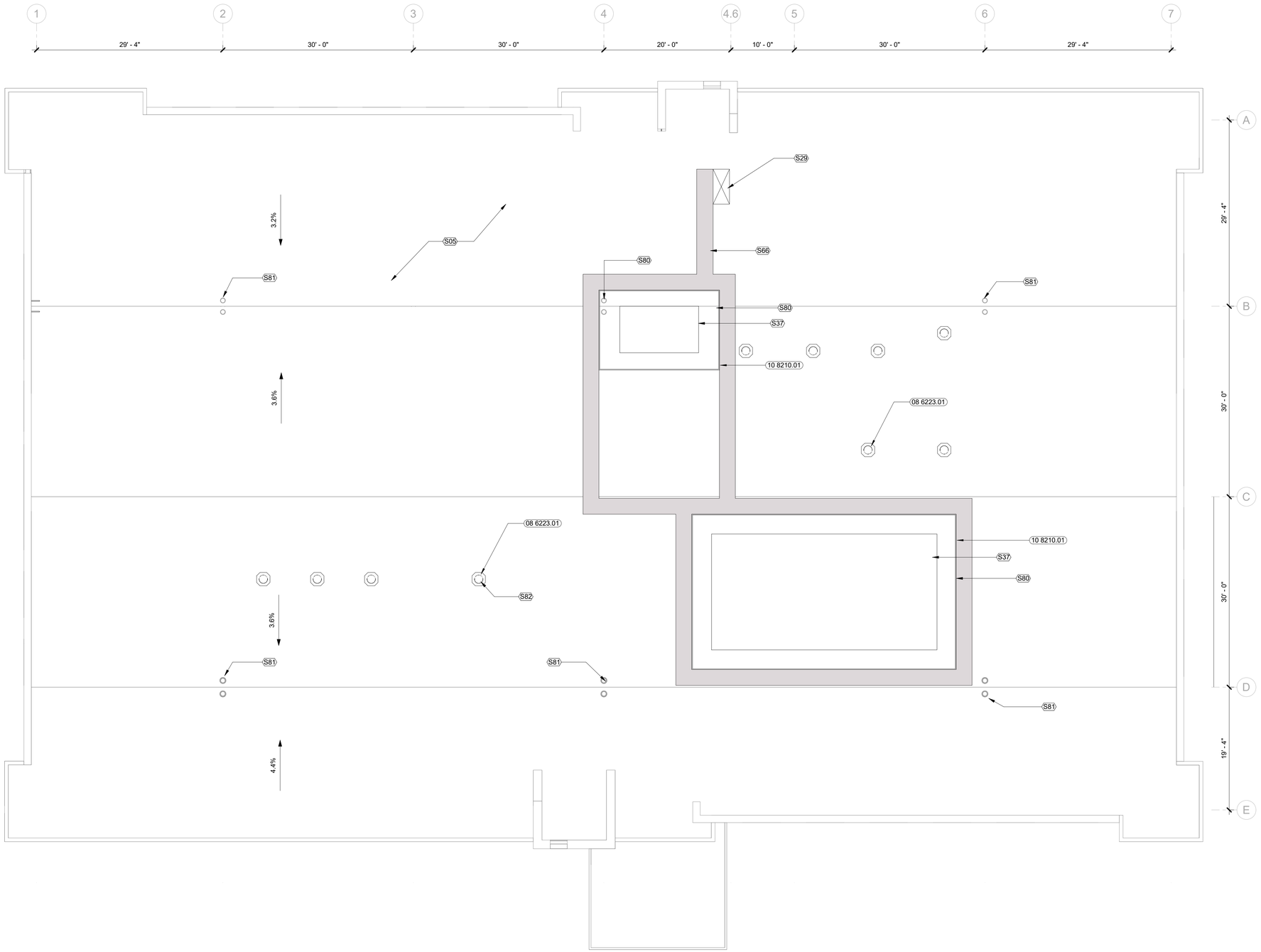

GENERAL NOTES: ROOF PLAN

1. DO NOT SCALE DRAWINGS. WRITTEN DIMENSIONS SHALL TAKE PRECEDENCE. IF ADDITIONAL DIMENSIONS ARE REQUIRED, CONTACT ARCHITECT.
2. CONTRACTOR TO VERIFY ALL FIELD CONDITIONS AND DIMENSIONS AND LAY OUT PROPOSED WORK PRIOR TO CONSTRUCTION IN NEW WORK AREA. REPORT DISCREPANCIES TO ARCHITECT FOR RESOLUTION.
3. IN THE EVENT OF CONFLICTING OR UNCLEAR INFORMATION, CONTRACTOR SHALL CONTACT ARCHITECT FOR CLARIFICATION DURING THE WORK AFFECTED.
4. SITE SURVEY PROVIDED IS DEEMED TO BE RELIABLE AND ACCURATE. CONTRACTOR TO NOTIFY ARCHITECT AND CIVIL ENGINEER WHEN DISCREPANCIES ARE ENCOUNTERED PRIOR TO OR DURING CONSTRUCTION.
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SHEET NOTES

NOTE	DESCRIPTION
S05	(E) ROOF MEMBRANE TO REMAIN; PATCH AS NEEDED FOR MODIFICATIONS FOR MEP EQUIPMENT AND TUBULAR DAYLIGHTING SYSTEMS
S29	(E) ROOF ACCESS HATCH
S37	MECH EQUIPMENT, RE: MECH; LOCATION AND STRUCTURAL MODIFICATIONS PER STRUCT.
S66	PROPOSED WALKING PAD. MATCH EXISTING; USE EXISTING WHERE FEASIBLE
S80	COORDINATE CLEARANCES WITH MECH EQUIPMENT
S81	(E) ROOF DRAINS TO REMAIN
S82	CENTER TUBULAR DAYLIGHTING DEVICES OVER ROOMS BELOW

KEYNOTE LEGEND

KEYNOTE	DESCRIPTION
08 6223.01	TUBULAR SKYLIGHT
10 8210.01	EQUIPMENT SCREEN ASSEMBLY

1 A-103 ROOF PLAN
1/8" = 1'-0"

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ROOF PLAN

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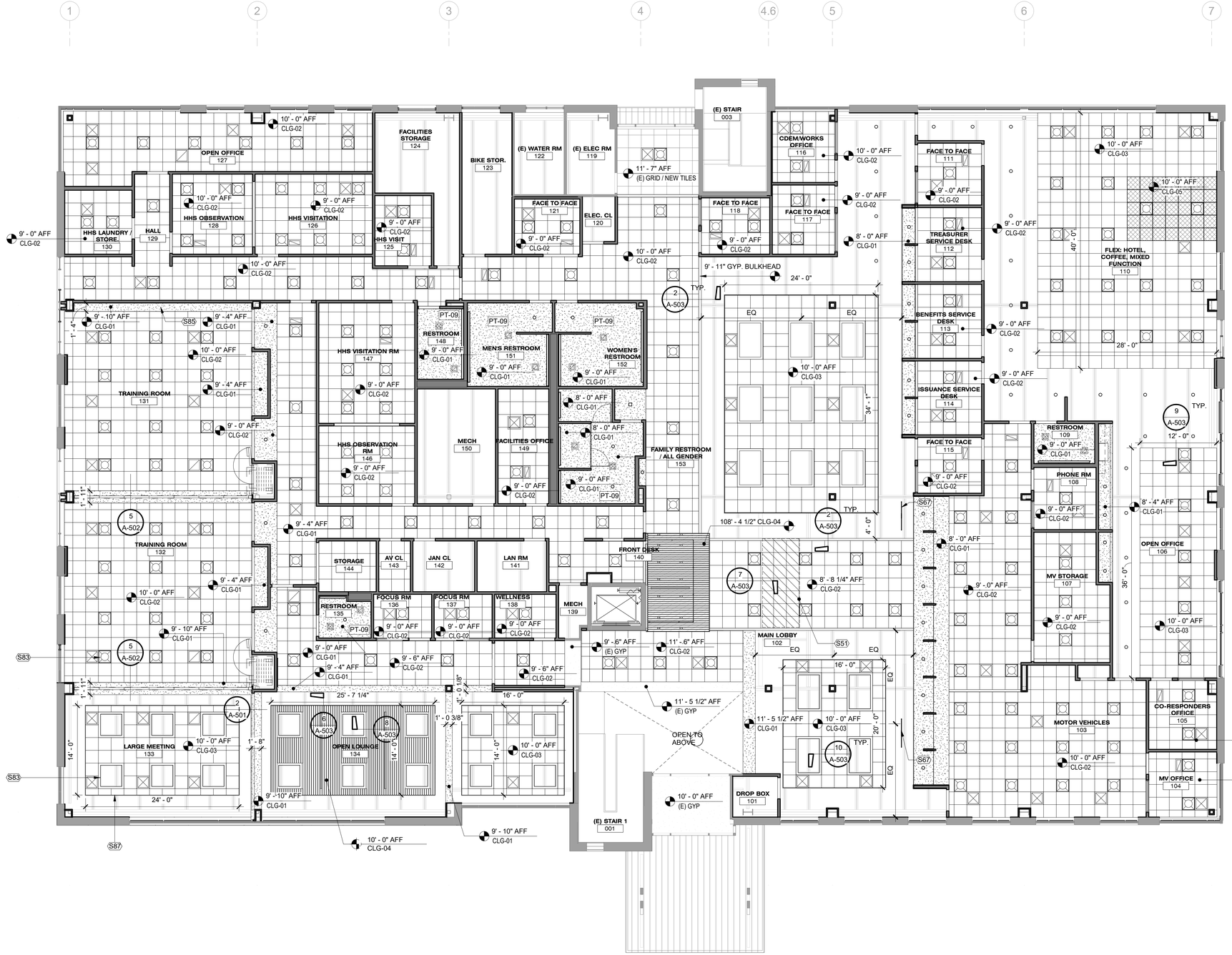

GENERAL NOTES: REFLECTED CEILING PLANS

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5. LOCATE SPRINKLER HEADS WHERE NEEDED FOR CODE COMPLIANT DESIGN. HEADS SHALL BE CENTERED IN TILE. HEADS SHALL ALIGN WITHIN A SINGLE VIEWABLE AREA.
6. ALL EXPOSED CEILINGS SHALL BE PAINTED PT-02. INCLUDING BUT NOT LIMITED TO CONDUIT, HVAC EQUIPMENT, ETC
7. ALL GYP CEILINGS ARE TO BE PAINTED PT-01 U.N.O.
8. ALL EXPOSED STRUCTURE IS TO BE PAINTED PT-02 U.N.O.
9. ALL EXPOSED CONDUIT TO BE INSTALLED IN AN ORDERLY AND ORTHOGONAL MANNER.
10. ALL WALLS TO EXTEND TO UNDERSIDE OF FLOOR ABOVE, U.N.O.

LEGEND: REFLECTED CEILING PLAN

- EXISTING WALL ASSEMBLY TO REMAIN
- PROPOSED WALL ASSEMBLY
- WOOD ACOUSTICAL SLAT - CLG 04
- OPEN TO STRUCTURE - (E) STRUCTURE TO BE EXPOSED. PAINT.
- PATCH AND REPAIR (E) CEILING
- (E) GWB CEILING
- GWB CEILING
- NEW ACT CEILING
- EXISTING ACT CEILING
- ACT CEILING, CLG-05
- TUBULAR SOLAR DIFFUSER
- RECESSED CAN LIGHT - ROUND; RE: ELEC.
- RECESSED CAN LIGHT - SQUARE; RE: ELEC.
- 2X2 TROFFER LIGHT; RE: ELEC.
- RECESS LINEAR LIGHT; RE: ELEC.
- DECORATIVE PENDANT LIGHT; RE: ELEC.
- DECORATIVE SURFACE MOUNT LIGHT; RE: ELEC.
- CAN PENDANT LIGHT - ROUND; RE: ELEC.
- RECTILINEAR PENDANT; RE: ELEC.
- SUPPLY DIFFUSER; RE: MECH
- RETURN GRILL; RE: MECH
- LINEAR DIFFUSER; RE: MECH

SHEET NOTES

NOTE	DESCRIPTION
S51	PROVIDE 1 HR RATED ENCLOSURE AT BOTTOM OF MECH SHAFT; INSTALL TIGHT TO UNDERSIDE OF EXISTING DUCTWORK
S67	CEILING MOUNTED SCREEN
S83	LIGHT FIXTURE; RE: ELEC.
S85	DROP DOWN PROJECTOR SCREEN
S87	6" AXIOM TRIM AT ALL EXPOSED EDGES OF ACT CEILINGS; RE: 9/A-503

1 A-111 LEVEL 01 REFLECTED CEILING PLAN
1/8" = 1'-0"

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LEVEL 01 REFLECTED CEILING PLAN

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LEGEND: REFLECTED CEILING PLAN

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- PROPOSED WALL ASSEMBLY
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- PATCH AND REPAIR (E) CEILING
- (E) GWB CEILING
- GWB CEILING
- NEW ACT CEILING
- EXISTING ACT CEILING
- ACT CEILING, CLG-05
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- RECESSED CAN LIGHT - ROUND; RE: ELEC.
- RECESSED CAN LIGHT - SQUARE; RE: ELEC.
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- RECESS LINEAR LIGHT; RE: ELEC.
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- DECORATIVE SURFACE MOUNT LIGHT; RE: ELEC.
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- RECTILINEAR PENDANT; RE: ELEC.
- SUPPLY DIFFUSER; RE: MECH
- RETURN GRILL; RE: MECH
- LINEAR DIFFUSER; RE: MECH

SHEET NOTES

NOTE	DESCRIPTION
S81	(E) ROOF DRAINS TO REMAIN
S83	LIGHT FIXTURE; RE: ELEC.
S87	6" AXIOM TRIM AT ALL EXPOSED EDGES OF ACT CEILINGS; RE: 9/A-503

KEYNOTE LEGEND

KEYNOTE	DESCRIPTION
08 6223.02	TUBULAR SOLAR DIFFUSER

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1 / A-112 LEVEL 02 REFLECTED CEILING PLAN
1/8" = 1'-0"

LEVEL 02 REFLECTED CEILING PLAN

A-112

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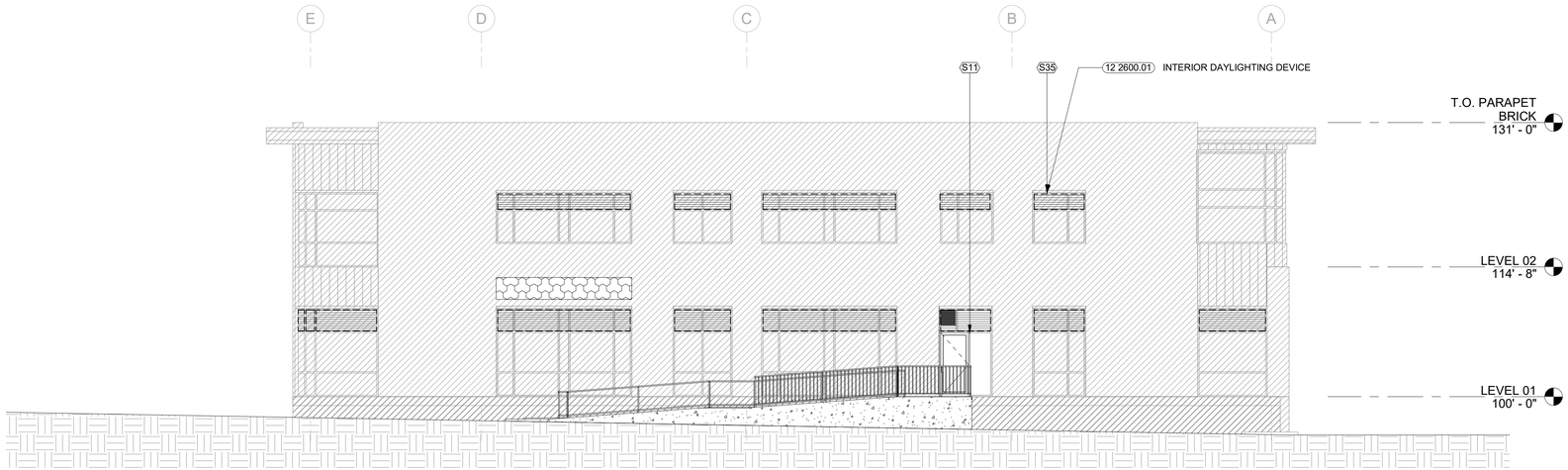
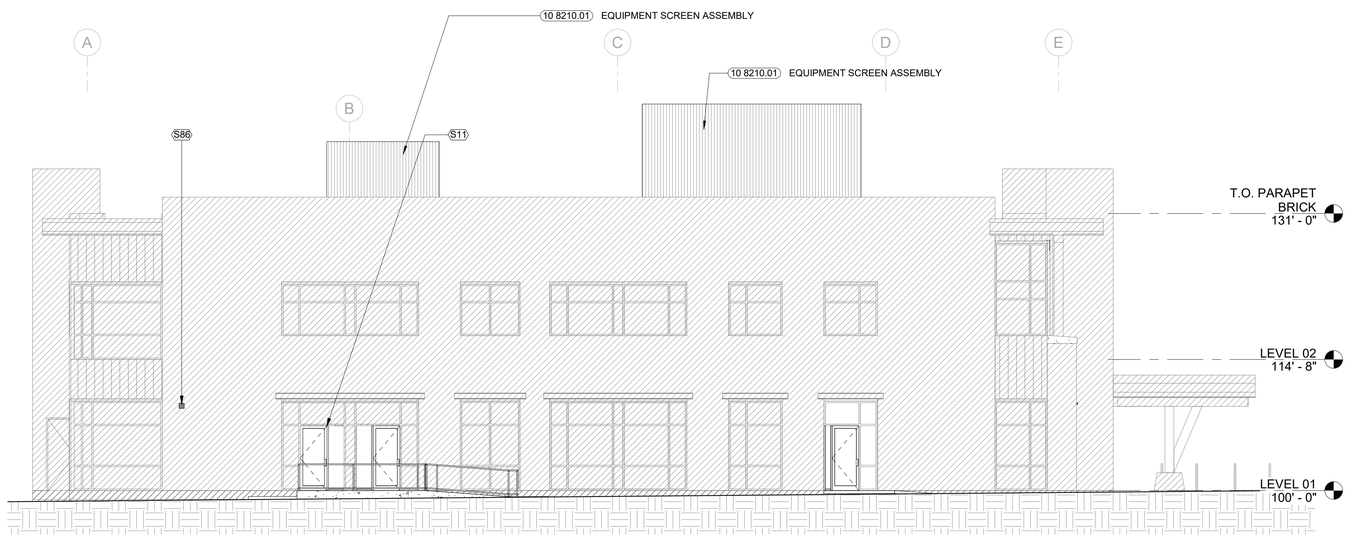


2 A-201 SOUTH ELEVATION

1/8" = 1'-0"



1 A-201 NORTH ELEVATION

1/8" = 1'-0"

GENERAL NOTES: ELEVATIONS

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BUILDING ELEVATION LEGEND

- NEW ELEMENTS
- EXISTING ELEMENT TO REMAIN
- LOCATIONS OF INTERIOR DAYLIGHTING DEVICES
- LOCATION OF FUTURE SIGNAGE. TO BE PROVIDED BY OWNER

SHEET NOTES

NOTE	DESCRIPTION
S11	REMOVE (E) GLAZING UNITS AND MULLIONS TO INSTALL DOORS AT (E) STOREFRONT UNIT; RE: A-605 AND A-600
S35	INSTALL INTERIOR DAYLIGHTING DEVICES AT INTERIOR SIDE OF EXISTING STOREFRONT WINDOWS
S86	DRYER VENT

INTERIOR DAYLIGHTING DEVICE SCHEDULE

TYPE MARK	DESCRIPTION	HEIGHT	WIDTH	COUNT	COMMENTS
	26 51 00_Recessed Can-Downlight2_sDC			34	
	26 51 00_Recessed Can-Downlight-Square_sDC			7	
	26 51 00 Can_Pendant_sDC			64	
	26 51 00 Can_Pendant_sDC			24	
	26_PENDANT FIXTURES AT ISLAND			6	
	COUNTY STANDARD 2X2			3	
	Downlight - Round - LED			4	
	Via Recessed			3	
	Via Recessed			2	
	Via Recessed			1	
	Via Recessed			1	
	Via Recessed			7	
	Via Recessed			3	
	Via Recessed			2	
	Via Recessed			1	
L1	LightLouver	2' - 5"	0' - 10"	3	V.I.F. DIMENSIONS
L2	LightLouver	1' - 9"	1' - 0"	2	V.I.F. DIMENSIONS
L3	LightLouver	2' - 5"	1' - 0"	4	V.I.F. DIMENSIONS
L4	LightLouver	1' - 9"	1' - 9"	18	V.I.F. DIMENSIONS
L5	LightLouver	2' - 5"	1' - 9"	17	V.I.F. DIMENSIONS
L6	LightLouver	2' - 5"	2' - 9"	1	V.I.F. DIMENSIONS
L7	LightLouver	1' - 9"	3' - 1"	2	V.I.F. DIMENSIONS
L8	LightLouver	2' - 5"	3' - 1"	2	V.I.F. DIMENSIONS
L9	LightLouver	1' - 9"	3' - 9"	14	V.I.F. DIMENSIONS
L10	LightLouver	2' - 5"	3' - 9"	11	V.I.F. DIMENSIONS
L11	LightLouver	2' - 5"	4' - 5"	3	V.I.F. DIMENSIONS
L12	LightLouver	1' - 9"	4' - 11"	4	V.I.F. DIMENSIONS
L13	LightLouver	2' - 5"	4' - 11"	4	V.I.F. DIMENSIONS
L14	LightLouver	2' - 5"	5' - 1"	4	V.I.F. DIMENSIONS
L15	LightLouver	2' - 5"	5' - 3"	3	V.I.F. DIMENSIONS
L16	LightLouver	2' - 5"	5' - 9"	1	V.I.F. DIMENSIONS
L17	LightLouver	2' - 5"	6' - 10"	1	V.I.F. DIMENSIONS
L18	LightLouver	2' - 5"	7' - 6"	1	V.I.F. DIMENSIONS
L19	LightLouver	2' - 5"	8' - 5"	4	V.I.F. DIMENSIONS

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ELEVATIONS - EXTERIOR
BUILDING ELEVATIONS

A-201

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2 A-202 WEST ELEVATION

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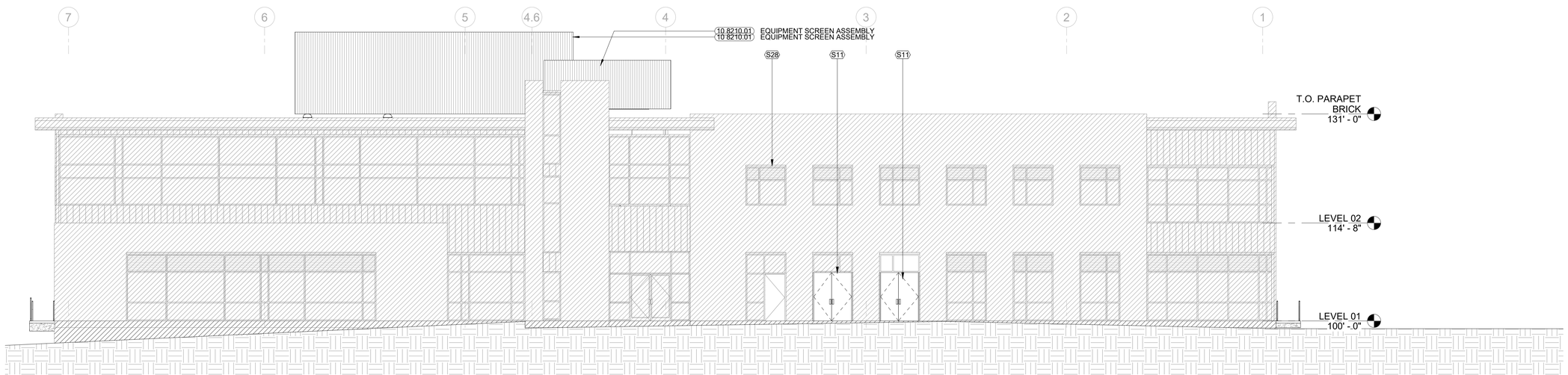

1 A-202 EAST ELEVATION

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BUILDING ELEVATION LEGEND

- NEW ELEMENTS
- EXISTING ELEMENT TO REMAIN
- LOCATIONS OF INTERIOR DAYLIGHTING DEVICES
- LOCATION OF FUTURE SIGNAGE. TO BE PROVIDED BY OWNER

SHEET NOTES

NOTE	DESCRIPTION
S11	REMOVE (E) GLAZING UNITS AND MULLIONS TO INSTALL DOORS AT (E) STOREFRONT UNIT; RE: A-605 AND A-600
S28	TUBULAR DAYLIGHTING DEVICE; PROVIDE UNIT COST
S35	INSTALL INTERIOR DAYLIGHTING DEVICES AT INTERIOR SIDE OF EXISTING STOREFRONT WINDOWS

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ELEVATIONS - EXTERIOR
BUILDING ELEVATIONS

A-202

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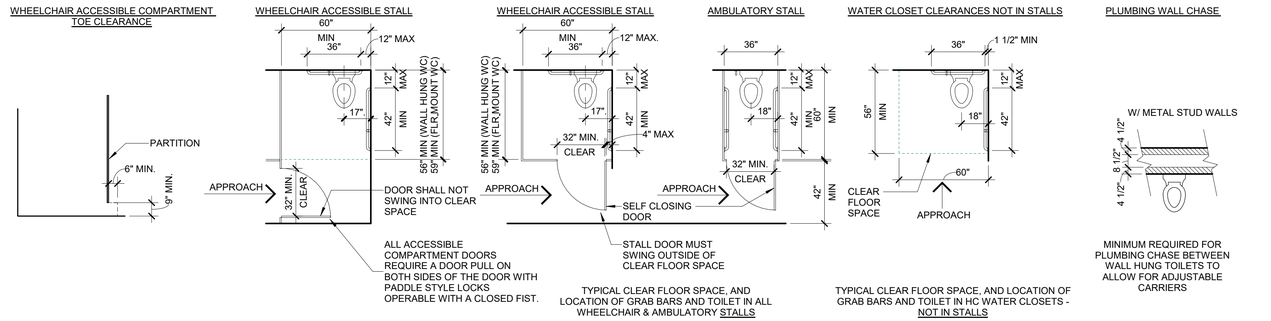
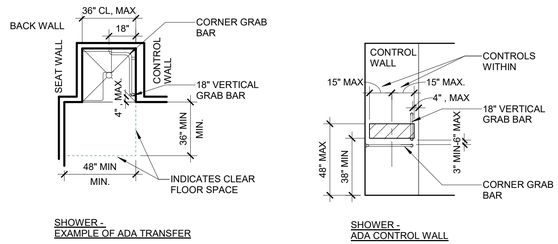
WASHROOM ACCESSORY SCHEDULE

KEY	ITEM	MANUFACTURER	MODEL	NOTES	C.F.C.I.	O.F.C.I.	O.F.O.I.
T01	TOILET			RE: PLUMB	X		
T02	URINAL			RE: PLUMB	X		
T03	LAVATORY			RE: PLUMB	X		
T04-A	TOILET TISSUE DISPENSER	GEORGIA PACIFIC	GP-100511	VERTICAL 4 - ROLL	X		
T04-B	TOILET TISSUE DISPENSER	GEORGIA PACIFIC	GP-5861	VERTICAL 2 - ROLL	X		
T05	SANITARY NAPKIN DISPOSAL	BOBRICK	B-270	SURFACE MOUNTED STAINLESS STEEL	X		
T07	TOILET SEAT COVER DISPENSER	ALPINE	483	STAINLESS STEEL 304, BRUSHED, WALL MOUNTED	X		
T08	LIQUID SOAP DISPENSER	FOAM-EEZ	9326	BLACK	X		
T09	PAPER TOWEL DISPENSER	BOBRICK	B-2974	20-GAUGE STAINLESS STEEL, SATIN FINISH ON EXPOSED SURFACES	X		
T10	HAND DRYER	XLERATOR		BRUSHED STAINLESS STEEL; 1.1 NOISE REDUCTION NOZEL; HEPA FILTER	X		
T11	WASTE RECEPTACLE						
T12	HORIZONTAL BABY CHANGING STATION	KOALA KARE	KB110-SSWM	STAINLESS STEEL	X		
T13	TEMPERED SAFETY GLASS MIRROR	TBD	TBD	DIMENSIONS PER ELEVATIONS	X		
T14	18" VERTICAL GRAB BAR	BOBRICK	B-6806X18	18-GAUGE STAINLESS STEEL, 1 1/2" DIAMETER 18" LONG. WHERE GRAB BARS ARE INSTALLED ON PARTITIONS PROVIDE ANCHOR 2586	X		
T15	42" GRAB BAR	BOBRICK	B-6806X42	18-GAUGE STAINLESS STEEL, 1 1/2" DIAMETER 42" LONG	X		
T16	36" GRAB BAR	BOBRICK	B-6806X36	18-GAUGE STAINLESS STEEL, 1 1/2" DIAMETER 18" LONG	X		
T18	SHELF W/ MOP AND BROOM HOLDER	THE CLINCHER	8CK06; 333-6-WHT2	18-GAUGE STAINLESS STEEL	X		
T19	COAT HOOK				X		
T20	DRINKING FOUNTAIN			RE: PLUMB	X		
T21	SHOWER ROD	BOBRICK	B-207	20-GAUGE STAINLESS STEEL ROD, VERIFY LENGTH WITH SHOWER ENCLOSURE SPEC	X		
T22	SHOWER SEAT				X		
T23	SHOWER TRIM PACKAGE			RE: PLUMB	X		
T24	JANITOR'S CLOSET SHELVES	GRAINGER'S CHOICE		VENITLATED STEEL WIRE WALL SHELF; 60" W x 14" D - 3 SHELF	X		
T25	JANITOR'S CLOSET SHELVES	GRAINGER'S CHOICE		VENITLATED STEEL WIRE WALL SHELF; 24" W x 14" D - 3 SHELF	X		

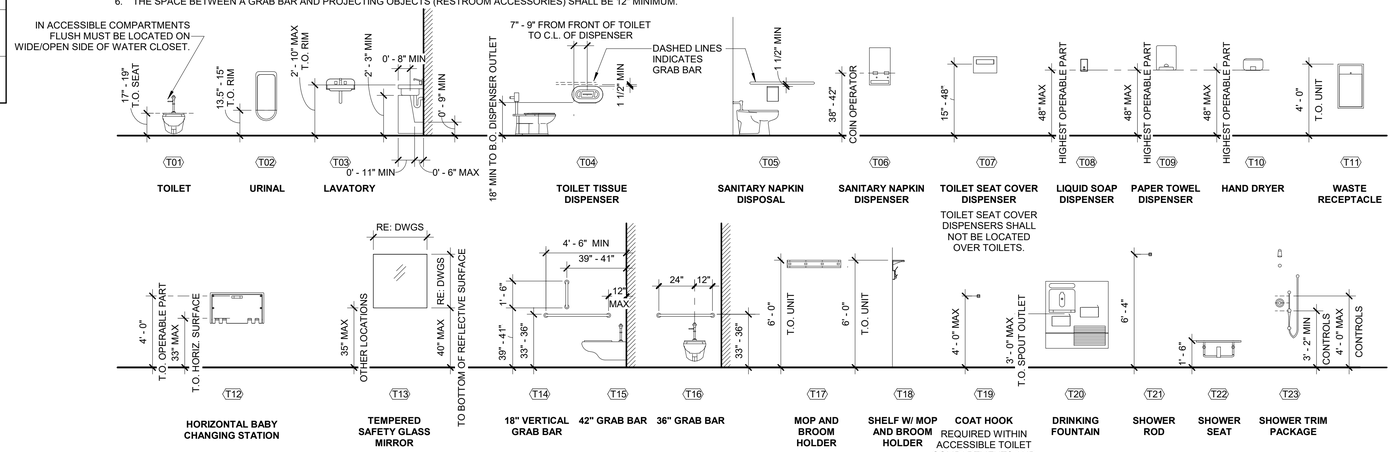
ACCESSIBLE RESTROOM AND SHOWER DIMENSIONS



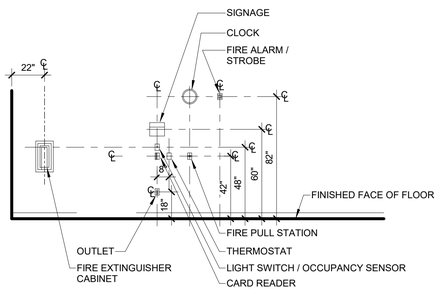


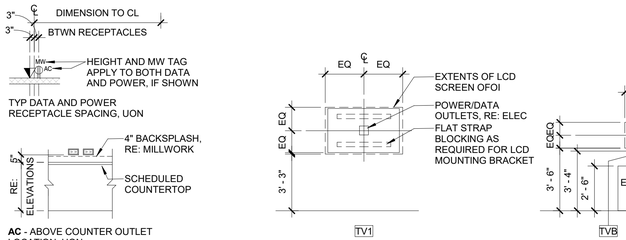
RESTROOM ACCESSORY MOUNTING HEIGHTS

1. NOT ALL ITEMS IN ACCESSORY SCHEDULE WILL BE USED. RE: PLANS AND INTERIOR ELEVATIONS FOR ITEMS USED.
2. DIMENSIONS SHOWN ARE TYPICAL U.N.O. IN PLANS AND INTERIOR ELEVATIONS
3. SEE INTERIOR ELEVATIONS AND PLANS FOR ACCESSORY AND GRAB BAR LOCATIONS.
4. FOR TOILET AND BATH ACCESSORIES, RE: SPEC SECTION 10 2800
5. WHERE A RANGE IS PROVIDED, THE TWO VALUES REPRESENT A MINIMUM AND MAXIMUM ALLOWABLE DIMENSION.
6. THE SPACE BETWEEN A GRAB BAR AND PROJECTING OBJECTS (RESTROOM ACCESSORIES) SHALL BE 12" MINIMUM.



TYPICAL DEVICE MOUNTING HEIGHTS AND LOCATIONS





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JVA CONSULTING ENGINEERS
1319 SPRUCE ST
BOULDER, CO 80302

PROJECT:
SOUTHEAST COUNTY SERVICE HUB
1755 S. PUBLIC RD
LAFAYETTE, CO 80026

PROJECT NO: 2007

#	ISSUE DATE	PHASE / REV NAME
	11-19-2021	CONSTRUCTION DOCUMENTS

TOILET ACCESSORIES / MOUNTING HEIGHTS / ADA CLEARANCES

A-400

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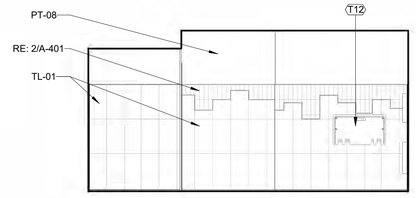
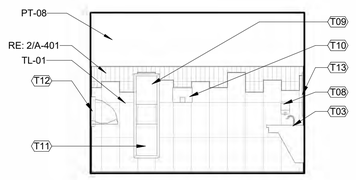
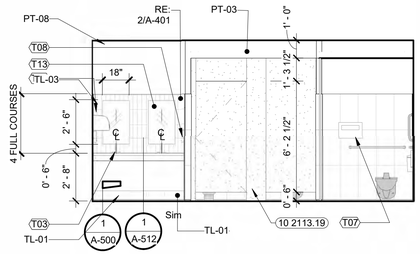
11/19/2021 4:45:35 PM



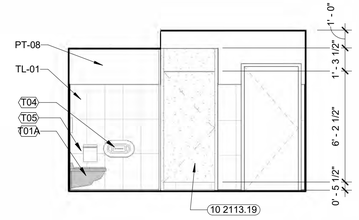
14 A-401 FAMILY RESTROOM #153 - SOUTH ELEVATION
1/4" = 1'-0"



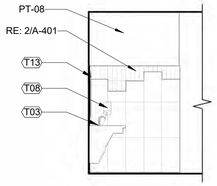
13 A-401 FAMILY RESTROOM #153 - WEST ELEVATION 2
1/4" = 1'-0"



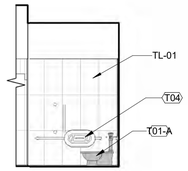
12 A-401 FAMILY RESTROOM #153 - NORTH ELEVATION
1/4" = 1'-0"



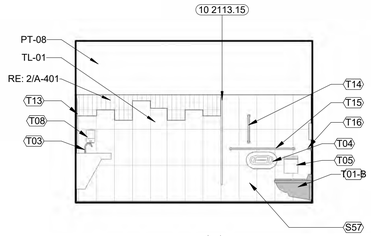
11 A-401 FAMILY RESTROOM #153 - EAST ELEVATION
1/4" = 1'-0"



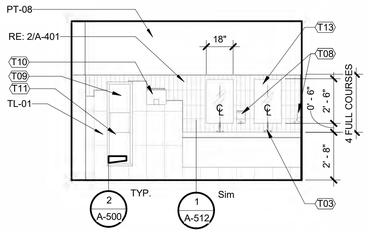
10 A-401 FAMILY RESTROOM #153 - EAST ELEVATION 1
1/4" = 1'-0"



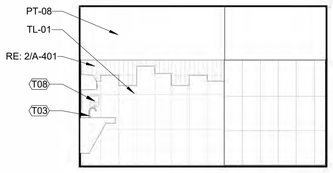
9 A-401 FAMILY RESTROOM #153 - WEST ELEVATION 1
1/4" = 1'-0"



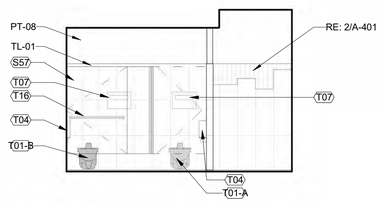
8 A-401 WOMEN'S RESTROOM #152 - WEST ELEVATION 2
1/4" = 1'-0"



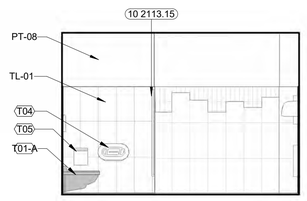
7 A-401 WOMEN'S RESTROOM #152 - SOUTH ELEVATION
1/4" = 1'-0"



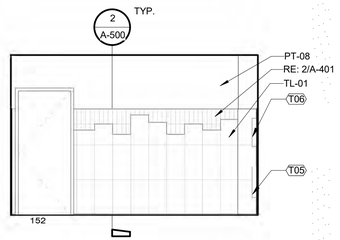
6 A-401 WOMEN'S RESTROOM #152 - WEST ELEVATION 1
1/4" = 1'-0"



5 A-401 WOMEN'S RESTROOM #152 - NORTH ELEVATION
1/4" = 1'-0"



4 A-401 WOMEN'S RESTROOM #152 - EAST ELEVATION 2
1/4" = 1'-0"

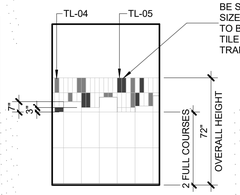


3 A-401 WOMEN'S RESTROOM #152 - EAST ELEVATION 1
1/4" = 1'-0"

ACCENT BAND TILE MIX RATIO TO BE AS FOLLOWS:
- 70% TL-03
- 15% TL-04
- 15% TL-05

PRECONSTRUCTION MEETING REQUIRED WITH SUBCONTRACTOR PRIOR TO TILE INSTALLATION

ACCENT TILE CUTS TO BE MADE IN 3" OR 7" INCREMENTS



2 A-401 FRINGE ACCENT BAND TILE MIX
1/4" = 1'-0"

1 A-401 ENLARGED FLOOR PLANS RMS #151, #152, #153
1/4" = 1'-0"

GENERAL NOTES: ENLARGED FLOOR PLANS AND INTERIOR ELEVATIONS

1. DO NOT SCALE DRAWINGS. WRITTEN DIMENSIONS SHALL TAKE PRECEDENCE. IF ADDITIONAL DIMENSIONS ARE REQUIRED, CONTACT ARCHITECT.
2. CONTRACTOR TO VERIFY ALL FIELD CONDITIONS AND DIMENSIONS AND LAY OUT PROPOSED WORK PRIOR TO CONSTRUCTION IN NEW WORK AREA. REPORT DISCREPANCIES TO ARCHITECT FOR RESOLUTION.
3. ALL DIMENSIONS ARE SHOWN TO FACE OF DRYWALL FOR NEW PARTITIONS. FINISH MATERIAL SUCH AS TILE OR FRP IS NOT ACCOUNTED FOR IN GIVEN DIMENSIONS.
4. IN THE EVENT OF CONFLICTING OR UNCLEAR INFORMATION, CONTRACTOR SHALL CONTACT ARCHITECT FOR CLARIFICATION.
5. ALL WORK SHALL CONFORM TO APPLICABLE CODES. NOTIFY ARCHITECT OF ANY CONDITIONS OR DETAILS WHICH ARE DEEMED TO BE NONCONFORMING.
6. COORDINATE WITH ALL OTHER DRAWINGS AND SPECIFICATIONS FOR ADDITIONAL SCOPE.
7. FOR ALL EXISTING SURFACES TO REMAIN THAT HAVE BEEN IDENTIFIED TO RECEIVE NEW PAINT: SCRAPE, SPACKLE, PATCH, CLEAN, OR OTHERWISE PREPARE SURFACE TO RECEIVE PAINT WITHOUT NOTICEABLE IMPERFECTION.
8. REFER TO ROOM FINISH LEGEND FOR FLOOR AND WALL FINISHES
9. REFER TO FINISH PLANS FOR EXTENT OF NEW FLOORING.
10. DIRECTIONS WHERE NOTED ARE ALWAYS IN REFERENCE TO PLAN NORTH.
11. SEE SHEET A-001 FOR WALL AND PARTITION TYPES. PARTITION ARE TYPE P1-4 UON
12. DOOR FRAMES ARE TO BE LOCATED 4" FROM ADJACENT WALL, UON.
13. SEE SHEET A-400 FOR STANDARD DIMENSIONS AND MOUNTING HEIGHTS.
14. SEE A-600 AND INTERIOR ELEVATIONS FOR CASEWORK TYPES.

FLOOR PLAN LEGEND

- WALL ASSEMBLY
- EXISTING WALL ASSEMBLY
- OVERHEAD LINE
- TV FLATSCREEN LOCATION, PROVIDE ELEC. AND DATA CONNECTIONS
- CR CARD READER LOCATION

KEYNOTE LEGEND

KEYNOTE	DESCRIPTION
10 2113.15	REINFORCED COMPOSITE TOILET COMPARTMENTS
10 2113.19	SOLID PLASTIC TOILET COMPARTMENTS

SHEET NOTES

NOTE	DESCRIPTION
S57	ACCESSIBLE TOILET STALL: RE: A-400 FOR MOUNTING HEIGHTS AND CLEARANCES
S58	ACCESSIBLE TOILET ROOM; RE: A-400 FOR MOUNTING HEIGHTS AND CLEARANCES
S59	ACCESSIBLE CHILDREN'S TOILET

TOILET ACCESSORY NOTES

NOTE	DESCRIPTION
T01-A	TOILET, RE: PLUMB
T01-B	TOILET, ADA; RE: PLUMB
T01-C	TOILET, CHILDREN'S' RE: PLUMB
T01A	
T02	URINAL, RE: PLUMB
T03	SINGLE LAVATORY, RE: PLUMB
T04	TOILET TISSUE DISPENSER
T04-A	TOILET TISSUE DISPENSER
T05	SANITARY NAPKIN DISPOSAL
T06	SANITARY NAPKIN DISPENSER
T07	TOILET SEAT COVER DISPENSER
T08	LIQUID SOAP DISPENSER
T09	PAPER TOWEL DISPENSER
T10	HAND DRYER
T11	WASTE RECEPTACLE
T12	HORIZONTAL BABY CHANGING STATION
T13	TEMPERED SAFETY GLASS MIRROR
T14	18" VERTICAL GRAB BAR
T15	42" GRAB BAR
T16	36" GRAB BAR
T22	SHOWER SEAT

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1	11-19-2021	CONSTRUCTION DOCUMENTS

RESTROOMS - ENLARGED PLANS AND ELEVATIONS

A-401

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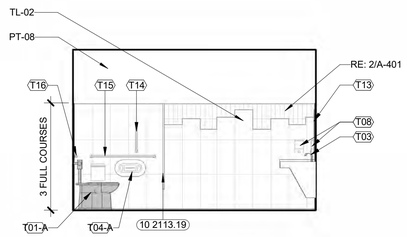
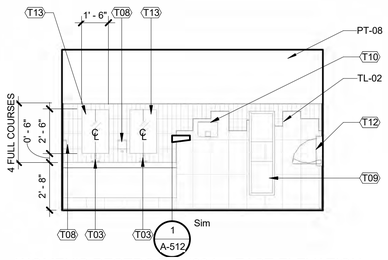


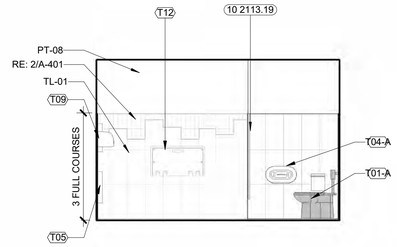
13 A-402 WOMEN'S RESTROOM #234 - NORTH ELEVATION

1/4" = 1'-0"



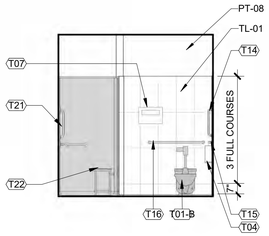
12 A-402 WOMEN'S RESTROOM #234 - EAST ELEVATION

1/4" = 1'-0"



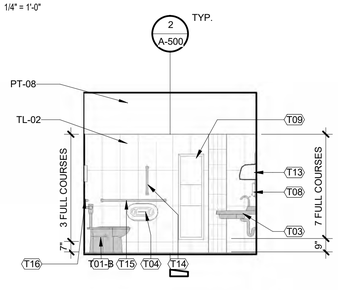
11 A-402 WOMEN'S RESTROOM #234 - SOUTH ELEVATION

1/4" = 1'-0"



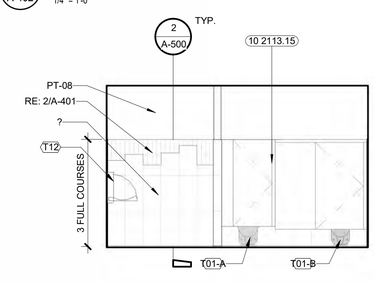
10 A-402 ADA SHOWER #215 - SOUTH ELEVATION

1/4" = 1'-0"



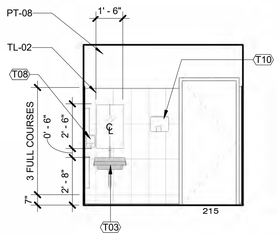
9 A-402 ADA SHOWER #215 - WEST ELEVATION

1/4" = 1'-0"



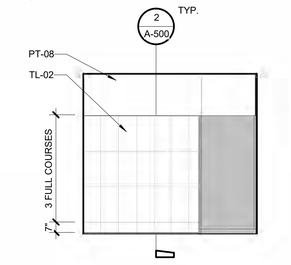
8 A-402 WOMEN'S RESTROOM #234 - WEST ELEVATION

1/4" = 1'-0"



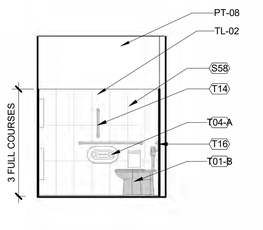
7 A-402 ADA SHOWER #215 - NORTH ELEVATION

1/4" = 1'-0"



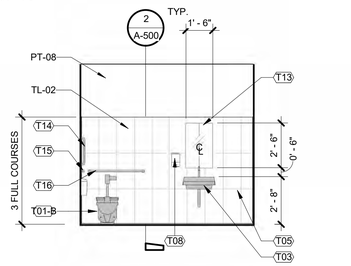
6 A-402 ADA SHOWER #215 - EAST ELEVATION

1/4" = 1'-0"



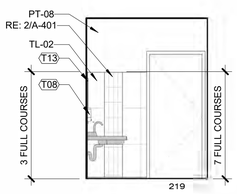
5 A-402 ADA RESTROOM #219 - SOUTH ELEVATION

1/4" = 1'-0"



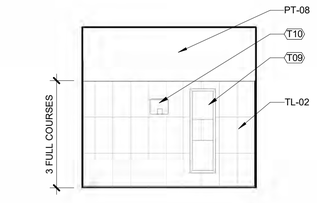
4 A-402 ADA RESTROOM #219 - WEST ELEVATION

1/4" = 1'-0"



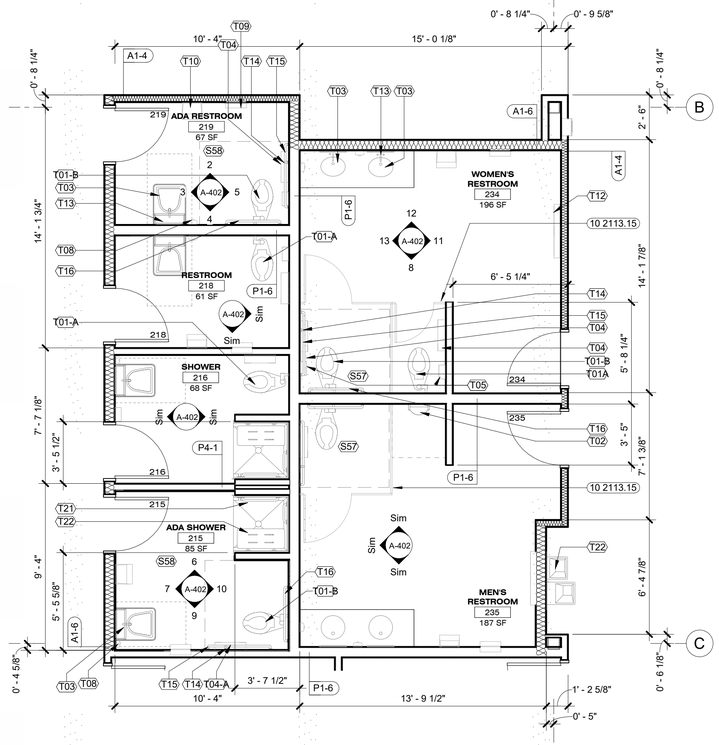
3 A-402 ADA RESTROOM #219 - NORTH ELEVATION

1/4" = 1'-0"



2 A-402 ADA RESTROOM #219 - EAST ELEVATION

1/4" = 1'-0"



1 A-402 ENLARGED FLOOR PLANS RMS #234, #235, #215, #216, #218, #219

1/4" = 1'-0"

GENERAL NOTES: ENLARGED FLOOR PLANS AND INTERIOR ELEVATIONS

1. DO NOT SCALE DRAWINGS. WRITTEN DIMENSIONS SHALL TAKE PRECEDENCE. IF ADDITIONAL DIMENSIONS ARE REQUIRED, CONTACT ARCHITECT.
2. CONTRACTOR TO VERIFY ALL FIELD CONDITIONS AND DIMENSIONS AND LAY OUT PROPOSED WORK PRIOR TO CONSTRUCTION IN NEW WORK AREA. REPORT DISCREPANCIES TO ARCHITECT FOR RESOLUTION.
3. ALL DIMENSIONS ARE SHOWN TO FACE OF DRYWALL FOR NEW PARTITIONS. FINISH MATERIAL SUCH AS TILE OR FRP IS NOT ACCOUNTED FOR IN GIVEN DIMENSIONS.
4. IN THE EVENT OF CONFLICTING OR UNCLEAR INFORMATION, CONTRACTOR SHALL CONTACT ARCHITECT FOR CLARIFICATION.
5. ALL WORK SHALL CONFORM TO APPLICABLE CODES. NOTIFY ARCHITECT OF ANY CONDITIONS OR DETAILS WHICH ARE DEEMED TO BE NONCONFORMING.
6. COORDINATE WITH ALL OTHER DRAWINGS AND SPECIFICATIONS FOR ADDITIONAL SCOPE.
7. FOR ALL EXISTING SURFACES TO REMAIN THAT HAVE BEEN IDENTIFIED TO RECEIVE NEW PAINT: SCRAPE, SPACKLE, PATCH, CLEAN, OR OTHERWISE PREPARE SURFACE TO RECEIVE PAINT WITHOUT NOTICEABLE IMPERFECTION.
8. REFER TO ROOM FINISH LEGEND FOR FLOOR AND WALL FINISHES
9. REFER TO FINISH PLANS FOR EXTENT OF NEW FLOORING.
10. DIRECTIONS WHERE NOTED ARE ALWAYS IN REFERENCE TO PLAN NORTH.
11. SEE SHEET A-001 FOR WALL AND PARTITION TYPES. PARTITION ARE TYPE P1-4 UON
12. DOOR FRAMES ARE TO BE LOCATED 4" FROM ADJACENT WALL, UON.
13. SEE SHEET A-400 FOR STANDARD DIMENSIONS AND MOUNTING HEIGHTS.
14. SEE A-600 AND INTERIOR ELEVATIONS FOR CASEWORK TYPES.

FLOOR PLAN LEGEND

- WALL ASSEMBLY
- EXISTING WALL ASSEMBLY
- OVERHEAD LINE
- TV FLATSCREEN LOCATION, PROVIDE ELEC. AND DATA CONNECTIONS
- CR CARD READER LOCATION

KEYNOTE LEGEND

KEYNOTE	DESCRIPTION
10 2113.15	REINFORCED COMPOSITE TOILET COMPARTMENTS
10 2113.19	SOLID PLASTIC TOILET COMPARTMENTS

SHEET NOTES

NOTE	DESCRIPTION
S57	ACCESSIBLE TOILET STALL: RE: A-400 FOR MOUNTING HEIGHTS AND CLEARANCES
S58	ACCESSIBLE TOILET ROOM; RE: A-400 FOR MOUNTING HEIGHTS AND CLEARANCES

TOILET ACCESSORY NOTES

NOTE	DESCRIPTION
T01-A	TOILET, RE: PLUMB
T01-B	TOILET, ADA; RE: PLUMB
T01A	
T02	URINAL, RE: PLUMB
T03	SINGLE LAVATORY, RE: PLUMB
T04	TOILET TISSUE DISPENSER
T04-A	TOILET TISSUE DISPENSER
T05	SANITARY NAPKIN DISPOSAL
T07	TOILET SEAT COVER DISPENSER
T08	LIQUID SOAP DISPENSER
T09	PAPER TOWEL DISPENSER
T10	HAND DRYER
T12	HORIZONTAL BABY CHANGING STATION
T13	TEMPERED SAFETY GLASS MIRROR
T14	18" VERTICAL GRAB BAR
T15	42" GRAB BAR
T16	36" GRAB BAR
T21	SHOWER ROD
T22	SHOWER SEAT

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PROJECT:
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RESTROOMS - ENLARGED PLANS AND ELEVATIONS

A-402

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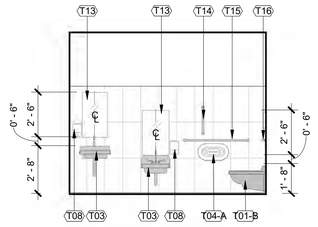
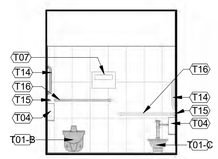


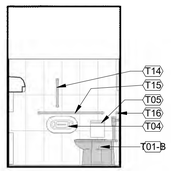
9 A-403 RESTROOM #148 - SOUTH ELEVATION

1/4" = 1'-0"



10 A-403 RESTROOM #148 - WEST ELEVATION

1/4" = 1'-0"



7 A-403 RESTROOM RM #109 - SOUTH ELEVATION

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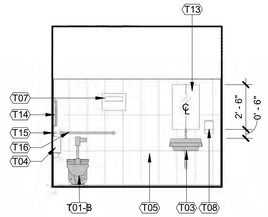
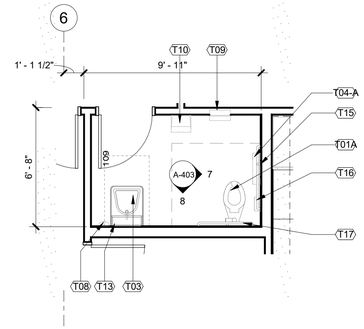


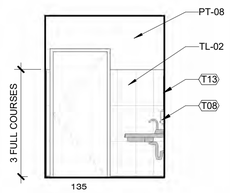
8 A-403 RESTROOM RM #109 - WEST ELEVATION

1/4" = 1'-0"



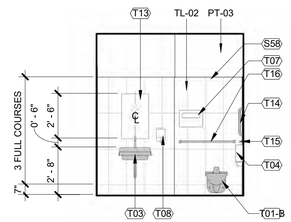
6 A-403 ENLARGED FLOOR PLAN RESTROOM RM #109

1/4" = 1'-0"



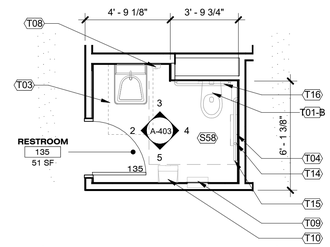
2 A-403 RESTROOM #135 - NORTH ELEVATION

1/4" = 1'-0"



3 A-403 RESTROOM #135 - EAST ELEVATION

1/4" = 1'-0"



1 A-403 ENLARGED FLOOR PLAN RESTROOM RM #135

1/4" = 1'-0"

GENERAL NOTES: ENLARGED FLOOR PLANS AND INTERIOR ELEVATIONS

1. DO NOT SCALE DRAWINGS. WRITTEN DIMENSIONS SHALL TAKE PRECEDENCE. IF ADDITIONAL DIMENSIONS ARE REQUIRED, CONTACT ARCHITECT.
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4. IN THE EVENT OF CONFLICTING OR UNCLEAR INFORMATION, CONTRACTOR SHALL CONTACT ARCHITECT FOR CLARIFICATION.
5. ALL WORK SHALL CONFORM TO APPLICABLE CODES. NOTIFY ARCHITECT OF ANY CONDITIONS OR DETAILS WHICH ARE DEEMED TO BE NONCONFORMING.
6. COORDINATE WITH ALL OTHER DRAWINGS AND SPECIFICATIONS FOR ADDITIONAL SCOPE.
7. FOR ALL EXISTING SURFACES TO REMAIN THAT HAVE BEEN IDENTIFIED TO RECEIVE NEW PAINT: SCRAPE, SPACKLE, PATCH, CLEAN, OR OTHERWISE PREPARE SURFACE TO RECEIVE PAINT WITHOUT NOTICEABLE IMPERFECTION.
8. REFER TO ROOM FINISH LEGEND FOR FLOOR AND WALL FINISHES
9. REFER TO FINISH PLANS FOR EXTENT OF NEW FLOORING.
10. DIRECTIONS WHERE NOTED ARE ALWAYS IN REFERENCE TO PLAN NORTH.
11. SEE SHEET A-001 FOR WALL AND PARTITION TYPES. PARTITION ARE TYPE P1-4 UON
12. DOOR FRAMES ARE TO BE LOCATED 4" FROM ADJACENT WALL, UON.
13. SEE SHEET A-400 FOR STANDARD DIMENSIONS AND MOUNTING HEIGHTS.
14. SEE A-600 AND INTERIOR ELEVATIONS FOR CASEWORK TYPES.

FLOOR PLAN LEGEND

- WALL ASSEMBLY
- EXISTING WALL ASSEMBLY
- OVERHEAD LINE
- TV FLATSCREEN LOCATION, PROVIDE ELEC. AND DATA CONNECTIONS
- CR CARD READER LOCATION

KEYNOTE LEGEND	
KEYNOTE	DESCRIPTION

SHEET NOTES	
NOTE	DESCRIPTION
S58	ACCESSIBLE TOILET ROOM; RE: A-400 FOR MOUNTING HEIGHTS AND CLEARANCES

TOILET ACCESSORY NOTES	
NOTE	DESCRIPTION
T01-B	TOILET, ADA; RE: PLUMB
T01-C	TOILET, CHILDREN'S' RE: PLUMB
T01A	
T03	SINGLE LAVATORY, RE: PLUMB
T04	TOILET TISSUE DISPENSER
T04-A	TOILET TISSUE DISPENSER
T05	SANITARY NAPKIN DISPOSAL
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T14	18" VERTICAL GRAB BAR
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T16	36" GRAB BAR
T17	

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RESTROOMS - ENLARGED PLANS AND ELEVATIONS

A-403

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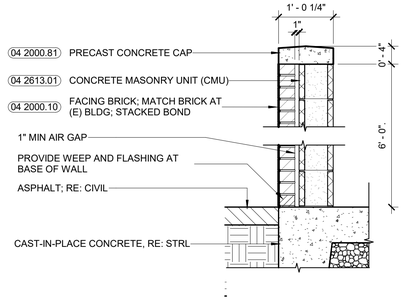
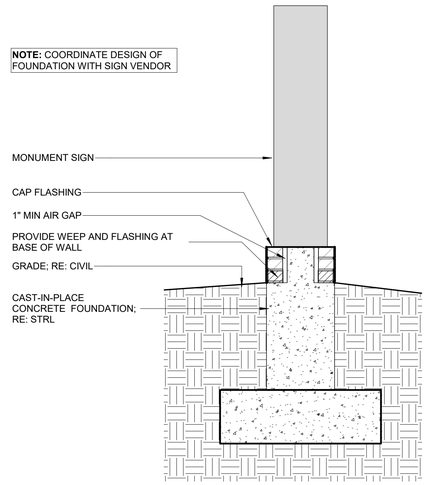


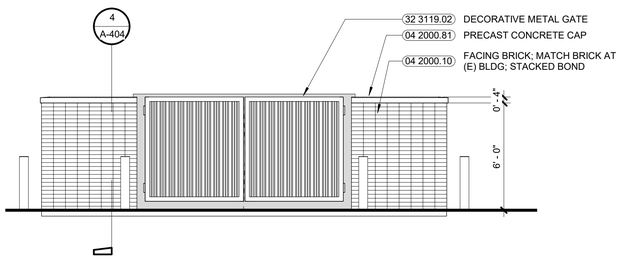
4 A-404 EMERGENCY GENERATOR ENCLOSURE WALL SECTION

3/4" = 1'-0"



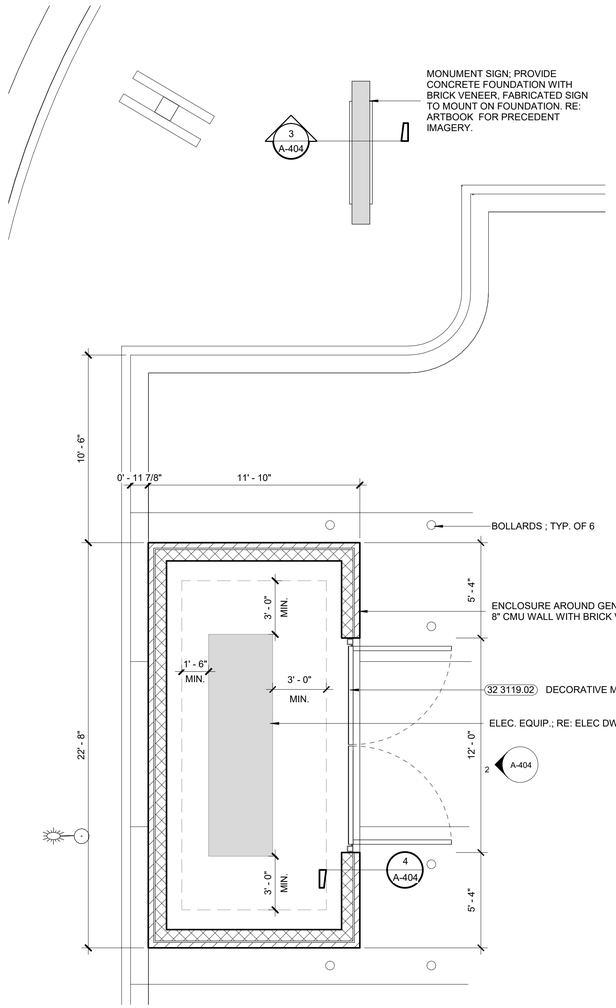
3 A-404 MONUMENT SIGN SECTION DETAIL

3/4" = 1'-0"



2 A-404 EMERGENCY GENERATOR ENCLOSURE - SOUTH ELEVATION

1/4" = 1'-0"



1 A-404 EMERGENCY GENERATOR ENCLOSURE - ENLARGED PLAN

1/4" = 1'-0"

GENERAL NOTES: ENLARGED FLOOR PLANS AND INTERIOR ELEVATIONS

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FLOOR PLAN LEGEND

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ENLARGED PLANS - EMERGENCY GENERATOR

A-404

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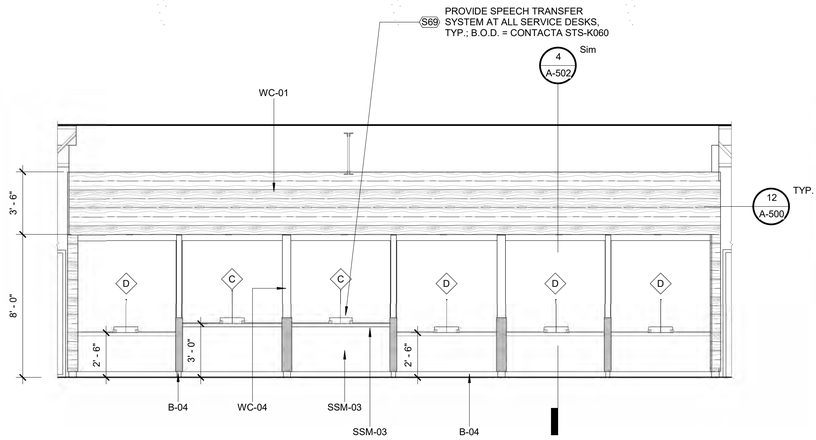
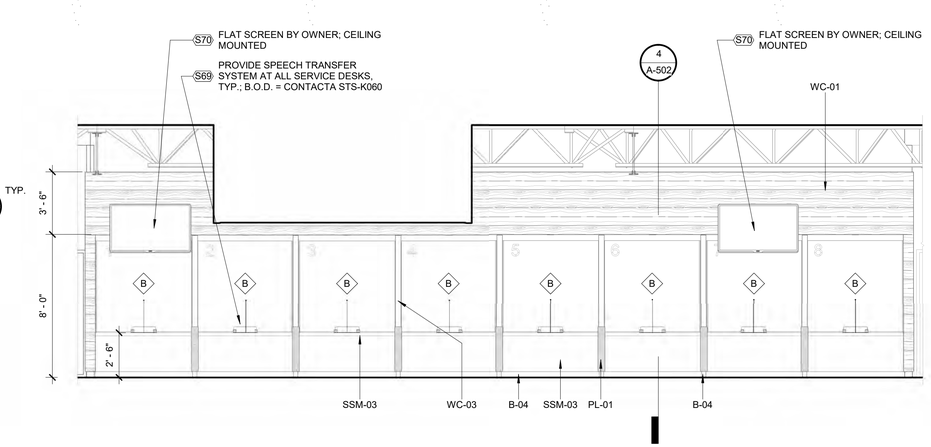


8 A-405 CUSTOMER SERVICE DESKS - INT. ELEVATION

1/4" = 1'-0"



7 A-405 MOTOR VEHICLES SERVICE DESKS - INT. ELEVATION

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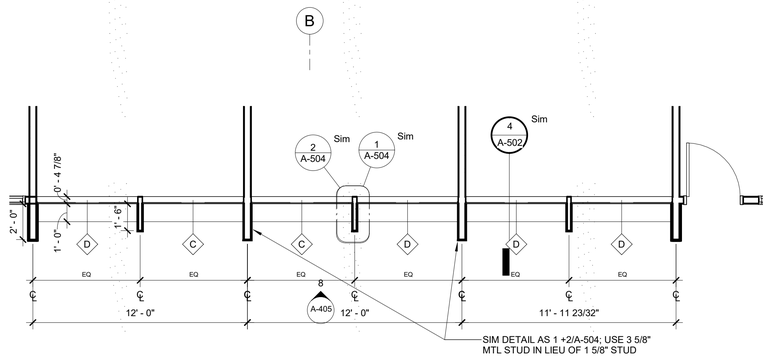
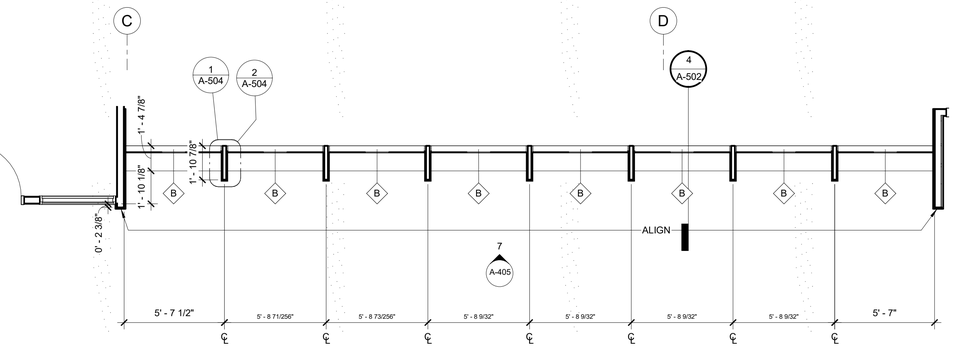
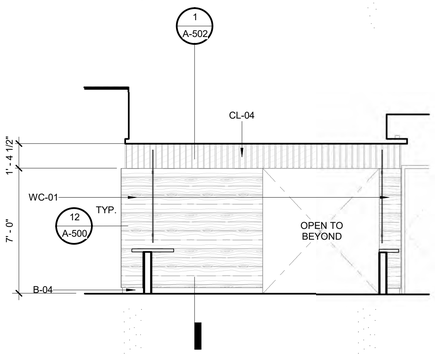




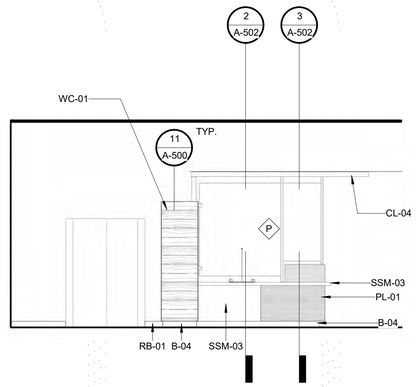
6 A-405 ENLARGED PLAN AT SERVICE DESKS

1/4" = 1'-0"



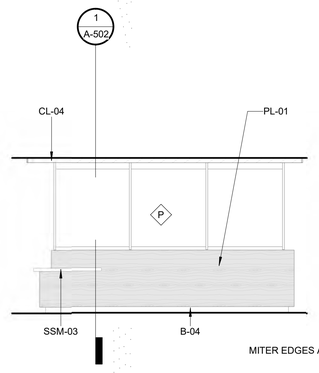
5 A-405 FRONT DESK - BACK WALL - SOUTH ELEVATION

1/4" = 1'-0"



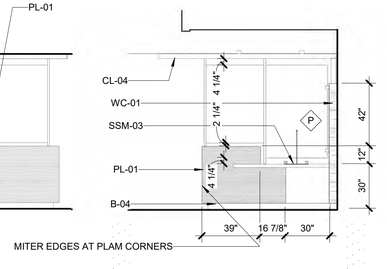
4 A-405 FRONT DESK - WEST ELEVATION

1/4" = 1'-0"



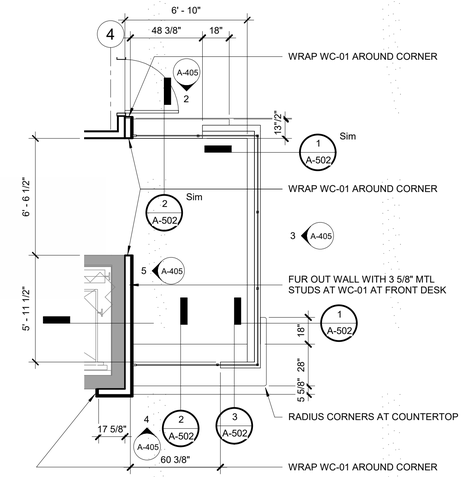
3 A-405 FRONT DESK - SOUTH ELEVATION

1/4" = 1'-0"



2 A-405 FRONT DESK - EAST ELEVATION

1/4" = 1'-0"



1 A-405 ENLARGED PLAN AT FRONT DESK

1/4" = 1'-0"

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FLOOR PLAN LEGEND

- WALL ASSEMBLY
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ENLARGED PLANS / INTERIOR ELEVATIONS - LOBBY

A-405

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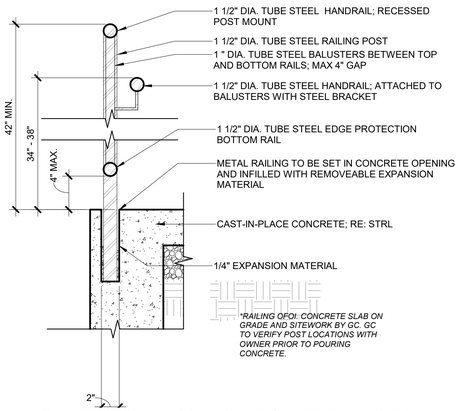
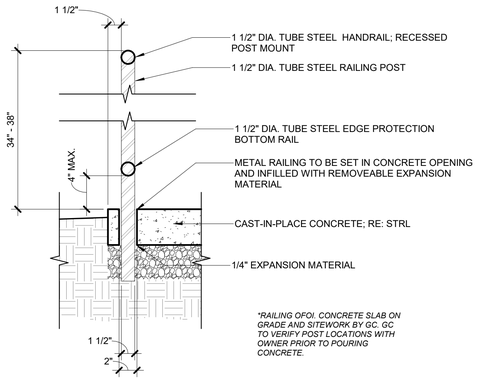


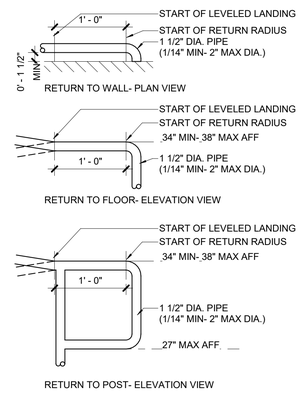
10 A-406 RECESSED POST MOUNT GUARD RAILING DETAIL

1 1/2" = 1'-0"



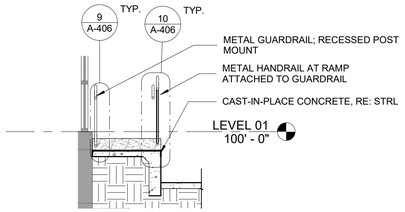
9 A-406 RECESSED POST MOUNT RAILING DETAIL

1 1/2" = 1'-0"



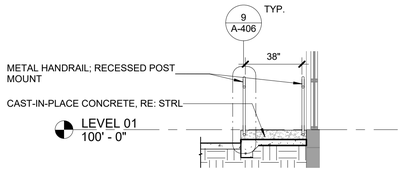
8 A-406 HANDRAIL EXTENSION DETAILS

1" = 1'-0"



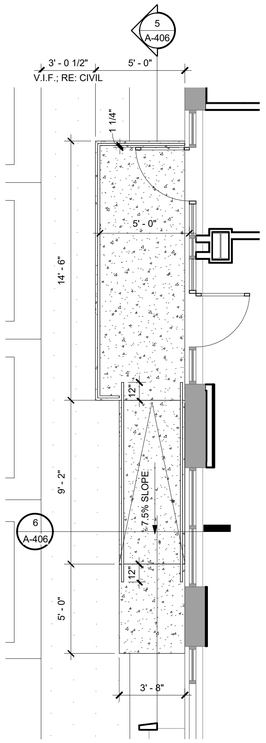
7 A-406 SOUTH EXTERIOR RAMP CROSS SECTION

1/4" = 1'-0"



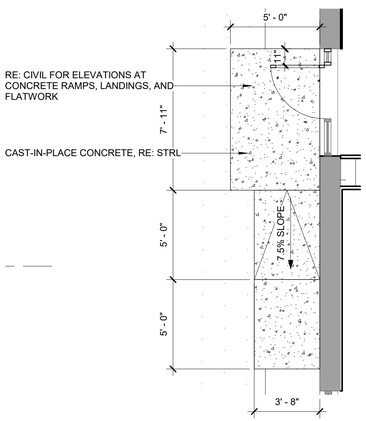
6 A-406 NORTH EXTERIOR RAMP CROSS SECTION

1/4" = 1'-0"



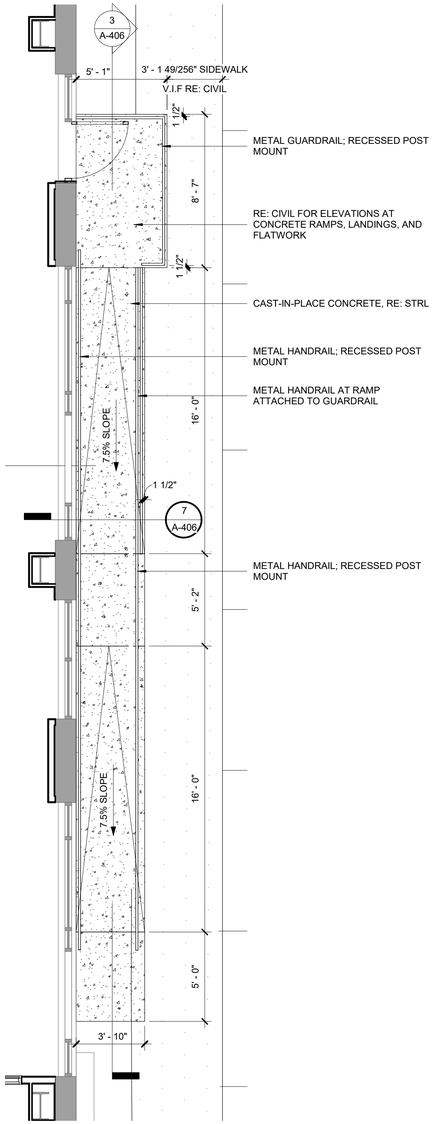
4 A-406 ENLARGED PLAN - NORTH EXTERIOR RAMP #1

1/4" = 1'-0"



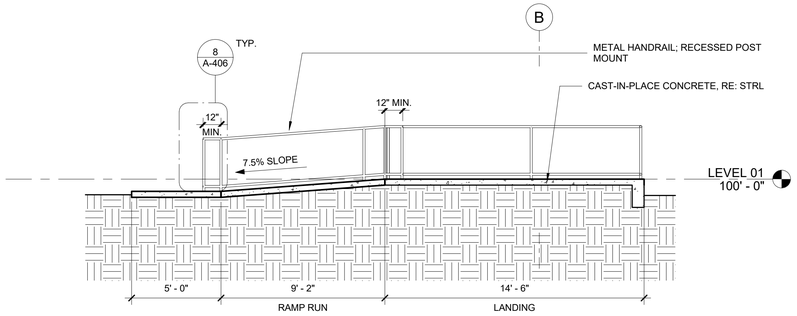
2 A-406 ENLARGED PLAN - NORTH EXTERIOR RAMP #2

1/4" = 1'-0"



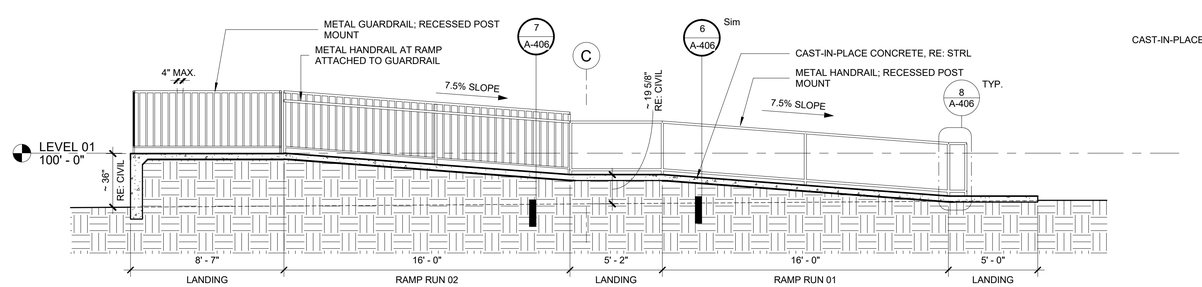
1 A-406 ENLARGED PLAN - SOUTH EXTERIOR ENTRY/RAMP

1/4" = 1'-0"



5 A-406 NORTH EXTERIOR RAMP LONGITUDINAL SECTION

1/4" = 1'-0"



3 A-406 SOUTH EXTERIOR RAMP LONGITUDINAL SECTION

1/4" = 1'-0"

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ENLARGED PLANS - EXTERIOR ENTRANCE

A-406

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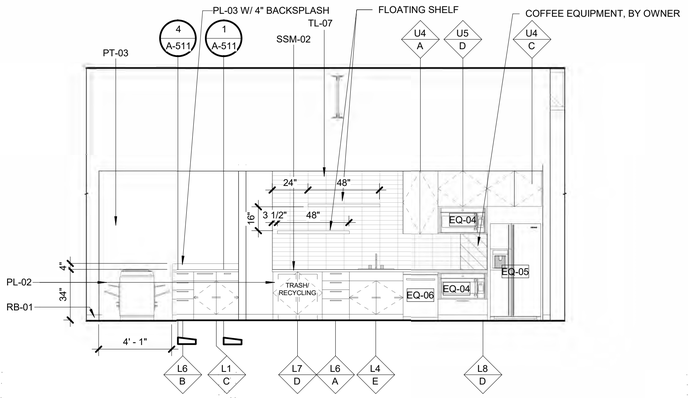
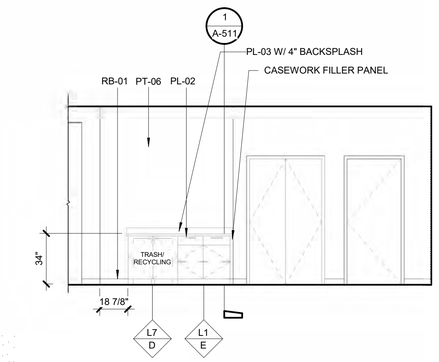


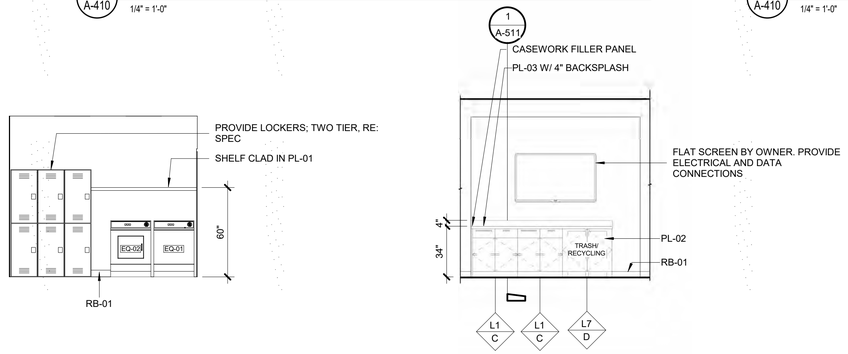
10 A-410 OPEN OFFICE RM #106 - NORTH ELEVATION

1/4" = 1'-0"



9 A-410 MOTOR VEHICLES #103- EAST ELEVATION

1/4" = 1'-0"



8 A-410 HHS LAUNDRY / STOR. RM #130 - EAST ELEVATION

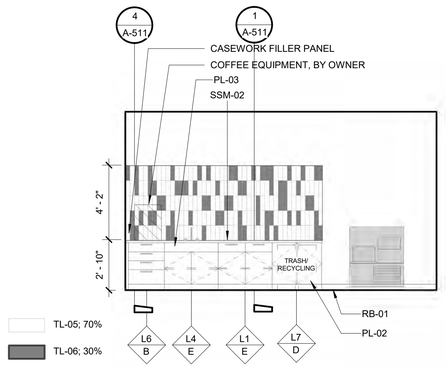
1/4" = 1'-0"

7 A-410 TRAINING RM #132 - SOUTH ELEVATION

1/4" = 1'-0"

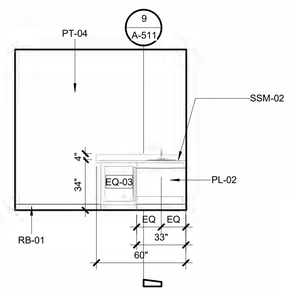
6 A-410 TRAINING RM #131 - SOUTH ELEVATION

1/4" = 1'-0"



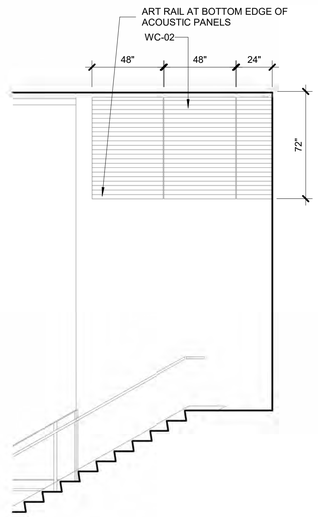
5 A-410 OPEN LOUNGE #134 - SOUTH ELEVATION

1/4" = 1'-0"



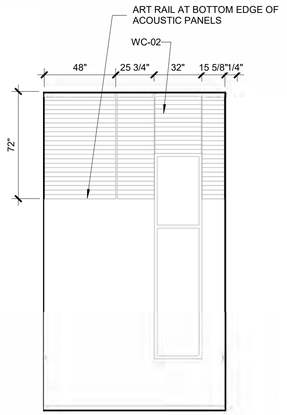
4 A-410 WELLNESS ROOM #138 - EAST ELEVATION

1/4" = 1'-0"



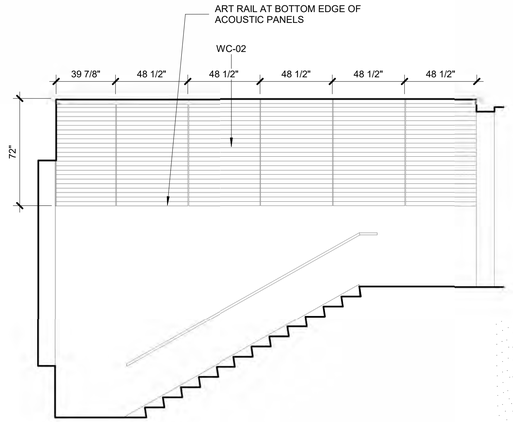
3 A-410 (E) STAIR 1 - SOUTH ELEVATION

1/4" = 1'-0"



2 A-410 (E) STAIR 1 - WEST ELEVATION

1/4" = 1'-0"



1 A-410 (E) STAIR 1 - NORTH ELEVATION

1/4" = 1'-0"

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INTERIOR ELEVATIONS

A-410

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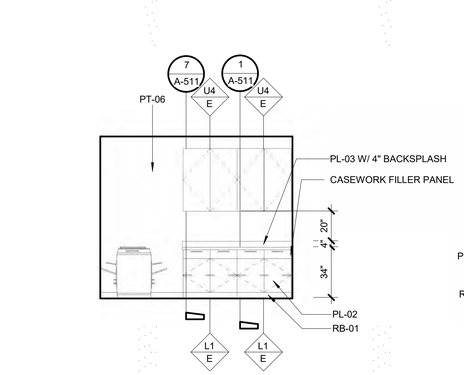
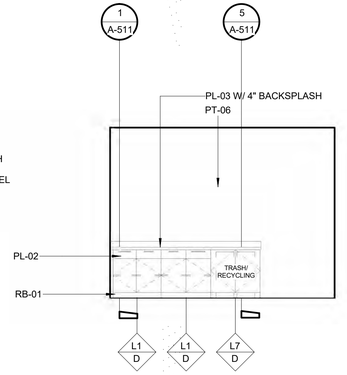


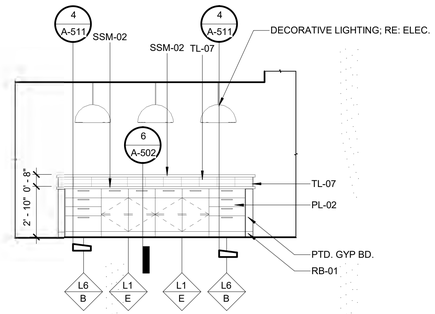
9 A-420 COPY / MAIL / SUPPLY RM #232 - SOUTH ELEVATION

1/4" = 1'-0"



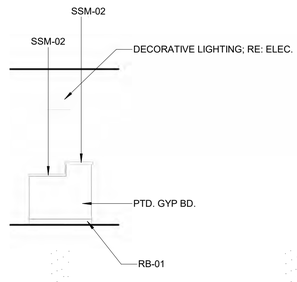
8 A-420 OPEN OFFICE RM #222 - WEST ELEVATION

1/4" = 1'-0"



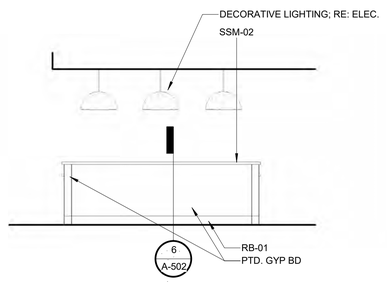
7 A-420 BREAK AREA RM #246 - WEST ELEVATION

1/4" = 1'-0"



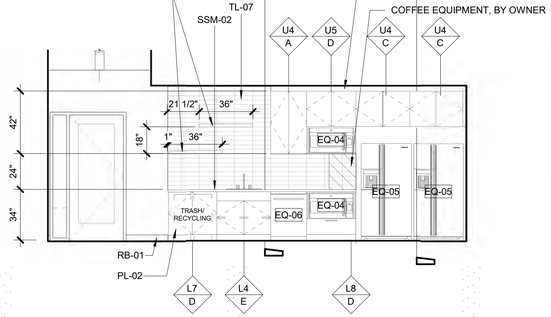
6 A-420 BREAK AREA RM #246 - NORTH ELEVATION

1/4" = 1'-0"



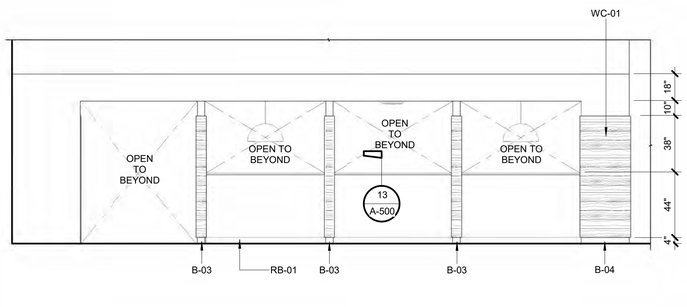
5 A-420 BREAK AREA RM #246 - EAST ELEVATION

1/4" = 1'-0"



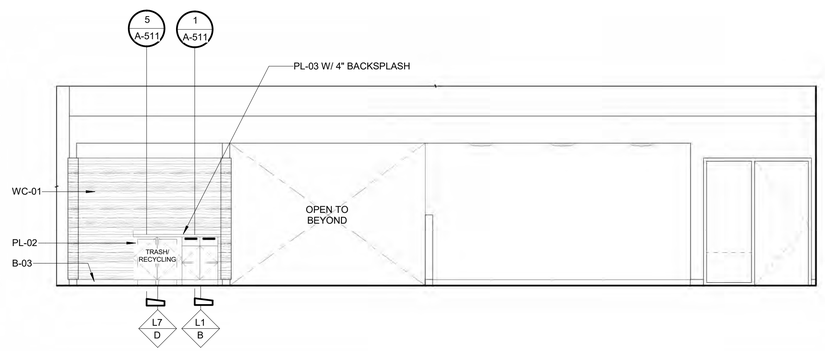
4 A-420 BREAK AREA RM #246 -EAST ELEVATION

1/4" = 1'-0"



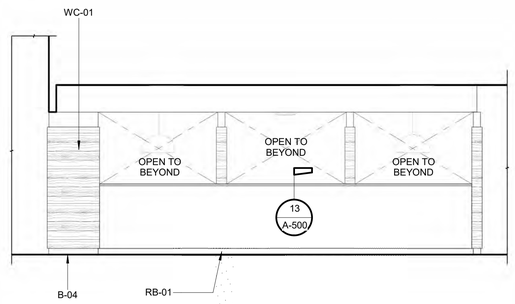
3 A-420 BUSINESS CENTER NOOKS - WEST ELEVATION

1/4" = 1'-0"



2 A-420 BUSINESS CENTER NOOKS - NORTH ELEVATION

1/4" = 1'-0"



1 A-420 BUSINESS CENTER NOOKS - EAST ELEVATION

1/4" = 1'-0"

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INTERIOR ELEVATIONS

A-420

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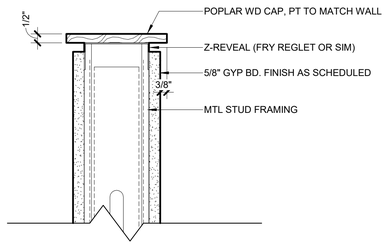
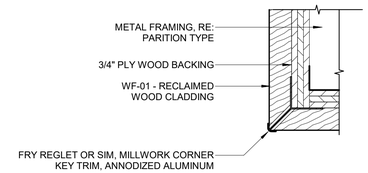


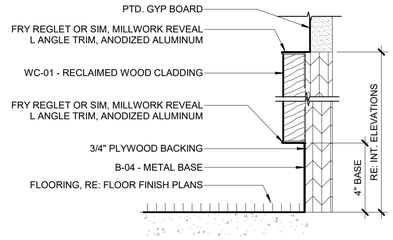
13 A-500 WALL CAP DETAIL

3" = 1'-0"



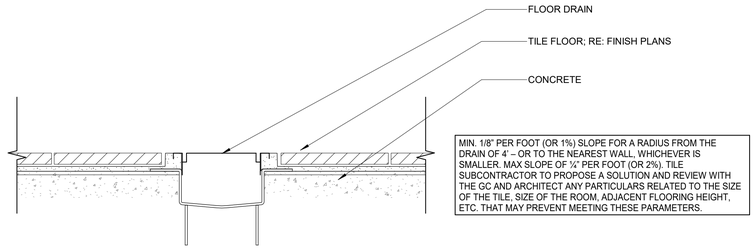
12 A-500 WC-01 CORNER DETAIL

1'-0" = 1'-0"



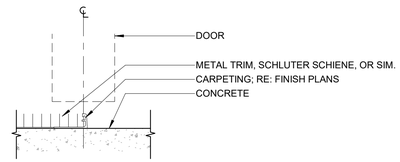
11 A-500 WC-01 BASE AND TOP DETAILS

1'-0" = 1'-0"



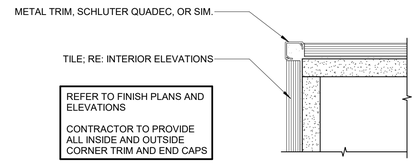
10 A-500 FLOOR DRAIN DETAIL

6" = 1'-0"



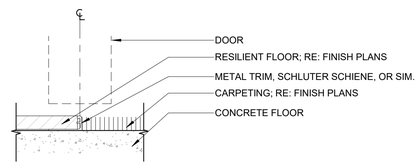
9 A-500 FLOORING TRANSITION - CARPET TO CONCRETE

1'-0" = 1'-0"



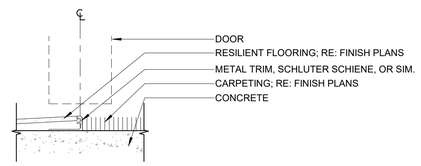
8 A-500 WALL TRANSITION - TILE TO TILE - OUTSIDE CORNER

6" = 1'-0"



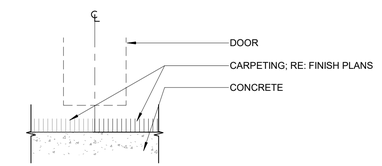
7 A-500 FLOORING TRANSITION - CARPET TO RESILIENT

6" = 1'-0"



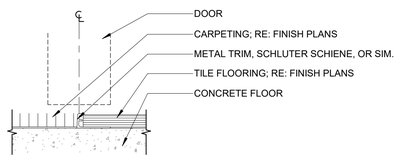
6 A-500 FLOORING TRANSITION - CARPET TO RESILIENT - FLOAT

6" = 1'-0"



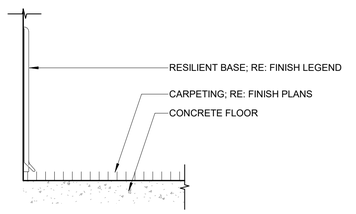
5 A-500 FLOORING TRANSITION - CARPET TO CARPET

6" = 1'-0"



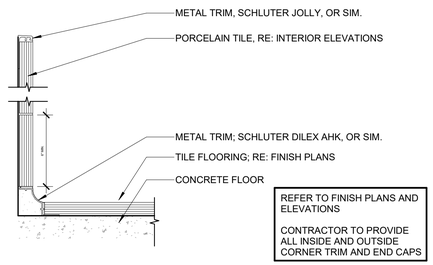
4 A-500 FLOORING TRANSITION - CARPET TO TILE

6" = 1'-0"



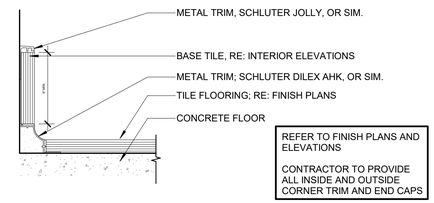
3 A-500 FLOORING TRANSITION - CARPET OR LVT TO RUBBER BASE

1'-0" = 1'-0"



2 A-500 FLOORING TRANSITION - TILE TO WALL TILE - COVED BASE

6" = 1'-0"



1 A-500 FLOORING TRANSITION - TILE TO CUT TILE - COVED BASE

6" = 1'-0"

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DETAILS - FINISH DETAILS

A-500

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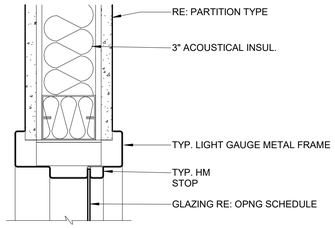
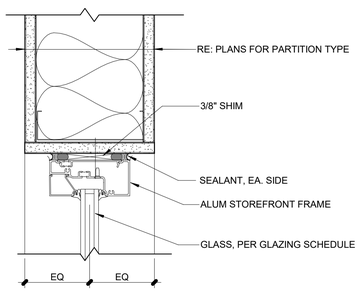


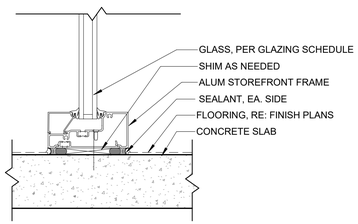
8 A-501 HEAD/JAMB DETAIL FOR HM WINDOW

3" = 1'-0"



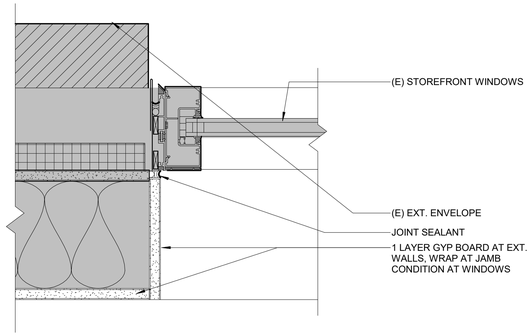
5 A-501 HEAD/JAMB DETAIL FOR TYP. INT STOREFRONT

3" = 1'-0"



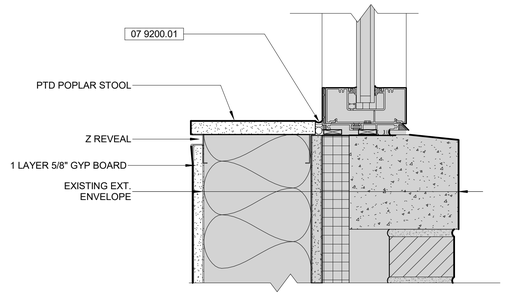
3 A-501 SILL DETAIL FOR TYP. INT STOREFRONT

3" = 1'-0"



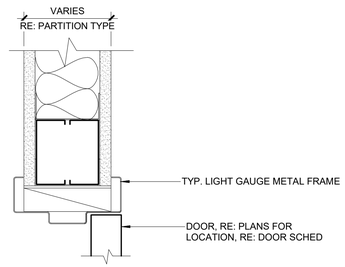
9 A-501 JAMB DETAIL @ (E) EXT. STOREFRONT

3" = 1'-0"



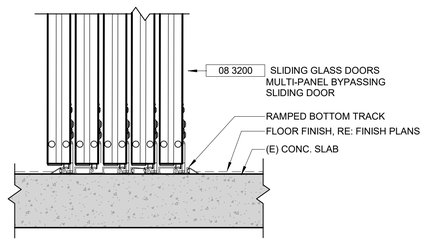
7 A-501 SILL DETAIL@ (E) EXT. STOREFRONT

3" = 1'-0"



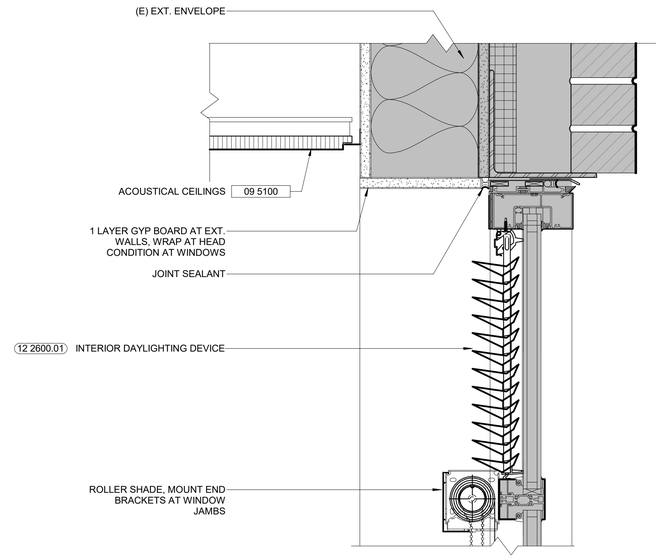
4 A-501 HM DOUBLE RABBET HEAD/JAMB @ GYP PARTITION

3" = 1'-0"



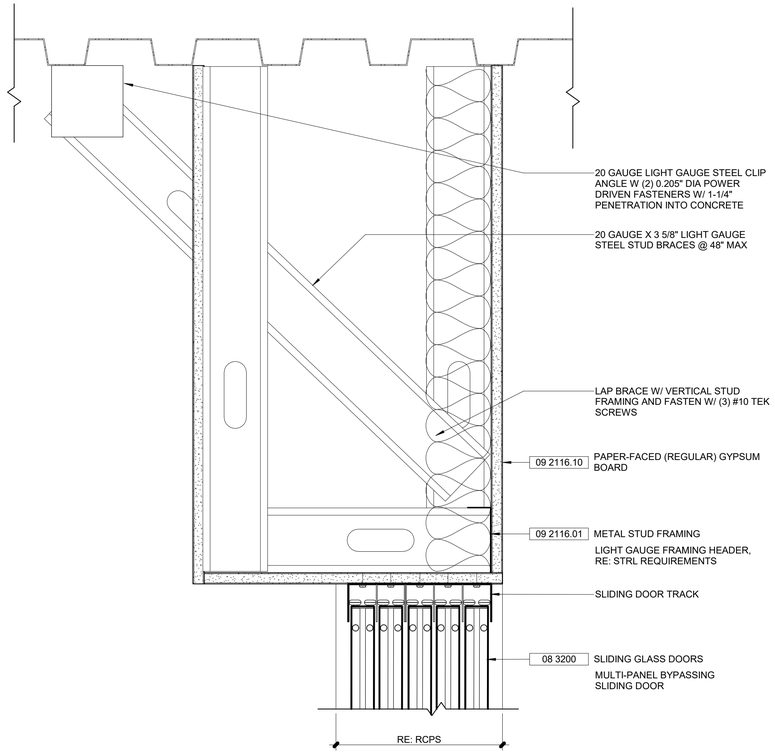
2 A-501 SILL DETAIL FOR MULTI-PANEL SLIDING DOOR

3" = 1'-0"



6 A-501 HEAD DETAIL@ LIGHT LOUVERS

3" = 1'-0"



1 A-501 HEAD DETAIL FOR MULTI-PANEL SLIDING DOOR

3" = 1'-0"

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WINDOW & DOOR DETAILS

A-501

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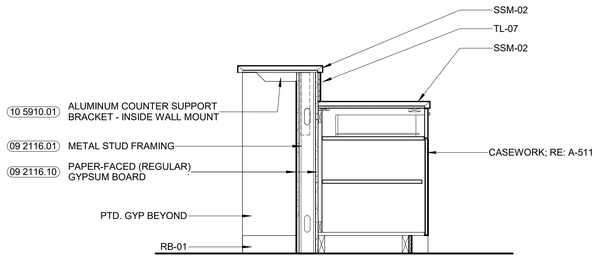
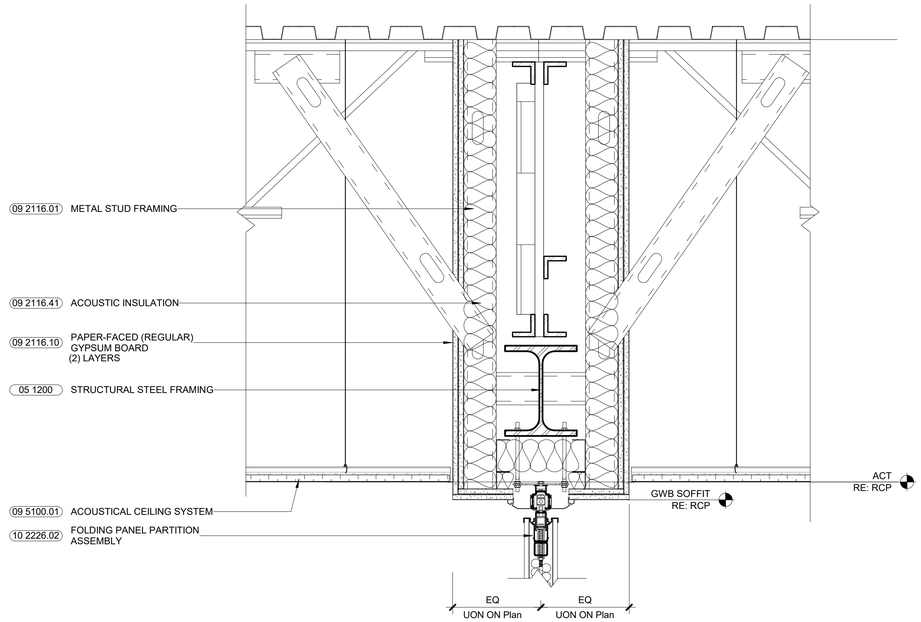


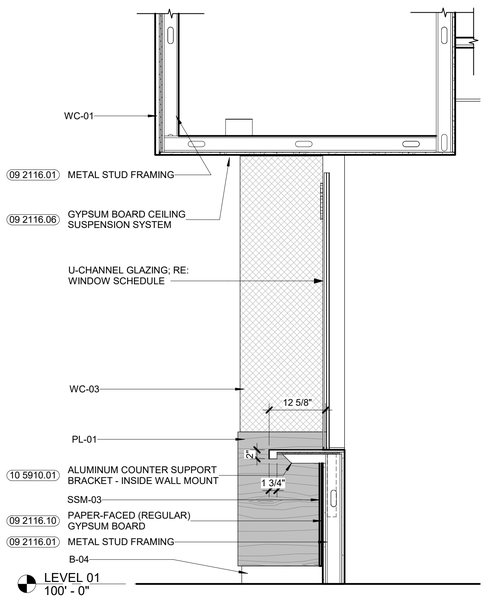
6 A-502 BREAK AREA ISLAND SECTION DETAIL

3/4" = 1'-0"



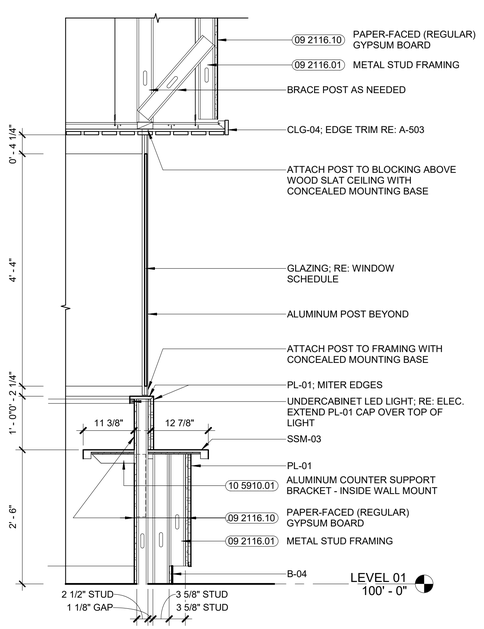
5 A-502 STANDARD OPERABLE PARTITION CEILING DETAIL

1 1/2" = 1'-0"



4 A-502 SECTION DETAIL - MV SERVICE DESK

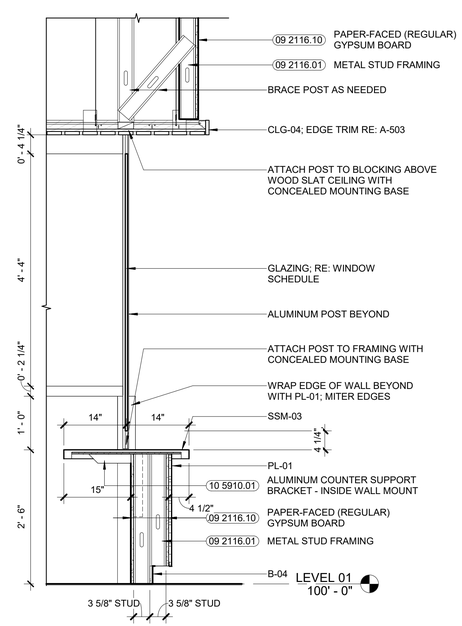
3/4" = 1'-0"



NOTE: AT PARTIAL HEIGHT PARTITIONS PROVIDE STEEL SUPPORTS PER DETAIL ON A-001

3 A-502 SECTION DETAIL 2 - FRONT DESK

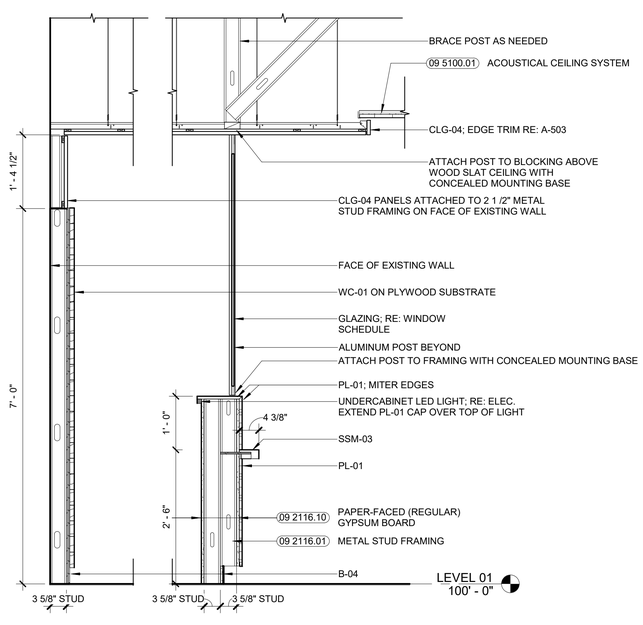
3/4" = 1'-0"



NOTE: AT PARTIAL HEIGHT PARTITIONS PROVIDE STEEL SUPPORTS PER DETAIL ON A-001

2 A-502 SECTION DETAIL 3 - FRONT DESK

3/4" = 1'-0"



NOTE: AT PARTIAL HEIGHT PARTITIONS PROVIDE STEEL SUPPORTS PER DETAIL ON A-001

1 A-502 SECTION DETAIL 1 - FRONT DESK

3/4" = 1'-0"

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SECTION DETAILS

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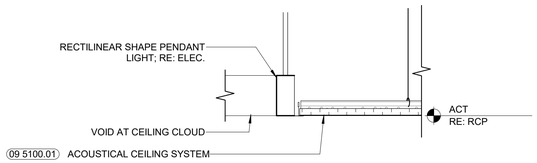
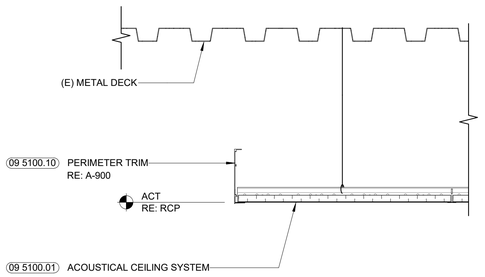


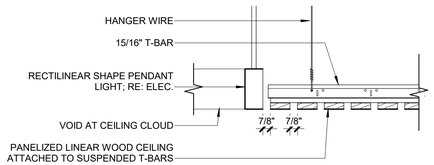
10 A-503 ACT CLOUD OPENING DETAIL

1 1/2" = 1'-0"



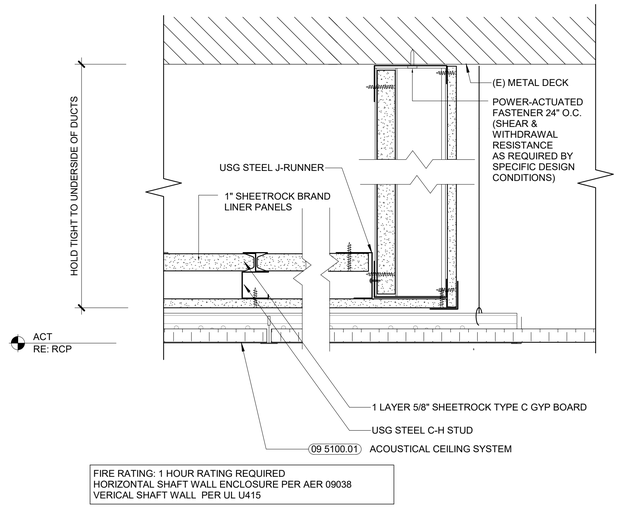
9 A-503 ACT EXPOSED EDGE DETAIL

1 1/2" = 1'-0"



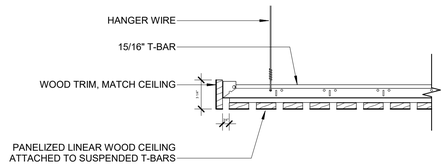
8 A-503 WOOD SLAT CLOUD CEILING OPENING DETAIL

1 1/2" = 1'-0"



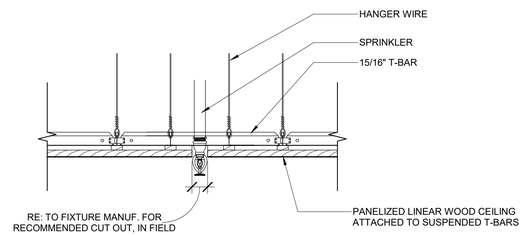
7 A-503 SHAFT WALL CEILING MEMBRANE DETAIL

3" = 1'-0"



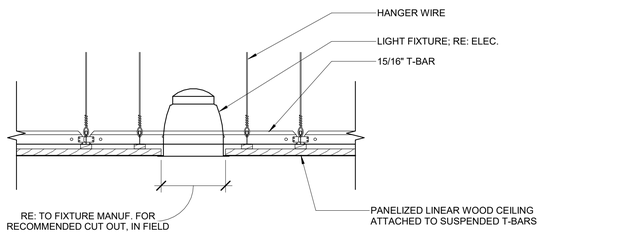
6 A-503 WOOD SLAT CEILING AT PERIMETER

1 1/2" = 1'-0"



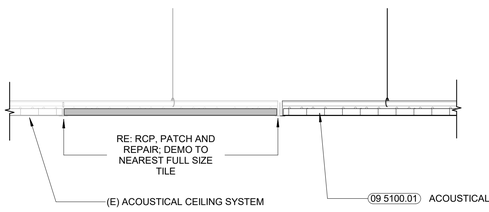
5 A-503 WOOD SLAT CEILING AT SPRINKER

1 1/2" = 1'-0"



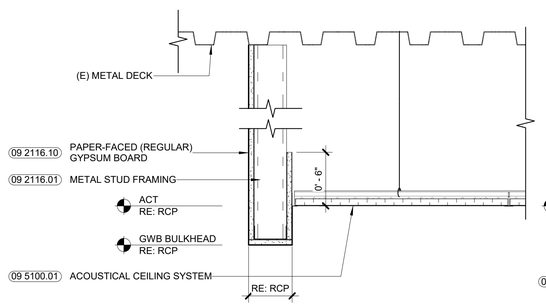
4 A-503 WOOD SLAT CEILING AT LIGHT FIXTURE

1 1/2" = 1'-0"



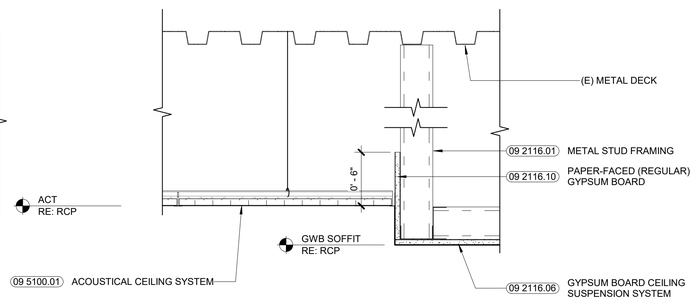
3 A-503 (N) ACT TO (E) ACT

1 1/2" = 1'-0"



2 A-503 ACT TO GWB BULKHEAD

1 1/2" = 1'-0"



1 A-503 GWB SOFFIT TO ACT

1 1/2" = 1'-0"

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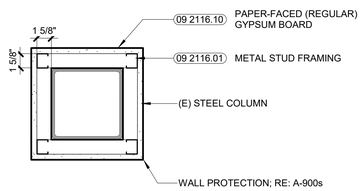
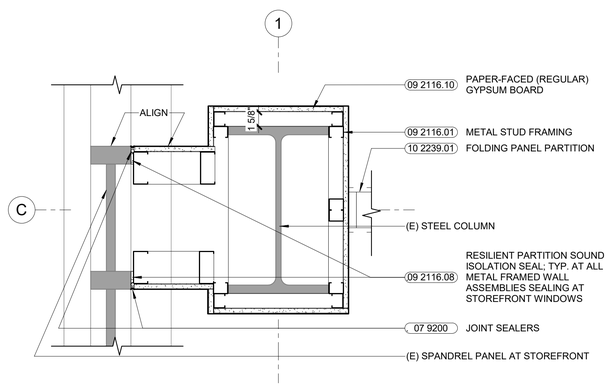
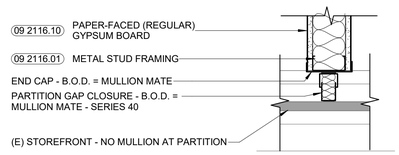


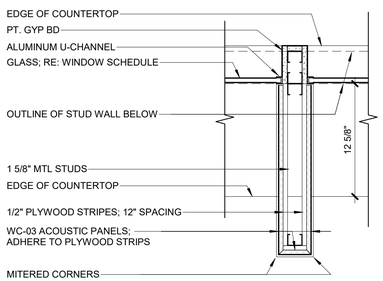
4 A-504 PLAN DETAIL 02- TYP. COLUMN
1 1/2" = 1'-0"



3 A-504 PLAN DETAIL 01
1 1/2" = 1'-0"

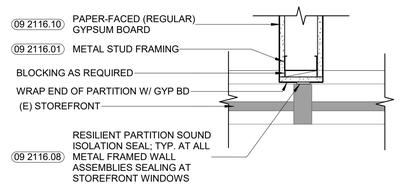


5 A-504 PLAN DETAIL 03
1 1/2" = 1'-0"

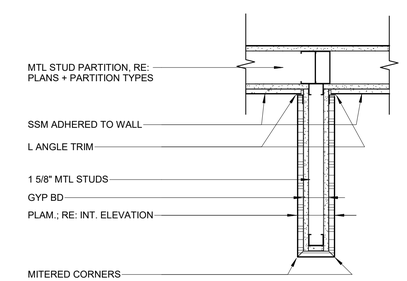


1 A-504 PLAN DTL - SERVICE DESK FIN - ABOVE COUNTER
1 1/2" = 1'-0"

3



6 A-504 PLAN DETAIL 04
1 1/2" = 1'-0"



2 A-504 PLAN DTL - SERVICE DESK FIN - BELOW COUNTER
1 1/2" = 1'-0"

DETAILS

A-504

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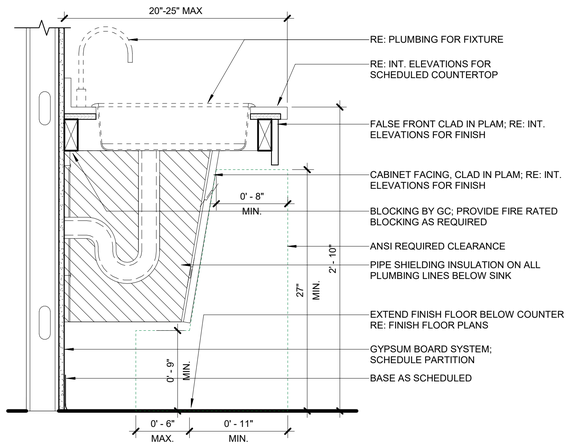
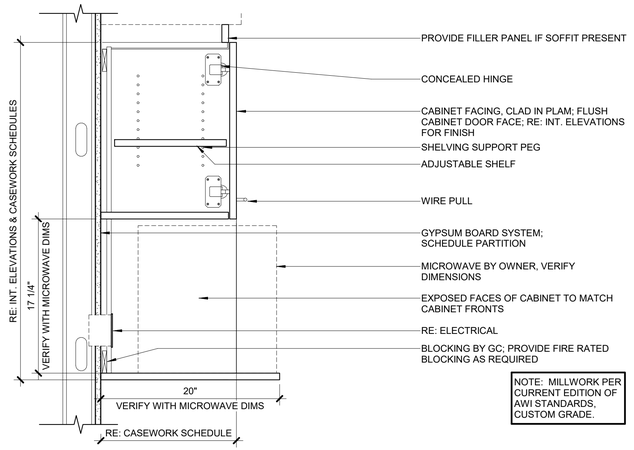


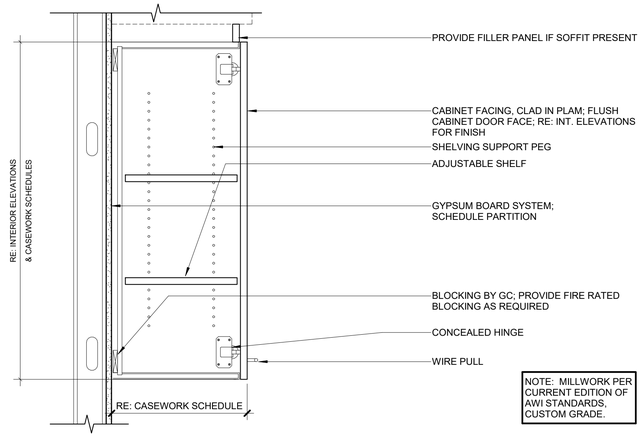
9 A-511 INTERIOR CASEWORK - LAVATORY WITH PLUMBING APRON

1 1/2" = 1'-0"



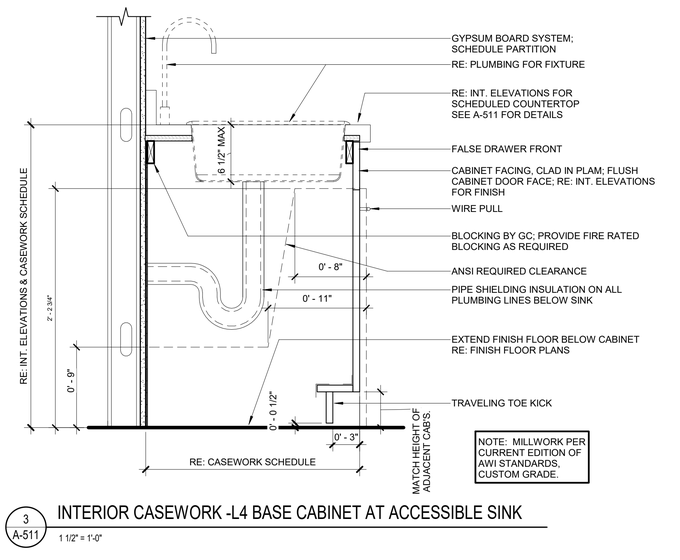
8 A-511 INTERIOR CASEWORK - U5 UPPER CABINET WITH MICROWAVE SHELF

1 1/2" = 1'-0"



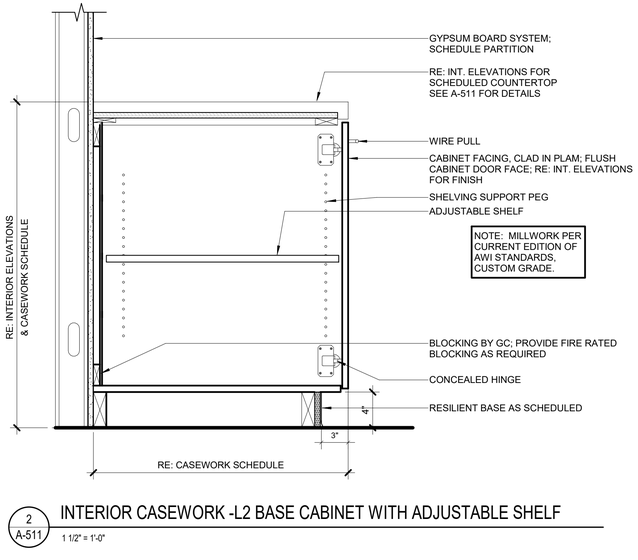
7 A-511 INTERIOR CASEWORK - U4 UPPER CABINET WITH DOORS

1 1/2" = 1'-0"



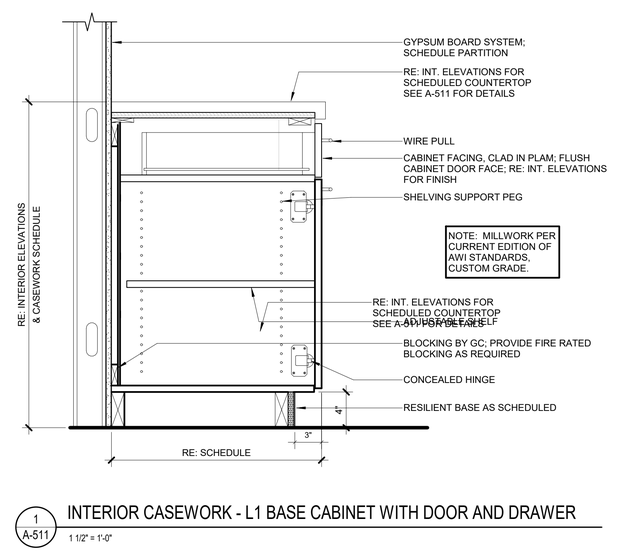
6 A-511 INTERIOR CASEWORK -L8 BASE CABINET WITH MICROWAVE SHELF

1 1/2" = 1'-0"



5 A-511 INTERIOR CASEWORK -L7 BASE CABINET WITH TRASH/RECYCLING

1 1/2" = 1'-0"



4 A-511 INTERIOR CASEWORK - L6 4-DRAWER BASE CABINET

1 1/2" = 1'-0"

3 A-511 INTERIOR CASEWORK -L4 BASE CABINET AT ACCESSIBLE SINK

1 1/2" = 1'-0"

2 A-511 INTERIOR CASEWORK -L2 BASE CABINET WITH ADJUSTABLE SHELF

1 1/2" = 1'-0"

1 A-511 INTERIOR CASEWORK - L1 BASE CABINET WITH DOOR AND DRAWER

1 1/2" = 1'-0"

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STANDARD CASEWORK DETAILS

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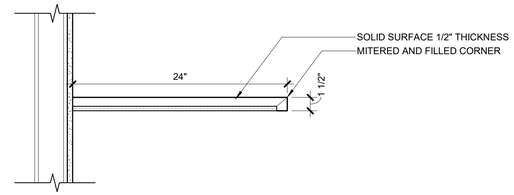
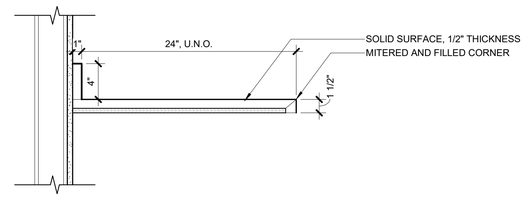


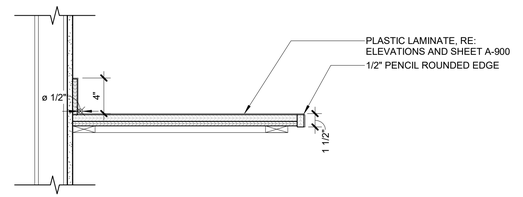
4 A-512 SSM COUNTER EDGE DETAIL - NO SPLASH, NON-WET AREAS

1 1/2" = 1'-0"



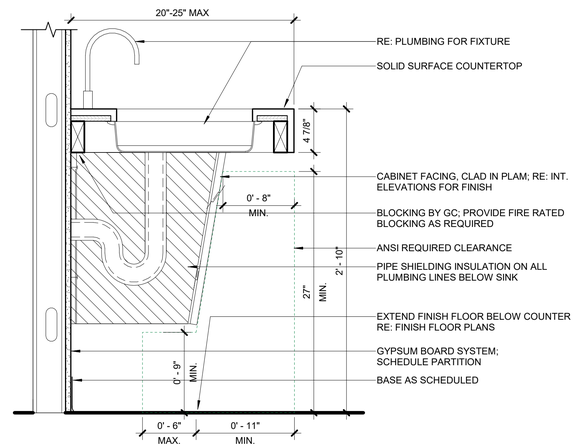
3 A-512 SSM COUNTER EDGE DETAIL - WITH BACKSPLASH

1 1/2" = 1'-0"



2 A-512 PLAM COUNTER EDGE DETAIL, WITH SPLASH

1 1/2" = 1'-0"



1 A-512 INTERIOR CASEWORK - LAVATORY WITH PLUMBING APRON @ RESTROOMS

1 1/2" = 1'-0"

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PROJECT:
SOUTHEAST COUNTY SERVICE HUB
1755 S. PUBLIC RD
LAFAYETTE, CO 80026

PROJECT NO: 2007

#	ISSUE DATE	PHASE / REV NAME
	11-19-2021	CONSTRUCTION DOCUMENTS

CASEWORK AND COUNTERTOP DETAILS

A-512

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APPLIANCE/EQUIPMENT SCHEDULE

TYPE MARK	DESCRIPTION	MANUFACTURER	MODEL	FINISH	DEPTH	WIDTH	HEIGHT	COMMENTS	COUNT	C.F.C.I.	O.F.C.I.	O.F.O.I.
EQ-01	COMMERCIAL TOP LOAD WASHER	MAYTAG	MVWP576K	WHITE	2' - 2"	2' - 3"	3' - 8"		1		X	
EQ-02	COMMERCIAL CLOTHES DRYER	MAYTAG	MEDP576KW	WHITE	2' - 6"	2' - 3"	3' - 6"		1		X	
EQ-03	UNDERCOUNTER ADA REFRIGERATOR	SUMMIT APPLIANCE	AL752BKSSHV	STAINLESS STEEL	1' - 11 1/2"	1' - 11 161/256"	2' - 8"	ADA COMPLIANT AND ENERGY STAR	2		X	
EQ-04	MICROWAVE OVEN	GE	JVM3160RFSS		1' - 3 1/4"	2' - 5 7/8"	1' - 4 1/2"		4		X	
EQ-05	SIDE BY SIDE REFRIGERATOR	GE	GSS25GSHSS	STAINLESS STEEL	2' - 9 5/8"	2' - 11 3/4"	5' - 9 3/4"	ENERGY STAR AND ADA COMPLIANT; COORDINATE WATERLINE WITH PLUMBING	3		X	
EQ-06	UNDERCOUNTER DISHWASHER	GE	GDT225SSLSS	STAINLESS STEEL	2' - 0"	2' - 0"	2' - 8 11/32"	ENERGY STAR AND ADA COMPLIANT; COORDINATE WATER LINE WITH PLUMBING	2		X	
EQ-07	SAFE	HAYMAN	MV3X-1512		1' - 6 3/4"	1' - 5 1/4"	1' - 8 1/4"		2		X	

DOOR SCHEDULE LEGEND:

ABBREVIATIONS

08 1416 FW = FLUSH WOOD

08 1233 HM = HOLLOW METAL/LIGHT GAUGE METAL FRAMES

08 4313 AL = ALUMINUM

AA = ANODIZED ALUMINUM

(E) = EXISTING

HDWR = HARDWARE GROUP

MTRL = MATERIAL

GLAZ = GLAZING TYPE

PT = PAINT

ST = STAIN

SF = STOREFRONT

GENERAL DOOR NOTES:

1. GENERAL CONTRACTOR SHALL BE RESPONSIBLE FOR CONFIRMING ALL DOOR QUANTITIES AND ACUTAL DIMENSIONS OF ALL OPENINGS IN FIELD.
2. ALL GLAZING IN HAZARDOUS LOCATIONS AS DEFINED IN IBC SHALL BE TEMPERED GLASS.
3. ALL EXTERIOR DOORS SHALL BE WEATHERSTRIPPED.
4. FOR ADA SIGNAGE, RE: SPEC SECTION 10 1402 AND A6.02 FOR EXAMPLES OF TYP. SIGNAGE
5. FOR DOOR HARDWARE GROUPS, RE: SPEC SECTION 08 7100

DOOR SCHEDULE

MARK	DOOR TYPE	DOOR MTRL	DOOR FINISH	DOOR WIDTH	DOOR HEIGHT	DOOR GLAZ	FRAME TYPE	FRAME MTRL	FRAME FINISH	FRAME SIDELITE WIDTH	FRAME CLERESTORY HEIGHT	FRAME GLAZ	HDWR	FIRE RATING	STC	COMMENTS
LEVEL 01																
101	A	FW	ST	3' - 0"	7' - 0"		1	HM	PT				9			
103A	A	FW	ST	3' - 0"	7' - 0"		1	HM	PT				10			CARD READER
103B	E	FW	ST	4' - 0"	7' - 0"		1	HM	PT				11			
103C	A	FW	ST	3' - 0"	7' - 0"		1	HM	PT				12			CARD READER
103D	A	FW	ST	3' - 0"	7' - 0"		1	HM	PT				12			CARD READER
104	A	FW	ST	3' - 0"	7' - 0"		1	HM	PT				13			
105	A	FW	ST	3' - 0"	7' - 0"		1	HM	PT				13			
107	A	FW	ST	3' - 0"	7' - 0"		1	HM	PT				14			
108	A	FW	ST	3' - 0"	7' - 0"		1	HM	PT				15			
109	A	FW	ST	3' - 0"	7' - 0"		1	HM	PT				16			
110A	A	FW	ST	3' - 0"	7' - 0"		1	HM	PT				10			CARD READER
110B	B	AL	AA	3' - 2"	7' - 3"	GL-1 T	SF	AL	AA				3			CARD READER; STOREFRONT RE: A-602
111A	A	FW	ST	3' - 0"	7' - 0"		1	HM	PT				15			
111B	A	FW	ST	3' - 0"	7' - 0"		1	HM	PT				17			CARD READER
112	A	FW	ST	3' - 0"	7' - 0"		1	HM	PT				19			CARD READER
113	A	FW	ST	3' - 0"	7' - 0"		1	HM	PT				18			
114	A	FW	ST	3' - 0"	7' - 0"		1	HM	PT				19			CARD READER
115A	A	FW	ST	3' - 0"	7' - 0"		1	HM	PT				15			
115B	A	FW	ST	3' - 0"	7' - 0"		1	HM	PT				17			CARD READER
116	A	FW	ST	3' - 0"	7' - 0"		1	HM	PT				18			
117	A	FW	ST	3' - 0"	7' - 0"		1	HM	PT				15			
118	A	FW	ST	3' - 0"	7' - 0"		1	HM	PT				15			
120	A	FW	ST	3' - 0"	7' - 0"		1	HM	PT				20			
121	A	FW	ST	3' - 0"	7' - 0"		2	HM	PT	2' - 0"		GL-3B T	15			
123A	A	FW	ST	3' - 0"	7' - 0"		1	HM	PT				47			CARD READER
123B	G	HM	AA	5' - 8"	7' - 3"		SF	AL	AA				4			INTALL INSULATED METAL DOOR (MIN R-4.75) - ANODIZED ALUMINUM FINISH TO MATCH STOREFRONT ; RE: A-602
124A	A	FW	ST	3' - 0"	7' - 0"		1	HM	PT				20	45 MIN		
124B	G	HM	AA	5' - 8"	7' - 3"		SF	AL	AA				5			INTALL INSULATED METAL DOOR (MIN R-4.75) - ANODIZED ALUMINUM FINISH TO MATCH STOREFRONT; A-602
125	A	FW	ST	3' - 0"	7' - 0"		1	HM	PT				22			
126	A	FW	ST	3' - 0"	7' - 0"		1	HM	PT				15			
127	A	FW	ST	3' - 0"	7' - 0"		1	HM	PT				12			CARD READER
128	A	FW	ST	3' - 0"	7' - 0"		1	HM	PT				15			
129A	A	FW	ST	3' - 0"	7' - 0"		1	HM	PT				10			CARD READER
129B	B	AL	AA	3' - 0"	7' - 3"	GL-1 T	SF	AL	AA				6			CARD READER; STOREFRONT RE: A-602
130	A	FW	ST	3' - 0"	7' - 0"		1	HM	PT				23			CYPHER LOCK
131A	A	FW	ST	3' - 0"	7' - 0"		2	HM	PT	2' - 6"		GL-3B T	24			
131B	A	FW	ST	3' - 0"	7' - 0"		2	HM	PT	2' - 6"		GL-3B T	25			
131C	B	AL	AA	3' - 0"	7' - 3"	GL-1 T	SF	AL	AA				7			STOREFRONT RE: A-602
132A	A	FW	ST	3' - 0"	7' - 0"		2	HM	PT	2' - 6"		GL-3B T	24			
132B	A	FW	ST	3' - 0"	7' - 0"		2	HM	PT	2' - 6"		GL-3B T	24			
132C	B	AL	AA	3' - 0"	7' - 3"	GL-1 T	SF	AL	AA				7			STOREFRONT RE: A-602
133	H	AL	AA	19' - 6"	9' - 10"			AL	AA				8			MULTIPANEL SLIDER
134	E	FW	ST	6' - 0"	7' - 0"		1	HM	PT				45			CARD READER
135	A	FW	ST	3' - 0"	7' - 0"		1	HM	PT				16			
136	A	FW	ST	3' - 0"	7' - 0"		1	HM	PT				15			
137	A	FW	ST	3' - 0"	7' - 0"		1	HM	PT				15			
138	A	FW	ST	3' - 0"	7' - 0"		1	HM	PT				26			CARD READER WITH A KEYPAD; OCCUPANCY INDICATOR DOOR LATCH
139	A	FW	ST	3' - 0"	7' - 0"		1	HM	PT				27			
140	A	FW	ST	3' - 0"	7' - 0"		1	HM	PT				12			CARD READER
141	A	FW	ST	3' - 0"	7' - 0"		1	HM	PT				12			CARD READER
142	A	FW	ST	3' - 0"	7' - 0"		1	HM	PT				28			
143	A	FW	ST	3' - 0"	7' - 0"		1	HM	PT				12			CARD READER
144	E	FW	ST	6' - 0"	7' - 0"		1	HM	PT				29			
145A	D	FW	ST	3' - 0"	7' - 0"	GL-3A T	1	HM	PT				10			CARD READER; RELEASE BUTTON FROM FRONT DESK
145B	A	FW	ST	3' - 0"	7' - 0"		1	HM	PT				32			CARD READER; ACCESS CONTROLLED EGRESS DOOR

DOOR SCHEDULE

MARK	DOOR TYPE	DOOR MTRL	DOOR FINISH	DOOR WIDTH	DOOR HEIGHT	DOOR GLAZ	FRAME TYPE	FRAME MTRL	FRAME FINISH	FRAME SIDELITE WIDTH	FRAME CLERESTORY HEIGHT	FRAME GLAZ	HDWR	FIRE RATING	STC	COMMENTS
145C	A	FW	ST	3' - 0"	7' - 0"		1	HM	PT				32			CARD READER; ACCESS CONTROLLED EGRESS DOOR
146	A	FW	ST	3' - 0"	7' - 0"		1	HM	PT				15			
147	A	FW	ST	3' - 0"	7' - 0"		1	HM	PT				15			
148	A	FW	ST	3' - 0"	7' - 0"		1	HM	PT				16			
149	A	FW	ST	3' - 0"	7' - 0"		1	HM	PT				18			
150	A	FW	ST	3' - 0"	7' - 0"		1	HM	PT				20			
151	A	FW	ST	3' - 0"	7' - 0"		1	HM	PT				33			
152	A	FW	ST	3' - 0"	7' - 0"		1	HM	PT				33			
153	A	FW	ST	3' - 0"	7' - 0"		1	HM	PT				33			
E119	A	FW	ST	3' - 0"	8' - 0"		1	(E)	PT				21			REPLACE DOOR PANEL
E122	A			3' - 0"	7' - 0"		1	HM					34			REMAINS AS IS
LEVEL 02																
200A	A	FW	ST	3' - 0"	7' - 0"		1	HM	PT				10			CARD READER
200B	A	FW	ST	3' - 0"	7' - 0"		1	HM	PT				35			CARD READER
200C	A	FW	ST	3' - 0"	7' - 0"		1	HM	PT				48			CARD READER
200D	A	FW	ST	3' - 0"	7' - 0"		1	HM	PT				35			CARD READER
201	A	FW	ST	3' - 0"	7' - 0"		3	AL	AA		8' - 6"	GL-3A	36			
202	A	FW	ST	3' - 0"	7' - 0"		1	HM	PT				15			
203	A	FW	ST	3' - 0"	7' - 0"		1	HM	PT				15			
205	A	FW	ST	3' - 0"	7' - 0"		3	AL	AA		8' - 6"		36			
207	A	FW	ST	3' - 0"	7' - 0"		1	HM	PT				15			
208	A	FW	ST	3' - 0"	7' - 0"		1	HM	PT				15			
209	A	FW	ST	3' - 0"	7' - 0"		2	HM	PT	1' - 6"		GL-3B T	15			
211	A	FW	ST	3' - 0"	7' - 0"		1	HM	PT				15			
212	A	FW	ST	3' - 0"	7' - 0"		1	HM	PT				20			
213	A	FW	ST	3' - 0"	7' - 0"		1	HM	PT				20			
214	A	FW	ST	3' - 0"	7' - 0"		1	HM	PT				37			
215	A	FW	ST	3' - 0"	7' - 0"		1	HM	PT				16			
216	A	FW	ST	3' - 0"	7' - 0"		1	HM	PT				16			
217A	A	FW	ST	3' - 0"	7' - 0"		1	HM	PT				37			
217B	E	FW	ST	6' - 0"	7' - 0"		1	HM	PT				38			
217C	E	FW	ST	6' - 0"	7' - 0"		1	HM	PT				38			
218	A	FW	ST	3' - 0"	7' - 0"		1	HM	PT				16			
219	A	FW	ST	3' - 0"	7' - 0"		1	HM	PT				16			
220	A	FW	ST	3' - 0"	7' - 0"		1	HM	PT				15			
221	A	FW	ST	3' - 0"	7' - 0"		1	HM	PT				15			
224	A	FW	ST	3' - 0"	7' - 0"		1	HM	PT				15			
225	A	FW	ST	3' - 0"	7' - 0"		1	HM	PT				15			
227	A	FW	ST	3' - 0"	7' - 0"		3	AL	PT		8' - 6"	GL-3A	36			
228	A	FW	ST	3' - 0"	7' - 0"		1	HM	PT				15			
229	A	FW	ST	3' - 0"	7' - 0"		1	HM	PT				13			
230	A	FW	ST	3' - 0"	7' - 0"		1	HM	PT				15			
231	A	FW	ST	3' - 0"	7' - 0"		1	HM	PT				13			
234	A	FW	ST	3' - 0"	7' - 0"		1	HM	PT				33			
235	A	FW	ST	3' - 0"	7' - 0"		1	HM	PT				33			
236	A	FW	ST	3' - 0"	7' - 0"		1	HM	PT				12			CARD READER
237	A	FW	ST	3' - 0"	7' - 0"		1	HM	PT				28			
238	A	FW	ST	3' - 0"	7' - 0"		1	HM	PT				16			
239A	A	FW	ST	3' - 0"	7' - 0"		1	HM	PT				15			
239B	A	FW	ST	3' - 0"	7' - 0"		1	HM	PT				12			CARD READER
240	A	FW	ST	3' - 0"	7' - 0"		1	HM	PT				20			
241	A	FW	ST	3' - 0"	7' - 0"		1	HM	PT				20			
242	A	FW	ST	5' - 0"	7' - 0"		3	AL	PT		8' - 6"	GL-3A	36			
243	A	FW	ST	3' - 0"	7' - 0"		1	HM	PT				15			
244	A	FW	ST	3' - 0"	7' - 0"		1	HM	PT				20			
245	A	FW	ST	3' - 0"	7' - 0"		2	HM	PT	2' - 6"		GL-3B T	15			
246	A	FW	ST	5' - 0"	7' - 0"		2	HM	PT	0' - 9"		GL-3B T	46			
249	A	FW	ST	3' - 0"	7' - 0"		1	HM	PT				37			
E003	A	FW	ST	3' - 0"	7' - 0"		1	HM						45 MIN		REMAIN AS IS
E223	A	FW	ST	3' - 0"	7' - 0"		1	HM								REMAIN AS IS

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ISSUE DATE	PHASE / REV NAME
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DOOR SCHEDULE / APPLIANCE SCHEDULE

A-600

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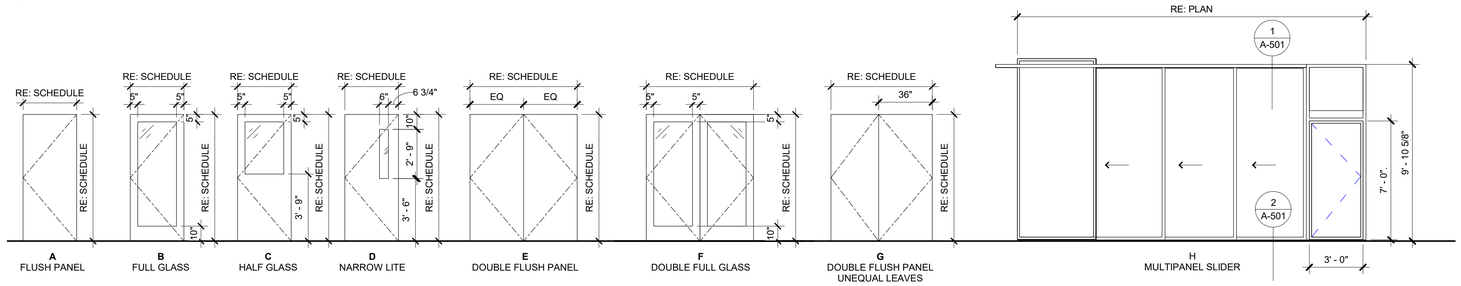
GENERAL WINDOW/DOOR NOTES:

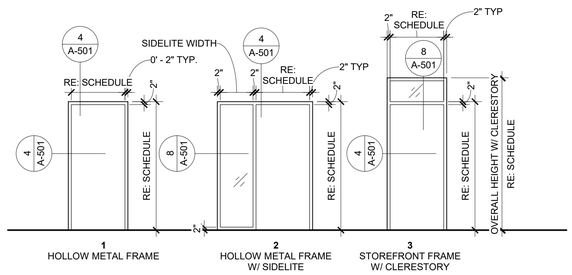
1. GENERAL CONTRACTOR SHALL BE RESPONSIBLE FOR CONFIRMING ALL WINDOW/DOOR QUANTITIES AND ACUTAL DIMENSIONS OF ALL OPENINGS IN FIELD.
2. ALL GLAZING IN HAZARDOUS LOCATIONS AS DEFINED IN IBC SHALL BE TEMPERED GLASS.
3. REFER TO ENLARGED FLOOR PLANS AND DOOR SCHEDULE FOR DOOR LOCATION, INFORMATION, AND DIMENSIONS. RE: A-600.

DOOR TYPES



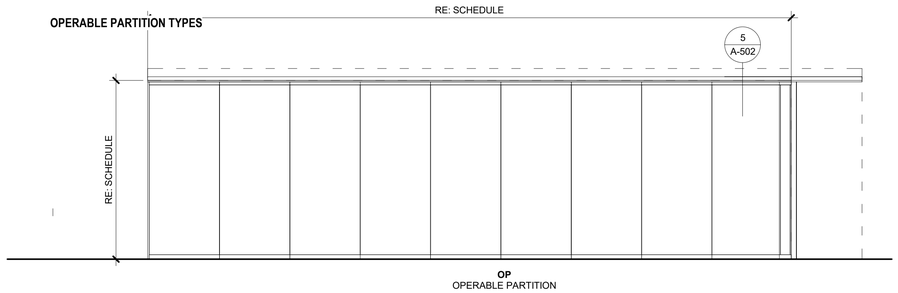
A FLUSH PANEL
B FULL GLASS
C HALF GLASS
D NARROW LITE
E DOUBLE FLUSH PANEL
F DOUBLE FULL GLASS
G DOUBLE FLUSH PANEL UNEQUAL LEAVES
H MULTIPANEL SLIDER

DOOR FRAME TYPES



1 HOLLOW METAL FRAME
2 HOLLOW METAL FRAME W/ SIDELITE
3 STOREFRONT FRAME W/ CLERESTORY

OPERABLE PARTITION TYPES



OP OPERABLE PARTITION

OPERABLE PARTITION SCHEDULE

MARK	DESCRIPTION	CEILING HEIGHT	WIDTH	FINISH	STACKING TYPE	MIN STC RATING	COMMENTS
OP1	Operable Partition	9' - 10"	27' - 10 11/128"	VINYL COATED FABRIC	REMOTE STACK	54	RE: SPEC 10 2239
OP2	Operable Partition	9' - 10"	27' - 10 11/128"	VINYL COATED FABRIC	REMOTE STACK	54	RE: SPEC 10 2239

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DOOR TYPES / OPERABLE PARTITION SCHEDULE

A-601

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GENERAL WINDOW/DOOR NOTES:

1. GENERAL CONTRACTOR SHALL BE RESPONSIBLE FOR CONFIRMING ALL WINDOW/DOOR QUANTITIES AND ACUTAL DIMENSIONS OF ALL OPENINGS IN FIELD.
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3. REFER TO ENLARGED FLOOR PLANS AND DOOR SCHEDULE FOR DOOR LOCATION, INFORMATION, AND DIMENSIONS. RE: A-600.

GLAZING TYPES LEGEND

(FOR GLAZING TYPES, RE: SPECIFICATION SECTION 08 800 00 GLAZING)

GL-1 INSULATING GLASS UNIT - VISION

GL-2 INSULATING GLASS UNIT - SPANDREL

GL-3A MONOLITHIC INTERIOR VISION GLAZING - 1/4" THICK
GL-3B MONOLITHIC INTERIOR VISION GLAZING - 3/8" THICK
GL-3C MONOLITHIC INTERIOR VISION GLAZING - 1/2" THICK

GL-4 TRANSPARENT ONE WAY MIRROR

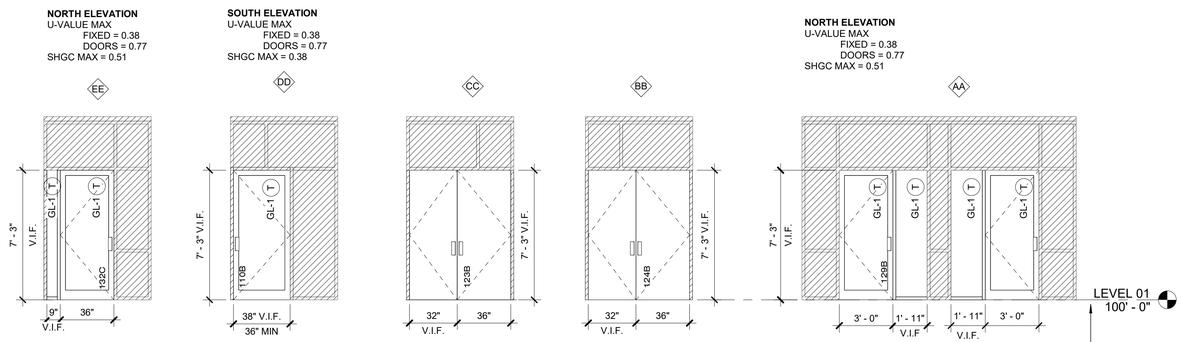
GL-5 FIRE RATED GLAZING

GL-6 BALLISTIC RESISTANT GLAZING

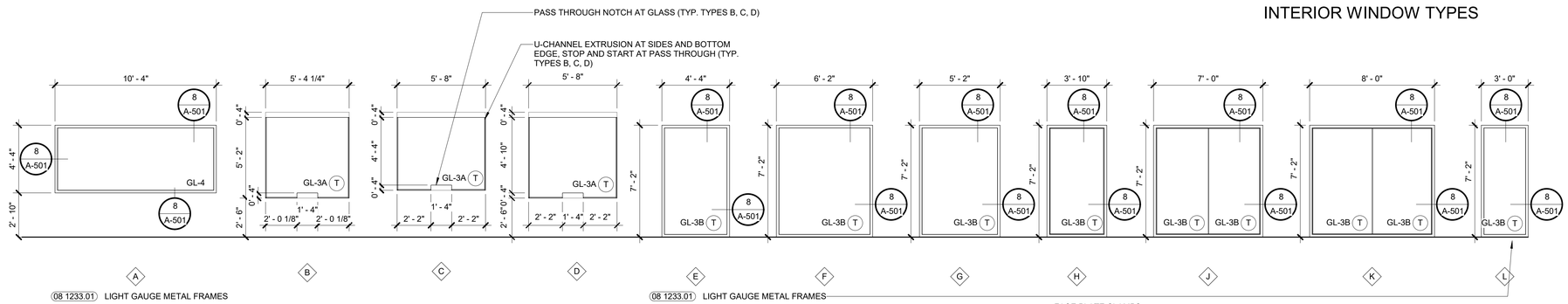
(T) INDICATES FULLY TEMPERED - SAFETY GLAZING

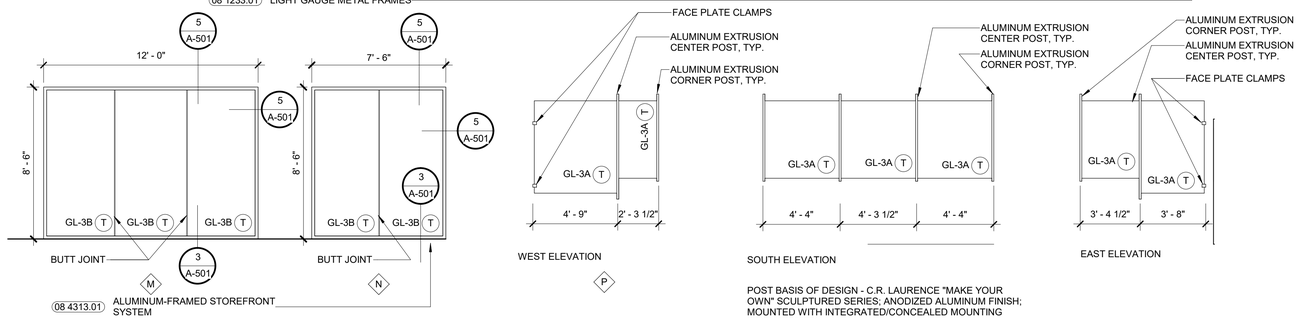
NEW ELEMENTS
EXISTING ELEMENT TO REMAIN

EXTERIOR WINDOW TYPES



INTERIOR WINDOW TYPES





POST BASIS OF DESIGN - C.R. LAURENCE "MAKE YOUR OWN" SCULPTURED SERIES; ANODIZED ALUMINUM FINISH; MOUNTED WITH INTEGRATED/CONCEALED MOUNTING BASE (6406002)

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WINDOW TYPES

A-605

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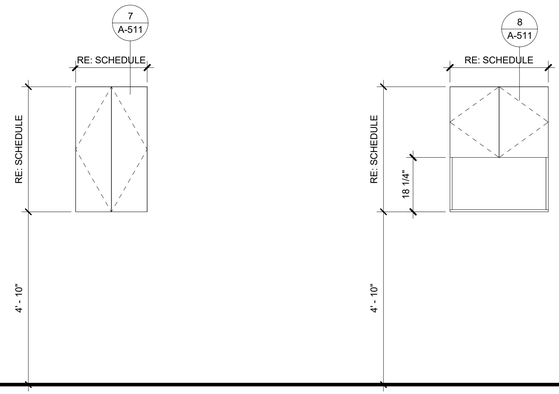


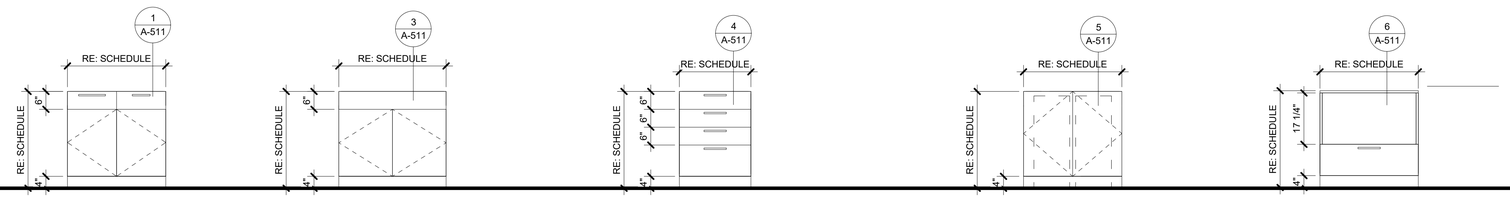
UPPER CASES

U4: UPPER CABINET WITH DOUBLE DOORS

Model	Type	Comments	Width	Depth	Height	Count
U4						
U4	A	DOUBLE DOOR	36"	12"	23 3/4"	1
U4	C	DOUBLE DOOR	36"	12"	23 3/4"	2
U4	A	DOUBLE DOOR	24"	12"	42"	2

U5: UPPER CABINET WITH MICROWAVE SHELF

Model	Type	Comments	Width	Depth	Height	Count
U4	E	DOUBLE DOOR	36"	12"	42"	2
U5						
U5	C	MICROWAVE, DOUBLE DOOR	33"	12"	42"	2



BASE CASES

L1: BASE CABINET WITH DOUBLE DOORS AND DRAWERS

Model	Type	Comments	Width	Depth	Height	Count
L1						
L1	A	DOUBLE DOOR	24"	24"	32 1/2"	1
L1	C	DOUBLE DOOR	30"	24"	32 1/2"	3
L1	D	DOUBLE DOOR	33"	24"	32 1/2"	6
L1	E	DOUBLE DOOR	36"	24"	32 1/2"	3
L1	E	DOUBLE DOOR, DRAWER	36"	24"	32 1/2"	3

L4: BASE CABINET WITH SINK AND DOUBLE DOORS

Model	Type	Comments	Width	Depth	Height	Count
L4						
L4	E	DOUBLE DOOR, SINK	36"	24"	32 1/2"	3

L6: BASE CABINET WITH 4 DRAWERS

Model	Type	Comments	Width	Depth	Height	Count
L6						
L6	A	4 DRAWERS	18"	24"	32 1/2"	1
L6	B	4 DRAWERS	24"	24"	32 1/2"	3
L6	C	DOUBLE DOOR	15"	24"	32 1/2"	1

L7: BASE CABINET WITH TRASH / RECYCLING

Model	Type	Comments	Width	Depth	Height	Count
L7						
L7	D	TRASH/ RECYCLING	33"	24"	32 1/2"	9

L8: BASE CABINET WITH MICROWAVE SHELF

Model	Type	Comments	Width	Depth	Height	Count
L8						
L8	D	MICROWAVE BASE	33"	24"	32 1/2"	2

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CASEWORK SCHEDULE

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VIEW OF LOBBY TOWARDS MOTOR VEHICLES

VIEW OF BUSINESS CENTER

VIEW OF OPEN LOUNGE AT TRAINING AREA

VIEW OF OPEN OFFICE AT SE CORNER LEVEL 02

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PERSPECTIVE VIEWS

A-801

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CEILING

CLG-01	GYPSUM BOARD CEILING
DESCRIPTION	PAINTED GYP BOARD, CONTROL JOINTS EVERY 30 FEET
NOTE	LEVEL 4 UON

CLG-02	ACOUSTICAL CEILING TILE
MFR	ARMSTRONG
MATERIAL	MINERAL FIBER
TILE	ULTIMA - HIGH NRC-1942 FINE TEXTURE
SIZE	2'X2'
NRC	.80 NRC
SUSPENSION	SUPRAFINE 9/16"
NOTE	6" AXIOM CLASSIC TRIM WHERE EXPOSED - WHITE, PUBLIC SPACES

CLG-03	ACOUSTICAL CLOUD
MFR	ARMSTRONG
MATERIAL	MINERAL FIBER
TILE	ULTIMA -1912 FINE TEXTURE
SIZE	2'X2'
NRC	.70 NRC
SUSPENSION	SUPRAFINE 9/16"
NOTE	6" AXIOM CLASSIC TRIM WHERE EXPOSED, OTHER AREAS

CLG-04	WOOD SLAT ACOUSTICAL
MANUFACTURER	9WOOD
STYLE	2000 LINEAR WOOD SERIES / 2100 PANELIZED LINEAR STYLE
COLOR	WHITE ASH (PLAIN SLICED VENEER)
SIZE	3 1/4" X 3/4" SLATS W/ 3/4" GAP
MATERIAL	WOOD COMPOSITE W/VENEER
NOTE	NRC MIN = 0.70; ATTACH 1.5" THICK DUCT LINER ATTACHED TO TOP OF WOOD PANELS (B.O.D. = KNAUF INSULATION ATMOSPHERE); WRAPS DOWN ONTO WALL. TRIM AND MITER EDGES PER DETAILS.

CLG-05	ACCENT ACOUSTICAL CEILING TILE
MFR	KIREI
MATERIAL	ECHOTILE SYNC - COLOR: 633 PACIFIC
TILE	
SIZE	23.75" X 23.75"
NRC	GREATER THAN .40
SUSPENSION	SUPRAFINE 9/16"
NOTE	KIREI TO CUT PANELS TO SIZE AT THE FACTORY. USE IN COLLABORATION AREA CEILINGS. SIZE OF CUTS TO BE FINALIZED IN CA

EXP-01	EXPOSED TO STRUCTURE - PAINTED
MFR	-
MATERIAL	-
TILE	-
SIZE	-
NRC	-
SUSPENSION	-
NOTE	PAINT, PT-02, CONDUIT, HVAC, ETC.

PAINT/ WALL FINISHES

PT-01	CEILING - GYP. BOARD
MFR	SHERWIN WILLIAMS
COLOR	SW7007 - CEILING BRIGHT WHITE
SHEEN	FLAT
NOTES	

PT-02	EXPOSED CEILING STRUCTURE
DESCRIPTION	DUST COLOR
NOTE	DRYFALL TYPE PAINT

PT-03	TYPICAL FIELD [SOFT WHITE]
MFR	SHERWIN WILLIAMS
COLOR	LIGHT MOVES SW1053
SHEEN	EGGSHELL
NOTES	

PT-04	ACCENT [LIGHT GREEN]
MFR	SHERWIN WILLIAMS
COLOR	CUCUZZA VERDA SW 9038
SHEEN	EGGSHELL
NOTES	

PT-05	ACCENT [DEEP GREEN]
MFR	SHERWIN WILLIAMS
COLOR	STARBOARD SW6755
SHEEN	EGGSHELL
NOTES	

PT-06	ACCENT [BLUE]
MFR	BENJAMIN MOORE
COLOR	NAPLES BLUE 2057-30
SHEEN	EGGSHELL
NOTES	

PT-07	ACCENT [DARK BLUE/NAVY]
MFR	SHERWIN WILLIAMS
COLOR	ANCHORS AWEIGH SW9179
SHEEN	EGGSHELL
NOTES	

PT-08	ACCENT [GREY]
MFR	SHERWIN WILLIAMS
COLOR	ARGOS SW7065
SHEEN	EGGSHELL
NOTES	

PT-09	ACCENT [RESTROOM CEILINGS]
MFR	SHERWIN WILLIAMS
COLOR	GREENBLACK SW6994
SHEEN	FLAT
NOTES	

PT-10	[EPOXY FORMULATION]
MFR	TBD
COLOR	MATCH COLOR DESIGNATION NOTED
SHEEN	EGGSHELL
NOTES	SEE SPECIFICATION FOR EPT REQUIREMENT

CG-01	CORNER GUARD
DESCRIPTION	KOROGUARD WALL PROTECTION SYSTEMS
NOTE	STAINLESS STEEL, 16 GUAGE - GS20, 2"X2"X4', #4 SATIN; PUBLIC SPACES AS NOTED

CG-02	CORNER GUARD
DESCRIPTION	KOROGUARD WALL PROTECTION SYSTEMS
NOTE	LEXAN SURFACE MOUNTED-J200, TRANSPARENT, POLYCARBONATE, 2"X2"X4', #4 SATIN; OPEN OFFICE EXPOSED CORNERS AS NOTED

WC-01	WOOD CLADDING
MANUFACTURER	RECLIMED DESIGN WORKS DENVER
STYLE	HISTORIC PLANK ORGINAL FACE
COLOR	MIXED HARDWOOD BARN WOOD
WEIGHT	
SIZE	4" WIDTH, MULTIPLE LENGTHS, 5/8" THICK
NOTE	FEATURE WALL, 3/4" FR PLY BACKING, USE B-03 ALL LOCATIONS. FRY REGLET F-REVEAL ANNODIZED ALUMINUM TRIM OR SCHLUTER JOLLY METAL TOP CAP

WC-02	ACOUSTIC PANELS [LIGHT GREY]
MANUFACTURER	SONUS
STYLE	DIMENSIONAL PANELS
COLOR	KNOLL REFLECT E884/4A STEEL
WEIGHT	
SIZE	CUSTOM SIZES: WIDTHS PER ELEVATIONS X 72" H
NOTE	STEPS DIMENSIONAL DESIGN

WC-03	ACOUSTIC PANELS [GREEN]
MANUFACTURER	KIREI
STYLE	ECHOPANEL
COLOR	338 JADE
WEIGHT	
SIZE	24MM
NOTE	KIREI TO LAMINATE (2) 12MM PANELS TOGETHER AT THE FACTORY. USE IN LOBBY AT SERVICE DESKS

WC-04	ACOUSTIC PANELS [BLUE]
MANUFACTURER	KIREI
STYLE	ECHOPANEL
COLOR	633 PACIFIC
WEIGHT	
SIZE	24MM
NOTE	COLLABORATIVE AREAS AND MOTOR VEHICLES IN THE LOBBY

WALL BASE

RB-01	RUBBER BASE [TYPICAL]
MANUFACTURER	BURKE - MANNINGTON
STYLE	PREFORMED INSIDE AND OUTSIDE CORNERS
COLOR	198 - DEEP SPACE
SIZE	4" HIGH
MATERIAL	THERMOSET RUBBER
NOTE	USE AT CASEWORK TOEKICKS AND ALL GYP WALLS UON

RB-02	RUBBER BASE
MANUFACTURER	BURKE - MANNINGTON
STYLE	PREFORMED INSIDE AND OUTSIDE CORNERS
COLOR	TBD
SIZE	6" HIGH
MATERIAL	THERMOSET RUBBER
NOTE	WORKOUT & CARDIO ROOM

B-01	TILE BASE
MANUFACTURER	CONCEPT SURFACES
STYLE	TL-01/TL-02; RE: ELEVATIONS
COLOR	TL-01/TL-02; RE: ELEVATIONS
SIZE	6" H CUT TILE
MATERIAL	PORCELAIN TILE
NOTE	MATCH TL-01, WITH METAL TOP CAP AND COVE BASE - INCLUDE INSIDE AND OUTSIDE CORNERS AND END CAPS

B-03	METAL BASE [2"H]
MANUFACTURER	MOULDINGS MX
STYLE	STRAIGHT PROFILE
COLOR	BRUSHED STAINLESS STEEL
SIZE	2" H
MATERIAL	STAINLESS STEEL
NOTE	FOR USE WITH WC-01 ONLY

B-04	METAL BASE [4"H]
MANUFACTURER	MOULDINGS MX
STYLE	STRAIGHT PROFILE
COLOR	BRUSHED STAINLESS STEEL
SIZE	4" H
MATERIAL	STAINLESS STEEL
NOTE	

FLOOR FINISH

CPT-01	WALK OFF MAT
MANUFACTURER	SHAW
STYLE	ALL ACCESS - JIVE 5T412
COLOR	STEP - 12549
SIZE	24X24
FIBER	TDX NYLON
DYE METHOD	SOLUTION DYED
TUFTED WEIGHT	30 OZ/YD
INSTALLATION	TBD
NOTE	$48 PER SQ YARD

CPT-02	FIELD
MANUFACTURER	MANNINGTON
STYLE	RIDGELINE
COLOR	COMPASS
SIZE	12" x 48" TILES
FIBER	ANTRON LUMENA TYPE 6,6 NYLON
DYE METHOD	SOLUTION
TUFTED WEIGHT	28OZ/YD
INSTALLATION	TBD
NOTE	

CPT-03	ACCENT [BLUE]
MANUFACTURER	SHAW
STYLE	ENDLESS TILE 5T305
COLOR	SPRINGS - 05440
SIZE	9" X 36" TILES
FIBER	ANTRON LUMENA TYPE 6,6 NYLON
DYE METHOD	SOLUTION
TUFTED WEIGHT	22 OZ.
INSTALLATION	RE: INSTALL DIAGRAMS
NOTE	

CPT-04	ACCENT [GREEN]
MANUFACTURER	SHAW
STYLE	ENDLESS TILE 5T305
COLOR	GREENHOUSE 05396
SIZE	9" X 36" TILES
FIBER	ECOSOLUTION Q100 NYLON
DYE METHOD	SOLUTION
TUFTED WEIGHT	22OZ
INSTALLATION	RE: INSTALL DIAGRAMS
NOTE	

CPT-05	ACCENT [GREEN + GREY]
MANUFACTURER	SHAW
STYLE	SUSPEND TILE
COLOR	GREENHOUSE 88396
SIZE	9" x 36" TILES
FIBER	ECOSOLUTION Q100 NYLON
DYE METHOD	
TUFTED WEIGHT	19OZ/YD
INSTALLATION	
NOTE	

CPT-06	WALK-OFF MAT
MANUFACTURER	TARKETT
STYLE	GEO TILE
COLOR	00979 CHARCOAL
SIZE	18" X 18" TILES
FIBER	100% POLYPROPYLENE
DYE METHOD	SOLUTION
TUFTED WEIGHT	
INSTALLATION	
NOTE	WALK OFF MAT IN VESTIBULES

RF-01	LVT [FIELD]
MANUFACTURER	PATCRAFT
STYLE	CROSSOVER LL 1439V
COLOR	SMOKEY TAUPE 00720
SIZE	7" X 48" X 5MM
MATERIAL	LUXURY VINYL PLANK WITH FIBERGLASS
NOTE	LOOSE LAY. INCLUDE UNDERLAYMENT

RF-02	SPECIALITY ACCENT
MANUFACTURER	JOKIMO
STYLE	LAVA FLOOR TILES
COLOR	BLUE/GREEN - TWO TONE
SIZE	20" SQUARES
MATERIAL	POLYCARBONATE
NOTE	PRODUCTION ONLY A FEW TIMES A YEAR, SO POSSIBLE LONG LEAD TIMES

RF-03	FITNESS FLOORING [CARDIO ROOM]
MANUFACTURER	ECORE COMMERCIAL FLOORING
STYLE	FOREST RX
COLOR	TOASTED OAK
SIZE	7MM THICK ROLL, 72" WIDE GOODS
MATERIAL	RUBBER COMPOSITE
NOTE	

RF-04	FITNESS FLOORING [WORKOUT ROOM]
MANUFACTURER	ECORE COMMERCIAL FLOORING
STYLE	MONSTER
COLOR	CHARCOAL
SIZE	7MM THICK ROLL, 72" WIDE GOODS
MATERIAL	RUBBER COMPOSITE
NOTE	WORKOUT ROOM

SC-01	SEALED CONCRETE
DESCRIPTION	CLEAR SEALED CONCRETE
NOTE	

TILE

TL-01	FLOOR + WALL TILE [LIGHT GREY]
MATERIAL	PORCELAIN
MANUFACTURER	CONCEPT SURFACES
STYLE-COLOR	EVOLVE GREY
SIZE	12" x 24"
GROUT COLOR	
GROUT WIDTH	1/8" EPOXY GROUT 100% SOLIDS
NOTE	METAL COVE BASE, METAL PREFORMED INSIDE AND OUTSIDE CORNERS. FOH RESTROOMS.

TL-02	FLOOR + WALL TILE [DARK GREY]
MATERIAL	PORCELAIN
MANUFACTURER	CONCEPT SURFACES
STYLE-COLOR	EVOLVE COAL
SIZE	12" x 24"
GROUT COLOR	
GROUT WIDTH	1/8" EPOXY GROUT 100% SOLIDS
NOTE	METAL COVE BASE, METAL PREFORMED INSIDE AND OUTSIDE CORNERS. BOH RESTROOMS.

TL-03	WALL TILE [ACCENT - FIELD]
MATERIAL	METAL EFFECT GLAZED PORCELAIN BRICKS
MANUFACTURER	VIVA
STYLE-COLOR	METALLICA GREY LUX
SIZE	2"X10" METAL BRICK
GROUT COLOR	TBD
GROUT WIDTH	1/8" POLYMER MODIFIED UNSANDED GROUT
NOTE	METAL TRIM AT TOP AND SIDES OF TILE WHEN TILE IS NOT ADJACENT. PUBLIC RR ACCENT & OPEN LOUNGE 134

TL-05	WALL TILE [ACCENT BAND - BLUE]
MATERIAL	METAL EFFECT GLAZED PORCELAIN BRICKS
MANUFACTURER	VIVA
STYLE-COLOR	METALLICA BLUE LUX
SIZE	2"X10" METAL BRICK
GROUT COLOR	TBD
GROUT WIDTH	1/8" POLYMER MODIFIED UNSANDED GROUT
NOTE	METAL TRIM AT TOP AND SIDES OF TILE WHEN TILE IS NOT ADJACENT. PUBLIC RR & OPEN LOUNGE 134 ACCENT

TL-06	WALL TILE [ACCENT BAND - GREEN]
MATERIAL	METAL EFFECT GLAZED PORCELAIN BRICKS
MANUFACTURER	VIVA
STYLE-COLOR	METALLICA GREEN LUX
SIZE	2"X10" METAL BRICK
GROUT COLOR	TBD
GROUT WIDTH	1/8" POLYMER MODIFIED UNSANDED GROUT
NOTE	METAL TRIM AT TOP AND SIDES OF TILE WHEN TILE IS NOT ADJACENT. PUBLIC RR & OPEN LOUNGE 134 ACCENT

TL-07	WALL TILE [ACCENT]
MATERIAL	CERAMIC TILE
MANUFACTURER	TILEBAR
STYLE-COLOR	LANCASTER - OPEN SEAS
SIZE	3" H x 12" W
GROUT COLOR	TBD
GROUT WIDTH	1/8" POLYMER MODIFIED UNSANDED GROUT
NOTE	TYPICAL BREAK ROOM WALL TILE EXCEPT OPEN LOUNGE 134

TL-08	FLOOR TILE [SHOWER ROOM]
MATERIAL	PORCELAIN MOSAIC
MANUFACTURER	CERAMIC TECHNICS
STYLE-COLOR	URBAN STUDIO - BLACK
SIZE	2" HEX
GROUT COLOR	TBD
GROUT WIDTH	1/8" POLYMER MODIFIED UNSANDED GROUT
NOTE	METAL TRIM AT TOP AND SIDES OF TILE.

GENERAL FINISH NOTES

1. SEE FINISH LEGEND AND RCP'S FOR ADDITIONAL INFORMATION.
2. CONSULT WITH ARCHITECT REGARDING ANY DISCREPANCIES OR OMISSIONS.
3. ARCHITECT WILL BE AVAILABLE TO REVIEW ON SITE AS REQUIRED
4. U.O.N. THE SUBSTRATE FOR ANY PAINT IS GWB.
5. ALL WALLS ARE TO BE PAINTED PT-03 U.N.O
6. ALL GYP SOFFITS AND CEILINGS ARE TO BE PAINTED PT-01 U.N.O.
7. ALL CASEWORK SHOWN IS TO BE ENGINEERED BY FABRICATOR, DRAWINGS ARE TO SHOW DESIGN INTENT AND FOR PRICING PURPOSES.
8. ALL LAMINATE CASEWORK TO HAVE 3MM EDGE BAND ON ALL EDGES, HEAVY DUTY DRAWER GLIDES, HIDDEN HINGES, WHITE MELAMINE INTERIORS OF ALL CABINETS, DRAWERS ETC. U.N.O.
9. GC TO PROVIDE ALL CODE REQUIRED ROOM SIGNAGE, REFER TO GRAPHICS PACKAGE FOR WAYFINDNG AND ENVIRONMENTAL GRAPHICS.
10. SEE ARCH SHEETS FOR ADDITIONAL ALLOWANCES FOR GRAPHIC ELEMENTS ETC.
11. FLOORING DETAILS, RE: SHEET A-500

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FINISH LEGEND

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MILLWORK FINISHES

SSM-01	SOLID SURFACE
DESCRIPTION	ALKEMI ACRYLIC BELUGA 600
NOTE	1 1/2" THICKNESS. RESTROOMS

SSM-02	SOLID SURFACE [QUARTZ]
DESCRIPTION	LG HIMACS URBAN CONCRETE
NOTE	1 1/2 THICKNESS. BREAK ROOMS / BOH WET COUNTERS

SSM-03	SOLID SURFACE [QUARTZ]
DESCRIPTION	ICE STONE SAGE PEARL
NOTE	1 1/2 THICKNESS. SERVICE DESKS

PL-01	PLASTIC LAMINATE
MANUFACTURER	WILSONART
STYLE	7992-38
COLOR	PINNACLE WALNUT
SIZE	4' X 8'
MATERIAL	HIGH PRESSURE LAMINATE
NOTE	HPL - PREMIUM AEON FINISH WITH ANTIMICROBIAL PROTECTION; USE 3MM EDGE BANDING UNLESS UNAVAILABLE IN COORDINATING FINISH, THEN 2MM THICK IS ACCEPTABLE SUBSTITUTION.

PL-02	PLASTIC LAMINATE
MANUFACTURER	WILSONART
STYLE	CASUAL RUSTIC FINISH
COLOR	GATHERING KNOT
SIZE	4' X 8'
MATERIAL	HIGH PRESSURE LAMINATE
NOTE	BREAK ROOM CABINETS; USE 3MM EDGE BANDING UNLESS UNAVAILABLE IN COORDINATING FINISH, THEN 2MM THICK IS ACCEPTABLE SUBSTITUTION.

PL-03	PLASTIC LAMINATE
MANUFACTURER	WILSONART
STYLE	FINE VELVET FINISH
COLOR	BACKYARD PATIO Y0755-38
SIZE	4' X 8'
MATERIAL	HIGH PRESSURE LAMINATE
NOTE	USED AT B.O.H. COUNTERS W/O WATER; USE 3MM EDGE BANDING UNLESS UNAVAILABLE IN COORDINATING FINISH, THEN 2MM THICK IS ACCEPTABLE SUBSTITUTION.

WINDOW TREATMENTS

WT-01	WINDOW TREATMENTS - SINGLE ROLL
MANUFACTURER	SPRINGS WINDOW FASHIONS
STYLE	3% OPENESS
COLOR	CROSSHATCH S300 IN STEEL GREY C8206
WEIGHT	
SIZE	
NOTE	MANUAL CORDED FUNCTION

WT-02	WINDOW TREATMENTS - DOUBLE ROLL
MANUFACTURER	SPRINGS WINDOW FASHIONS
STYLE	3% OPENESS & BLACKOUT
COLOR	CROSSHATCH S300 IN STEEL GREY C8206
WEIGHT	
SIZE	
NOTE	MECHANIZED DUAL FUNCTION

OTHER MATERIALS

TLT-01	TOILET PARTITION
DESCRIPTION	BRADLEY ARIA OR BRADMAR PANELS IN CHARCOAL GRAY M248
NOTE	SEE SPECIFICATION MANUAL FOR PARTITION DETAILS

TLT-02	TOILET PARTITION
DESCRIPTION	BOBRICK SIERRA SERIES FOREST GREEN SC04
NOTE	SEE SPECIFICATION MANUAL FOR PARTITION DETAILS

GENERAL FINISH NOTES

1. SEE FINISH LEGEND AND RCP'S FOR ADDITIONAL INFORMATION.
2. CONSULT WITH ARCHITECT REGARDING ANY DISCREPANCIES OR OMISSIONS.
3. ARCHITECT WILL BE AVAILABLE TO REVIEW ON SITE AS REQUIRED
4. U.O.N. THE SUBSTRATE FOR ANY PAINT IS GWB.
5. ALL WALLS ARE TO BE PAINTED PT-03 U.N.O
6. ALL GYP SOFFITS AND CEILINGS ARE TO BE PAINTED PT-01 U.N.O.
7. ALL CASEWORK SHOWN IS TO BE ENGINEERED BY FABRICATOR, DRAWINGS ARE TO SHOW DESIGN INTENT AND FOR PRICING PURPOSES.
8. ALL LAMINATE CASEWORK TO HAVE 3MM EDGE BAND ON ALL EDGES, HEAVY DUTY DRAWER GLIDES, HIDDEN HINGES, WHITE MELAMINE INTERIORS OF ALL CABINETS, DRAWERS ETC. U.N.O.
9. GC TO PROVIDE ALL CODE REQUIRED ROOM SIGNAGE, REFER TO GRAPHICS PACKAGE FOR WAYFINDNG AND ENVIRONMENTAL GRAPHICS.
10. SEE ARCH SHEETS FOR ADDITIONAL ALLOWANCES FOR GRAPHIC ELEMENTS ETC.
11. FLOORING DETAILS, RE: SHEET A-500

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FINISH LEGEND

A-901

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1 A-910 LEVEL 01 FLOOR FINISH PLAN
1/8" = 1'-0"

GENERAL NOTES - FLOOR FINISH PLAN

1. REFER TO G-004 FOR ALL FLOORING TRANSITION DETAILS.
2. ALIGN ALL FLOOR TILE GROUT LINES WITH WALL TILE GROUT LINES, WHENEVER POSSIBLE.
3. FOR ADDITIONAL INFORMATION REFER TO, A-901, A-902, A-903 AND A905 FOR INTERIOR FINISH LEGEND AND SCHEDULES. NOTIFY ARCHITECT OF ANY DISCREPANCIES.
4. FLOOR FINISHES SHOULD EXTEND UNDER MILLWORK & INTO RECESSES.
5. CARPET INSTALLATION SHALL COMPLY WITH THE WORKMANSHIP GUIDELINES AS PUBLISHED BY THE AMERICAN CARPET INSTITUTES LATEST EDITION AND SHALL BE IN STRICT ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS, PROVIDING AN ATTRACTIVE WRINKLE FREE APPEARANCE. CARPET SEAMS SHALL BE BUTT MATCHED RUNNING IN THE SAME DIRECTION.
6. FLASH-PATCH / FLOOR ALL AREAS WHERE FLOOR IS NOT LEVEL OR TRUE PRIOR TO FLOORING INSTALLATION.
7. GENERAL CONTRACTOR TO SCRAPE EXISTING SLAB FREE OF SCREWS, ADHESIVE & OTHER MISCELLANEOUS MATERIALS FOR A SMOOTH EVEN FINISH.
8. CONTRACTOR TO VERIFY ALL APPROPRIATE INSTALLATION & CONSTRUCTION DETAILS AND ABILITY TO INSTALL PER DESIGN INTENT. PLEASE VERIFY ANY QUESTIONS AND/OR DISCREPANCIES WITH DESIGNER PRIOR TO CONSTRUCTION.
9. ALL TILE INSTALLATIONS MUST COMPLY WITH THE LATEST APPLICABLE TCNA GUIDELINES.
10. CARPET TO CARPET TRANSITIONS AT DOORS SHOULD BE CONCEALED BY CLOSED DOOR

CARPET LEGEND

- CPT-01 WALK OFF MAT
- CPT-02 FIELD, GREY W. GREEN LINES
- CPT-03 ACCENT, BLUE
- CPT-04 ACCENT, GREEN
- CPT-05 ACCENT, GREEN + GREY
- RF-01 LVT FIELD
- RF-02 SPECIALTY ACCENT
- RF-03 CARDIO ROOM
- RF-04 WORKOUT ROOM
- SC-01 SEALED CONCRETE
- TL-01 TYPICAL
- TL-06 SHOWER ROOM

FINISH SYMBOL LEGEND

- FLOOR FINISH TRANSITION DESIGNATION RE: SHEET A-500
- INDICATES SOFFIT ABOVE

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LEVEL 01 FLOOR FINISH PLAN

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GENERAL NOTES - FLOOR FINISH PLAN

1. REFER TO G-004 FOR ALL FLOORING TRANSITION DETAILS.
2. ALIGN ALL FLOOR TILE GROUT LINES WITH WALL TILE GROUT LINES, WHENEVER POSSIBLE.
3. FOR ADDITIONAL INFORMATION REFER TO, A-901, A-902, A-903 AND A905 FOR INTERIOR FINISH LEGEND AND SCHEDULES. NOTIFY ARCHITECT OF ANY DISCREPANCIES.
4. FLOOR FINISHES SHOULD EXTEND UNDER MILLWORK & INTO RECESSES.
5. CARPET INSTALLATION SHALL COMPLY WITH THE WORKMANSHIP GUIDELINES AS PUBLISHED BY THE AMERICAN CARPET INSTITUTES LATEST EDITION AND SHALL BE IN STRICT ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS, PROVIDING AN ATTRACTIVE WRINKLE FREE APPEARANCE. CARPET SEAMS SHALL BE BUTT MATCHED RUNNING IN THE SAME DIRECTION.
6. FLASH-PATCH / FLOOR ALL AREAS WHERE FLOOR IS NOT LEVEL OR TRUE PRIOR TO FLOORING INSTALLATION.
7. GENERAL CONTRACTOR TO SCRAPE EXISTING SLAB FREE OF SCREWS, ADHESIVE & OTHER MISCELLANEOUS MATERIALS FOR A SMOOTH EVEN FINISH.
8. CONTRACTOR TO VERIFY ALL APPROPRIATE INSTALLATION & CONSTRUCTION DETAILS AND ABILITY TO INSTALL PER DESIGN INTENT. PLEASE VERIFY ANY QUESTIONS AND/OR DISCREPANCIES WITH DESIGNER PRIOR TO CONSTRUCTION.
9. ALL TILE INSTALLATIONS MUST COMPLY WITH THE LATEST APPLICABLE TCNA GUIDELINES.
10. CARPET TO CARPET TRANSITIONS AT DOORS SHOULD BE CONCEALED BY CLOSED DOOR

CARPET LEGEND

- CPT-01 WALK OFF MAT
- CPT-02 FIELD, GREY W. GREEN LINES
- CPT-03 ACCENT, BLUE
- CPT-04 ACCENT, GREEN
- CPT-05 ACCENT, GREEN + GREY
- RF-01 LVT FIELD
- RF-02 SPECIALTY ACCENT
- RF-03 CARDIO ROOM
- RF-04 WORKOUT ROOM
- SC-01 SEALED CONCRETE
- TL-01 TYPICAL
- TL-06 SHOWER ROOM

FINISH SYMBOL LEGEND

- FLOOR FINISH TRANSITION DESIGNATION RE: SHEET A-500
- INDICATES SOFFIT ABOVE

1 A-911 LEVEL 02 FLOOR FINISH PLAN
1/8" = 1'-0"

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LEVEL 02 FLOOR FINISH PLAN

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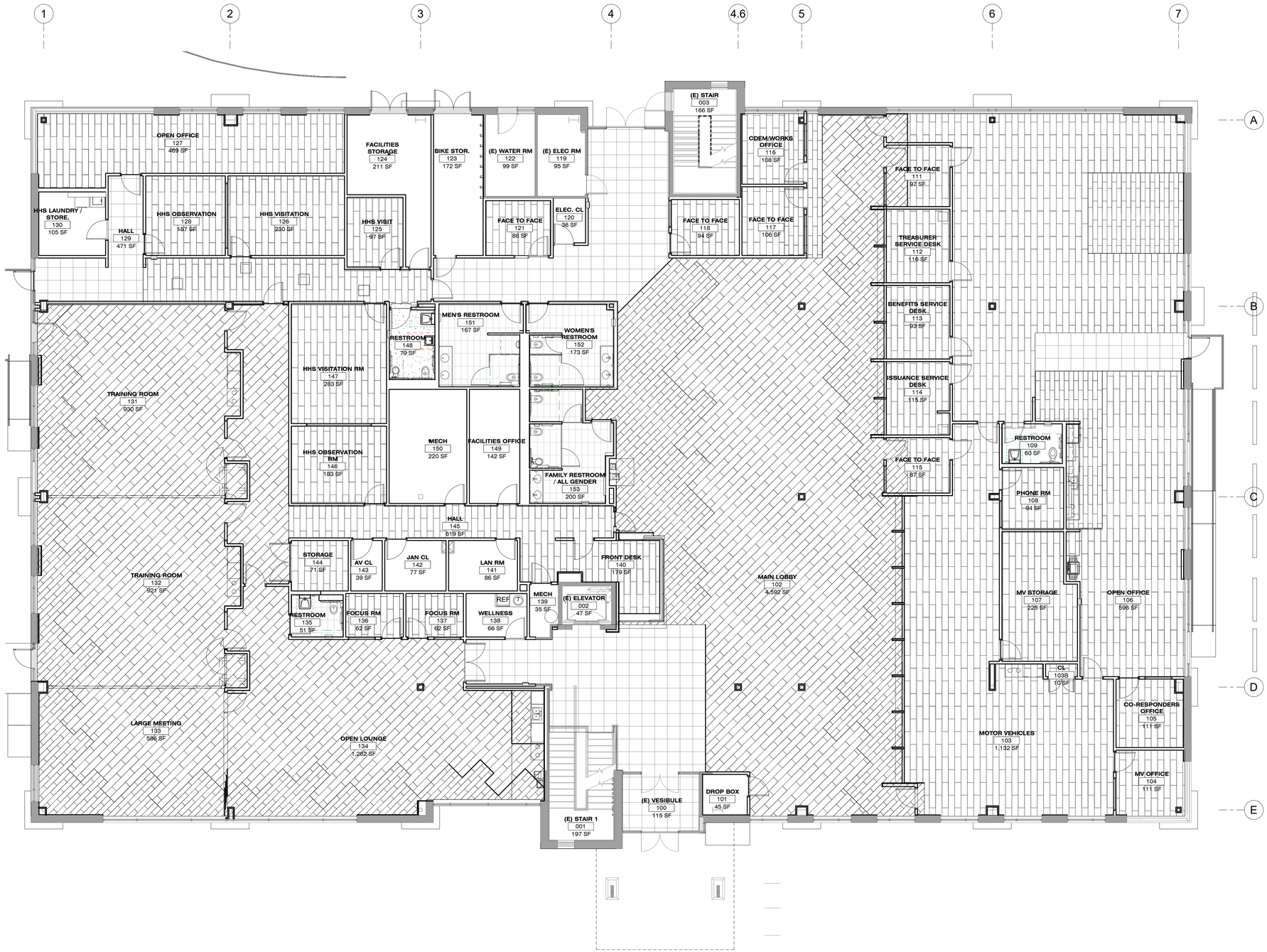

1 A-912 LEVEL 01 FLOOR FINISH PLAN - INSTALLATION DIAGRAM

1/8" = 1'-0"

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LEVEL 01 FLOOR FINISH PLAN - INSTALL DIAGRAM

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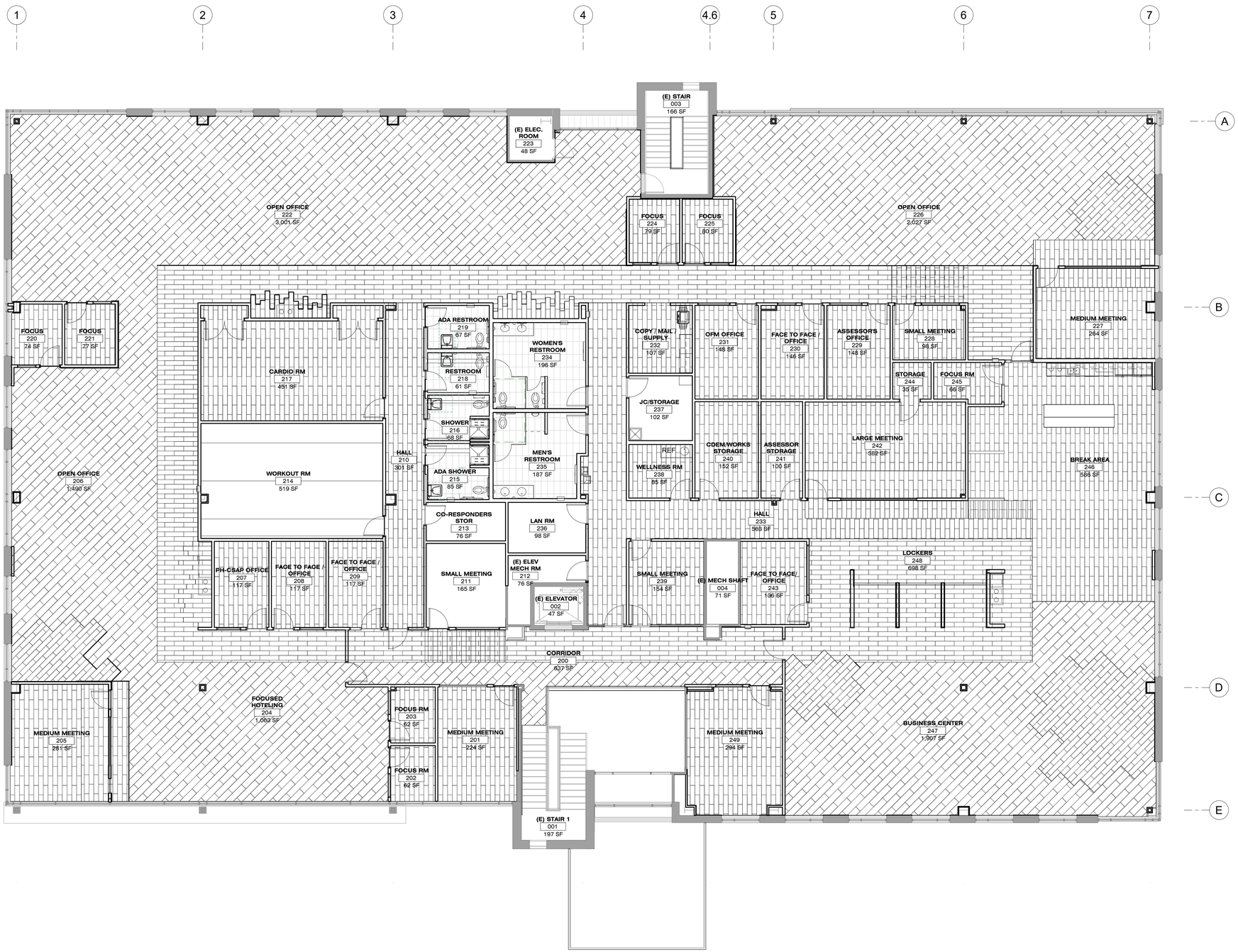

1 A-913 LEVEL 02 FLOOR FINISH PLAN - INSTALLATION DIAGRAM

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LEVEL 02 FLOOR FINISH PLAN - INSTALL DIAGRAM

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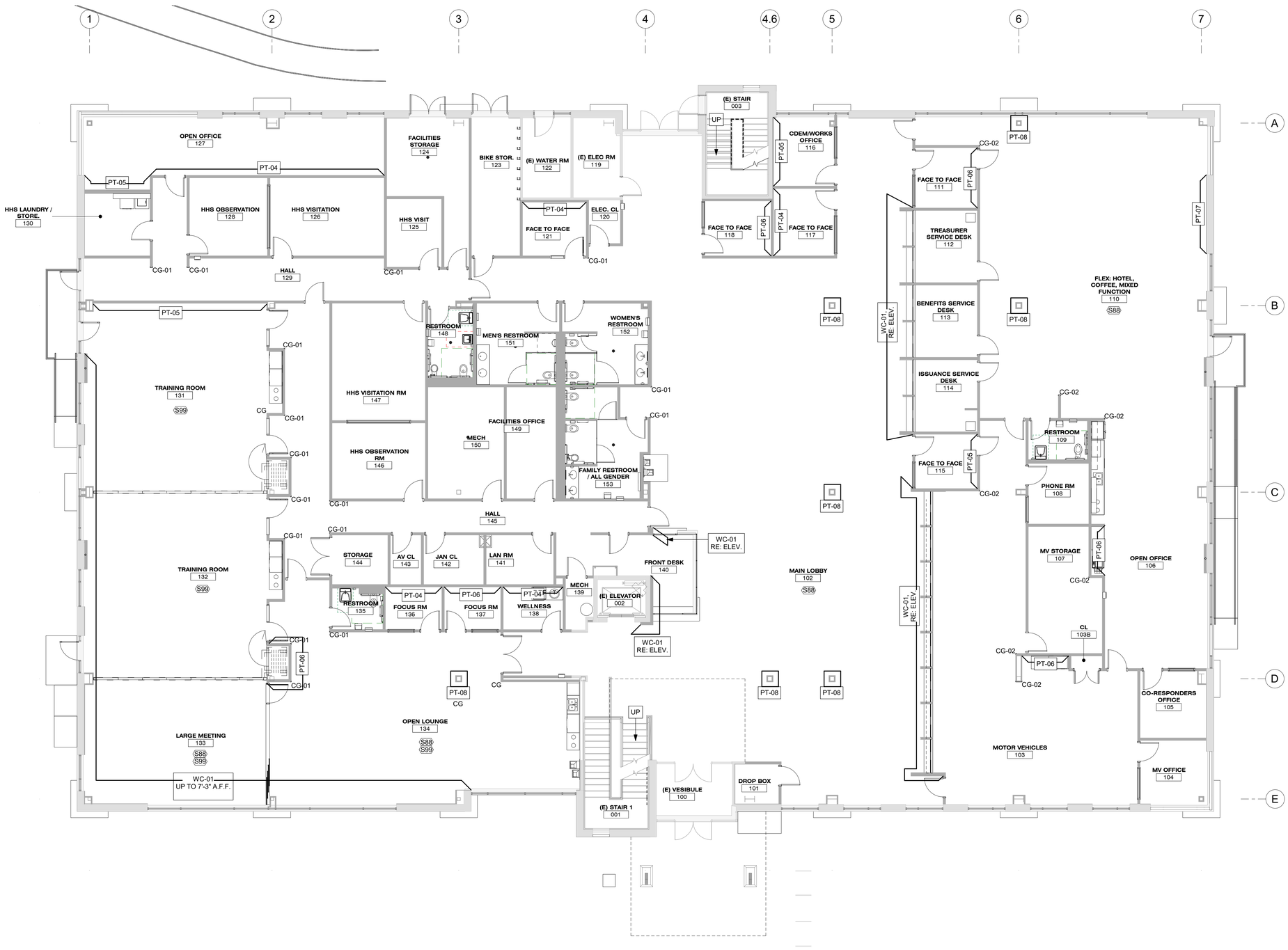

1 A-920 LEVEL 01 FINISH PLAN

1/8" = 1'-0"

GENERAL NOTES - WALL FINISH PLAN

1. ALL INFRASTRUCTURE ATTACHED TO A SURFACE INDICATED TO BE PAINTED IS TO ALSO BE PAINTED TO MATCH - INCLUDING BUT NOT LIMITED TO CONDUIT, ELECTRICAL BOXES, PIPING ETC UNLESS NOTED OTHERWISE.
2. ALL WALLS AND COLUMNS TO BE PAINTED PT-03 U.O.N.
3. IN AREAS TO BE PAINTED THAT ARE OPEN TO ABOVE, PAINT WALL UP TO REVEAL ABOVE REVEAL CEILING COLOR TO EXTEND UP TO STRUCTURE.
4. WALLS EXPOSED ABOVE 9'-6" TO HAVE pT-02 ABOVE TYPICAL PT-03.
5. ALL CASEWORK SHOWN IS TO BE ENGINEERED BY FABRICATOR, DRAWINGS ARE FOR DESIGN INTENT.
6. FLOOR FINISHES SHOULD EXTEND UNDER MILLWORK & INTO RECESSES.
7. PROVIDE CORNER GUARDS W/ 2" WINGS AT ALL PROTRUDING CORNERS IN HIGH TRAFFIC LOCATIONS, U.O.N. CONFIRM LOCATIONS ON SITE WITH OWNER.
8. ALL LAMINATE CASEWORK TO HAVE 3MM PVC EDGE BANDING, HEAVY DUTY DRAWER GLIDES, HIDDEN HINGES, WITH MELAMINE INTERIOR SURFACES.
9. GC TO PROVIDE AND INSTALL ALL CODE COMPLIANT ROOM SIGNAGE.
10. REFER TO ENVIRONMENTAL GRAPHICS SPECS FOR GRAPHIC ELEMENT DETAILS.
11. ALL DOOR FRAMES TO BE PAINTED TO MATCH ADJACENT WALLS U.O.N. ON DOOR SCHEDULE, SPLIT FRAME COLOR AS NEEDED.
12. SWITCHES, OUTLET PLATES WILL BE SURFACE MOUNTED ON AREAS OF WF-xx. RECLOCATE STROBES TO OPPOSITE OR ADJACENT WALL WHERE POSSIBLE.
13. MOCK UP OF ALL PAINT COLORS IS REQUIRED. 1 FULL WALL OF EACH COLOR TO BE APPROVED BY OWNER AS PART OF SUBMITTAL.

LEGEND: WALL FINISHES

CG INDICATES THE LOCATION OF CORNER GUARDS

SHEET NOTES

NOTE	DESCRIPTION
S88	WALLS AT EXPOSED TO STRUCTURE AREAS - PROVIDE PAINT DATUM - LEVEL TO BE SET AT HEIGHT OF ADJACENT CEILING CLOUDS - PT-02 ABOVE DATUM
S99	PROVIDE HORIZONTAL REVEAL CHANNEL SCREED (FRY REGLET OR SIM.) AT DRYWALL AT 32" A.F.F. AT ALL WALLS IN THIS ROOM

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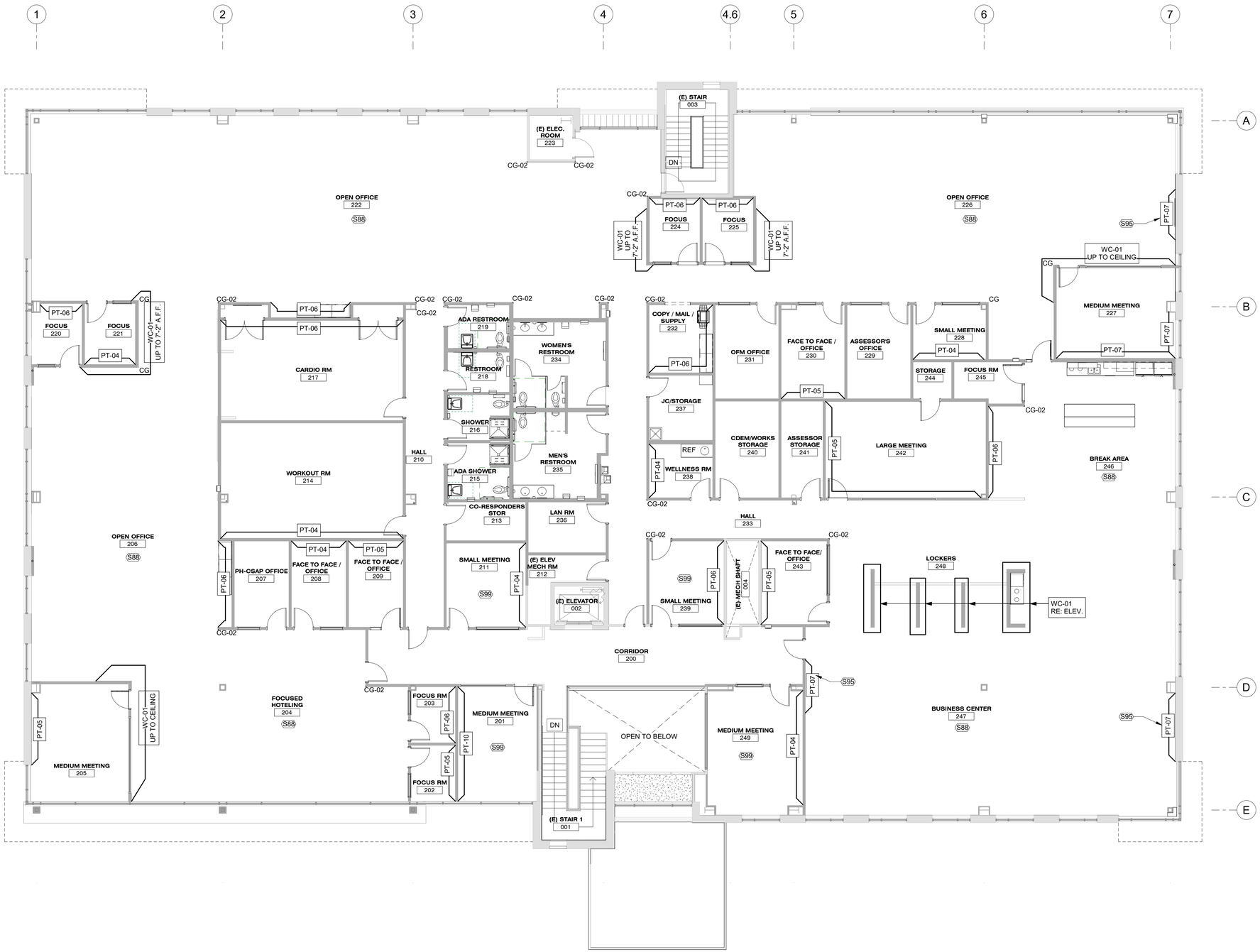

1 A-921 LEVEL 02 FINISH PLAN

1/8" = 1'-0"

GENERAL NOTES - WALL FINISH PLAN

1. ALL INFRASTRUCTURE ATTACHED TO A SURFACE INDICATED TO BE PAINTED IS TO ALSO BE PAINTED TO MATCH - INCLUDING BUT NOT LIMITED TO CONDUIT, ELECTRICAL BOXES, PIPING ETC UNLESS NOTED OTHERWISE.
2. ALL WALLS AND COLUMNS TO BE PAINTED PT-03 U.O.N.
3. IN AREAS TO BE PAINTED THAT ARE OPEN TO ABOVE, PAINT WALL UP TO REVEAL, ABOVE REVEAL CEILING COLOR TO EXTEND UP TO STRUCTURE.
4. WALLS EXPOSED ABOVE 9'-6" TO HAVE pT-02 ABOVE TYPICAL PT-03.
5. ALL CASEWORK SHOWN IS TO BE ENGINEERED BY FABRICATOR, DRAWINGS ARE FOR DESIGN INTENT.
6. FLOOR FINISHES SHOULD EXTEND UNDER MILLWORK & INTO RECESSES.
7. PROVIDE CORNER GUARDS W/ 2" WINGS AT ALL PROTRUDING CORNERS IN HIGH TRAFFIC LOCATIONS, U.O.N. CONFIRM LOCATIONS ON SITE WITH OWNER.
8. ALL LAMINATE CASEWORK TO HAVE 3MM PVC EDGE BANDING, HEAVY DUTY DRAWER GLIDES, HIDDEN HINGES, WITH MELAMINE INTERIOR SURFACES.
9. GC TO PROVIDE AND INSTALL ALL CODE COMPLIANT ROOM SIGNAGE.
10. REFER TO ENVIRONMENTAL GRAPHICS SPECS FOR GRAPHIC ELEMENT DETAILS.
11. ALL DOOR FRAMES TO BE PAINTED TO MATCH ADJACENT WALLS U.O.N. ON DOOR SCHEDULE, SPLIT FRAME COLOR AS NEEDED.
12. SWITCHES, OUTLET PLATES WILL BE SURFACE MOUNTED ON AREAS OF WF-xx. RECLOCATE STROBES TO OPPOSITE OR ADJACENT WALL WHERE POSSIBLE.
13. MOCK UP OF ALL PAINT COLORS IS REQUIRED. 1 FULL WALL OF EACH COLOR TO BE APPROVED BY OWNER AS PART OF SUBMITTAL.

LEGEND: WALL FINISHES

CG INDICATES THE LOCATION OF CORNER GUARDS

SHEET NOTES

NOTE	DESCRIPTION
S88	WALLS AT EXPOSED TO STRUCTURE AREAS - PROVIDE PAINT DATUM - LEVEL TO BE SET AT HEIGHT OF ADJACENT CEILING CLOUDS - PT-02 ABOVE DATUM
S95	ACCENT PAINT TO ALIGN WITH ACT GRID. COORDINATE WITH ARCHITECT ON SITE
S99	PROVIDE HORIZONTAL REVEAL CHANNEL SCREED (FRY REGLET OR SIM.) AT DRYWALL AT 32" A.F.F. AT ALL WALLS IN THIS ROOM

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LEVEL 02 FINISH PLAN

A-921

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GENERAL NOTES - FURNITURE PLAN

1. NOTE: MOVEABLE FURNISHINGS ARE P.B.O., I.B.O.; SHOWN FOR INFORMATION ONLY.
2. ARCHITECT TO PROVIDE DIMENSIONED POWER PLAN BASED ON OWNER APPROVED FURNITURE PLAN. BOX WALK REQUIRED PRIOR TO POURING SLABS.

1 A-990 LEVEL 01 FURNITURE PLAN

1/8" = 1'-0"

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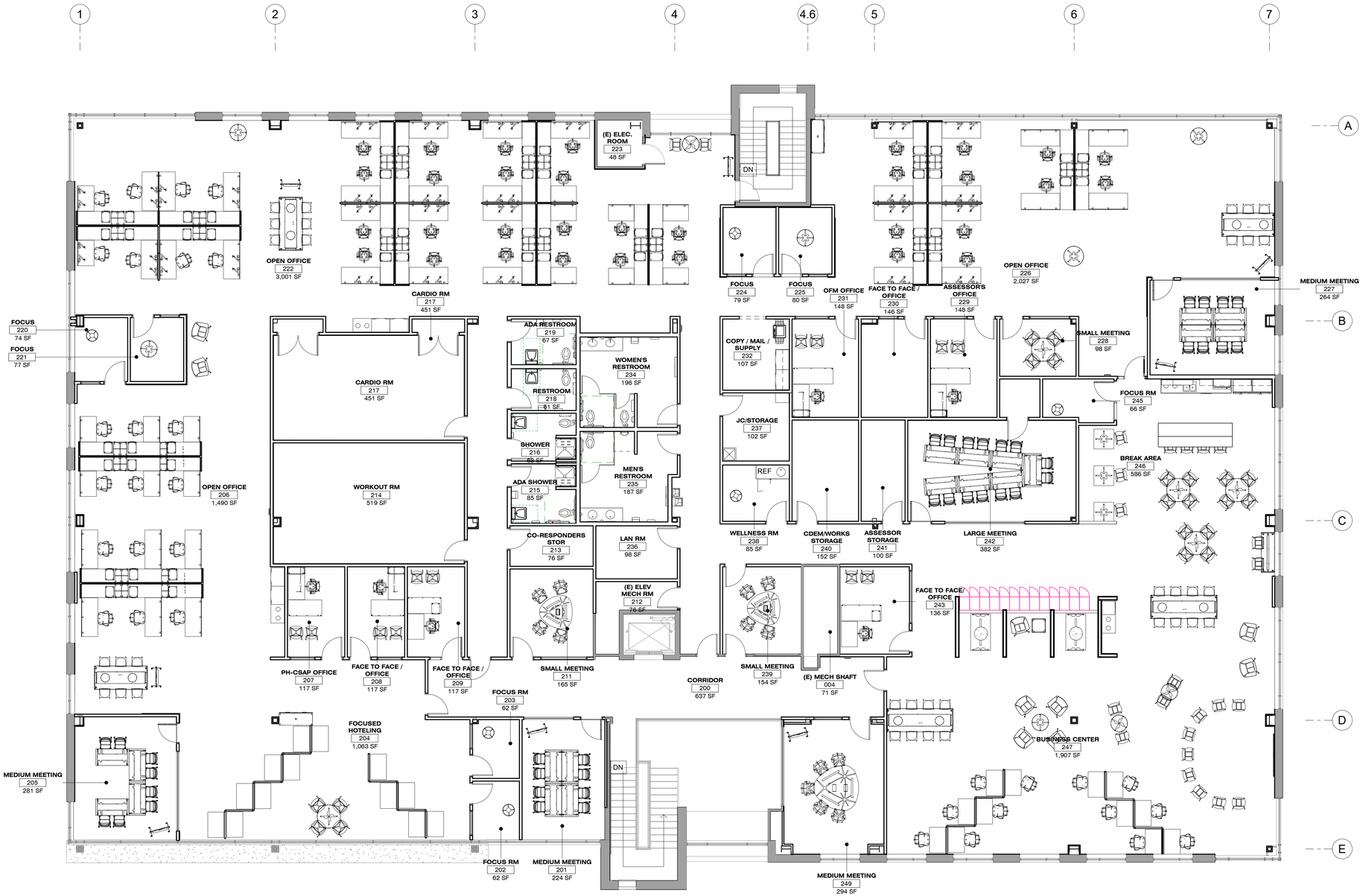
GENERAL NOTES - FURNITURE PLAN

1. NOTE: MOVEABLE FURNISHINGS ARE P.B.O., I.B.O.; SHOWN FOR INFORMATION ONLY.
2. ARCHITECT TO PROVIDE DIMENSIONED POWER PLAN BASED ON OWNER APPROVED FURNITURE PLAN. BOX WALK REQUIRED PRIOR TO POURING SLABS.



1 A-991 LEVEL 02 FURNITURE PLAN

1/8" = 1'-0"

studiotrope design collective

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OWNER
BOULDER COUNTY PUBLIC WORKS
2525 13TH STREET
BOULDER, CO 80304

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STUDIOTROPE DESIGN COLLECTIVE
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JVA CONSULTING ENGINEERS
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BOULDER, CO 80302

PROJECT:
SOUTHEAST COUNTY SERVICE HUB
1755 S. PUBLIC RD
LAFAYETTE, CO 80026

PROJECT NO: 2007

#	ISSUE DATE	PHASE / REV NAME
	11-19-2021	CONSTRUCTION DOCUMENTS

LEVEL 02 FURNITURE PLAN

A-991

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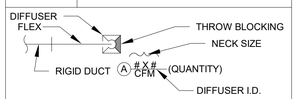
MECHANICAL LEGEND

SYMBOL	ABBREVIATION	DESCRIPTION
	(E)	EXISTING (LIGHT LINE)
	(D) DEMO	TO BE DEMOLISHED
	(N)	NEW (HEAVY LINE)
CHR	CHR	DUAL TEMPERATURE RETURN
CHS	CHS	DUAL TEMPERATURE SUPPLY
CR	CR	CHILLED WATER RETURN
CS	CS	CHILLED WATER SUPPLY
CWR	CWR	CONDENSER WATER RETURN
CWS	CWS	CONDENSER WATER SUPPLY
HWR	HWR	HEATING WATER RETURN
HWS	HWS	HEATING WATER SUPPLY
HPC	HPC	HIGH PRESSURE CONDENSATE
HPS	HPS	HIGH PRESSURE STEAM
LPC	LPC	LOW PRESSURE CONDENSATE
LPS	LPS	LOW PRESSURE STEAM
MPC	MPC	MEDIUM PRESSURE CONDENSATE
MPS	MPS	MEDIUM PRESSURE STEAM
PC	PC	PUMPED CONDENSATE
RD	RD	REFRIGERANT DISCHARGE
RL	RL	REFRIGERANT LIQUID
RS	RS	REFRIGERANT SUCTION
CW	CW	DOMESTIC COLD WATER
HW	HW	DOMESTIC HOT WATER
HWR	HWR	DOMESTIC HOT WATER CIRCULATION
A	A	AIR PIPING (COMPRESSED)
D	D	DRAIN
DIC	DIC	DE-IONIZED WATER CIRCULATION
F	F	FIRE
FOR	FOR	FUEL OIL RETURN
FOS	FOS	FUEL OIL SUPPLY
FOV	FOV	FUEL OIL VENT
G	G	GAS
GW	GW	GREASE WASTE
IW	IW	INDIRECT WASTE
MA	MA	MEDICAL AIR
N	N	NITROGEN
ORDL	ORDL	OVERFLOW ROOF DRAIN LEADER
O	OXY	OXYGEN
RDL	RDL	ROOF DRAIN LEADER
SAN	SAN	SANITARY WASTE
SMS	SMS	SNOW MELT SUPPLY
SMR	SMR	SNOW MELT RETURN
SOD	SOD	SAND AND OIL DRAIN
ST	ST	STORM
VAC	VAC	VACUUM
V	V	VENT
W	W	WASTE
	AFF	ABOVE FINISHED FLOOR
	AFG	ABOVE FINISHED GRADE
	EC	ELECTRICAL CONTRACTOR
	EOR	ENGINEER OF RECORD
	GC	GENERAL CONTRACTOR
	MC	MECHANICAL CONTRACTOR
	PC	PLUMBING CONTRACTOR
	ER	EXISTING RETURN AIR DEVICE
	ES	EXISTING SUPPLY AIR DEVICE
	ET	EXISTING TRANSFER AIR DEVICE
	RR	RELOCATED RETURN AIR DEVICE
	RS	RELOCATED SUPPLY AIR DEVICE
	RT	RELOCATED TRANSFER AIR DEVICE
	DWV	DOMESTIC WASTE & VENT

SYMBOL	DESCRIPTION
	PIPE UP AND DOWN ELBOW
	PIPE DOWN TEE
	PIPE CONTINUATION
PIPE FLOW DIRECTION (SHOWN TO RIGHT)	
	PIPE REDUCER
	PIPE UNION AND CAP
	BALL VALVE, GATE VALVE
	MOTORIZED VALVE - 2-WAY
	MOTORIZED VALVE - 3-WAY
	PRESSURE REDUCING VALVE
	CHECK VALVE
	BUTTERFLY VALVE, GLOBE VALVE
	BALANCE VALVE
	STRAINER
	HOSE-END DRAIN VALVE
	STRAINER WITH BLOW-OFF
	VENTURI
	GAS COCK
	PUMP
	DUAL CHECK BACKFLOW PREVENTOR
	REDUCED PRESSURE BACKFLOW PREVENTOR
	PRESSURE-TEMPERATURE TAP
	PRESSURE-TEMPERATURE RELIEF VALVE
	AIR PIVENT
	FLOOR DRAIN
	FLOOR SINK-FULL-3/4-HALF GRATE
	DRAIN ABOVE
	ROOF DRAIN
	ROOF DRAIN - OVERFLOW
	DOWNSPOUT NOZZLE
	CLEANOUT - VERTICAL
	CLEANOUT - HORIZONTAL
W H	WALL HYDRANT, HOSE BIBB

SYMBOL	DESCRIPTION
	SMOKE DETECTOR
20/16	DUCT SIZE INDICATING SHEET METAL DIMENSIONS. FIRST NUMBER WIDTH AND SECOND IS DEPTH (INCHES).
	DUCT ELBOW WITH TURNING VANE
	DUCT TEE WITH TURNING VANES
	MANUAL DAMPER WITH LOCKING QUADRANT.
M	MOTORIZED DAMPER
	FLEXIBLE DUCT CONNECTOR
	SPIN-IN FITTING WITH DAMPER
	45° DUCT TAKE-OFF
	RECTANGULAR SUPPLY AIR DUCT UP
	RECTANGULAR RETURN AIR DUCT UP
	RECTANGULAR EXHAUST AIR DUCT UP
	ROUND DUCT UP
V.C. 5/8"	DOOR UNDERCUT
	FIRE DAMPER
	FIRE AND SMOKE DAMPER
	SMOKE DAMPER
	EXISTING FIRE DAMPER
	SUPPLY DIFFUSER
	RETURN OR TRANSFER GRILLE
	EXHAUST GRILLE
	CARBON MONOXIDE SENSOR
xxx	THERMOSTAT OR TEMPERATURE SENSOR FOR DEVICE "XXX"
xxx	HUMIDISTAT OR HUMIDITY SENSOR FOR DEVICE "XXX"
	CARBON DIOXIDE SENSOR
	CONNECTION NEW TO EXISTING



NOTE: NOT ALL SYMBOLS ON THIS LEGEND ARE NECESSARILY USED ON THIS PROJECT.

PROJECT DESCRIPTION

THIS PROJECT INVOLVES A MULTI-PHASE WORKPLACE IMPROVEMENT. AS FIRST PHASE, THERE WILL BE TENANT IMPROVEMENT ON LEVEL 01 AND 02 OF THIS CORE AND SHELL BUILDING. SPACES WILL INCLUDE WORKSPACES, CONFERENCE ROOMS, COLLABORATION AREAS, COMMON AREAS, STAFF KITCHEN, SUPPORT ROOMS AND STORAGE. THIS PROJECT WILL PURSUE LEED GOLD CERTIFICATION.

PLUMBING WORK INVOLVES INSTALLATION OF A NEW INDIRECT DOMESTIC WATER HEATER WITH HOT WATER RECIRCULATION PUMPS, EXTENSION OF EXISTING CW, HW, SAN, V AND GAS SYSTEMS. NEW PLUMBING FIXTURES THROUGHOUT. EXISTING CW, SAN AND GAS SERVICES TO THE BUILDING ARE EXISTING TO REMAIN. THE ROOF DRAIN/STORM SYSTEM IS EXISTING TO REMAIN.

SPECIFICATION GENERAL NOTES

GENERAL NOTES:

A. REVIEW THE CONTRACT CONDITIONS AND GENERAL REQUIREMENTS FOR INFORMATION THAT APPLIES.

B. THE WORD "PROVIDE" IS USED TO MEAN "FURNISH AND INSTALL."

C. PROVIDE ALL ITEMS FOR A COMPLETE AND SUCCESSFUL OPERATION OF ALL SYSTEMS SHOWN ON THESE DRAWINGS.

D. THE DRAWINGS ARE DIAGRAMMATIC AND INDICATE GENERAL ARRANGEMENT OF THE WORK. LOCATIONS ARE APPROXIMATE UNLESS DIMENSIONED. MINOR MODIFICATIONS IN LOCATION TO MEET SITE REQUIREMENTS ARE ACCEPTABLE. REFER TO LATEST ARCHITECTURAL DRAWINGS FOR EXACT WALL LOCATIONS AND DIMENSIONS.

E. THE ARCHITECTURAL AND ENGINEERING DRAWINGS ARE COMPLEMENTARY. GENERAL CONTRACTORS, SUBCONTRACTORS, AND VENDORS SHALL ACKNOWLEDGE ALL THE ARCHITECTURAL AS WELL AS ALL THE ENGINEERING DRAWINGS AND INCLUDE ALL WORK NECESSARY TO ACHIEVE A COMPLETE WORKING INSTALLATION FOR ALL DEVICES OR EQUIPMENT WHICH MAY BE SHOWN ON ONE DRAWING BUT NOT SHOWN ON ANOTHER. WHERE ELEMENTS ARE INDICATED OR DESCRIBED IN ANY DRAWING, IT IS THE INTENT THAT ALL RELATED CONSTRUCTION ASSOCIATED WITH SUCH ELEMENTS IS TO BE INCLUDED IN ORDER TO OBTAIN A COMPLETE INSTALLATION. FOR INSTANCE, IF A PIECE OF EQUIPMENT IS IDENTIFIED IN THE ARCHITECTURAL AND/OR MECHANICAL DRAWINGS, BUT THE ELECTRICAL CIRCUIT FOR SUCH EQUIPMENT IS NOT IDENTIFIED IN THE ELECTRICAL DRAWINGS, THE CONTRACTOR IS TO PROVIDE SUCH CIRCUIT IN ORDER TO HAVE FULLY OPERATIONAL EQUIPMENT. FOR ANOTHER EXAMPLE, IF A SINK IS INDICATED, IT IS THE INTENT THAT RELATED PLUMBING WORK INCLUDING DRAINS, VENT, PIPING, VALVES, ETC. ARE TO BE INCLUDED IN ORDER TO RESULT IN A FULLY OPERATIONAL SYSTEM. NO SUBCONTRACTOR SHALL BE ALLOWED TO EXCLUDE PORTIONS OF THE COMPLIMENTARY DRAWING SET.

F. LAY OUT ALL WORK IN ADVANCE. DO NOT DEFACE THE WORK OF OTHER TRADES OR THE EXISTING BUILDING.

G. LOCATION OF PIPES, DUCTS, SWITCHES, PANELS, EQUIPMENT, AND FIXTURES SHALL BE ADJUSTED TO ACCOMMODATE THE WORK OR INTERFERENCES ANTICIPATED AND ENCOUNTERED. DETERMINE THE EXACT ROUTE AND LOCATION OF EACH PIPE AND DUCT PRIOR TO FABRICATION.
G.A. RIGHT-OF-WAY: LINES WHICH PITCH SHALL HAVE THE RIGHT-OF-WAY OVER THOSE WHICH DO NOT PITCH. LINES WHOSE ELEVATIONS CANNOT BE CHANGED SHALL HAVE THE RIGHT-OF-WAY OVER LINES WHOSE ELEVATIONS CAN BE CHANGED.
G.B. OFFSETS, TRANSITIONS, AND CHANGES IN DIRECTION: OFFSETS, TRANSITIONS, AND CHANGES IN DIRECTION OF PIPES AND DUCTS SHALL BE MADE AS REQUIRED TO MAINTAIN PROPER HEADROOM AND PITCH OF SLOPING LINES WHETHER OR NOT INDICATED ON THE DRAWINGS.
G.C. FURNISH AND INSTALL ALL TRAPS, AIR VENTS, SANITARY VENTS, AND DEVICES AS REQUIRED TO EFFECT THESE OFFSETS, TRANSITIONS, AND CHANGES IN DIRECTION.

H. ALL PENETRATIONS OF FIRE RATED WALLS, FLOORS, AND CEILINGS SHALL HAVE THE SPACE AROUND PENETRATIONS SEALED WITH A FIRE BARRIER SEALANT MEETING THE REQUIREMENTS OF U.L. STANDARD 1479 AND ASTM-E 814. INSTALL SEALANT IN FULL COMPLIANCE WITH MANUFACTURER'S STANDARD INSTALLATION INSTRUCTIONS.

I. ALL MATERIALS LOCATED ABOVE CEILING SHALL BE SUITABLE FOR USE WITHIN A RETURN AIR PLENUM AS REQUIRED BY THE ADOPTED EDITION OF THE INTERNATIONAL MECHANICAL CODE.

J. WHEN USING A TORCH OR OTHER FLAME-PRODUCING DEVICE ON THIS PROJECT, CONTRACTOR SHALL PROVIDE ONE APPROVED FIRE EXTINGUISHER OR WATER HOSE EQUIPPED WITH A SUITABLE NOZZLE, SUFFICIENT IN LENGTH TO REACH ALL PORTIONS OF THE BUILDING AND CONNECTED TO A WATER SUPPLY ON THE PREMISES WHERE SAID BURNING OPERATION IS PERFORMED. COMBUSTIBLE MATERIAL IN THE CLOSE PROXIMITY OF OPEN FLAME SHALL BE PROTECTED AGAINST IGNITION BY SHIELDING, WETTING, OR OTHER MEANS. IN ALL CASED, A FIRE WATCH SHALL BE MAINTAINED IN THE VICINITY OF THE OPERATION BY THE CONTRACTOR FOR ONE-HALF HOUR AFTER THE TORCH OR FLAME-PRODUCING DEVICE HAS BEEN USED.

K. THE CONTRACTOR SHALL VISIT THE SITE PRIOR TO BIDDING THE PROJECT AND TAKE INTO CONSIDERATION CONDITIONS THAT MAY AFFECT THE WORK. NO ADDITIONAL COMPENSATION WILL BE APPROVED FOR FAILURE TO VISIT THE SITE PRIOR TO PRICING THE WORK.

L. MAINTAIN A CONTRACT SET OF THESE DRAWINGS AT THE SITE, WITH ALL CHANGES OR DEVIATIONS FROM THE ORIGINAL DRAWINGS NEATLY MARKED ON THEM IN RED COLOR. THIS SHALL BE A SEPARATE SET OF DRAWINGS NOT USED FOR CONSTRUCTION PURPOSES, WHICH SHALL BE KEPT UP TO DATE AS THE JOB PROGRESSES AND SHALL BE MADE AVAILABLE FOR INSPECTION BY THE ENGINEER AT ALL TIMES. UPON COMPLETION OF THE CONTRACT, THIS SET OF "AS-BUILTS" SHALL BE DELIVERED TO THE ENGINEER WITHIN 15 DAYS OF COMPLETION OF THE PROJECT.

M. MATERIAL SHALL BE AS SPECIFIED. SUBSTITUTIONS WILL BE CONSIDERED IF SUBMITTED FOR PRIOR APPROVAL AT LEAST ONE (1) WEEK PRIOR TO THE CONTRACT BID DATE. SUBSTITUTIONS SHOULD BE SUBMITTED SEPARATELY FOR EACH PRODUCT WITH SUPPORTING DATA, DRAWINGS AND SAMPLES AS APPROPRIATE, INCLUDING: 1.) COMPARISON OF THE QUALITIES OF THE PROPOSED SUBSTITUTION WITH THAT SPECIFIED. 2.) CHANGES REQUIRED IN OTHER ELEMENTS OF THE WORK BECAUSE OF THE SUBSTITUTION. 3.) COST DATA COMPARING THE PROPOSED SUBSTITUTION WITH THE PRODUCT SPECIFIED. THE ENGINEER WILL DETERMINE THE ACCEPTABILITY OF THE PROPOSED SUBSTITUTION.

N. SUBMIT ELECTRONIC PDF OF MANUFACTURER'S SHOP DRAWINGS FOR EQUIPMENT AND DEVICES. PRIOR TO SUBMITTING THE SHOP DRAWINGS FOR REVIEW, THE CONTRACTOR SHALL REVIEW AND CERTIFY SAME AS TO COMPLIANCE WITH THE PLANS AND SPECIFICATIONS AND FOR DIMENSIONAL SUITABILITY FOR THE APPLICATIONS.

O. WHEN ALTERNATE OR SUBSTITUTED EQUIPMENT IS USED, CONTRACTOR IS RESPONSIBLE FOR COORDINATING SPACE REQUIREMENTS, CONFIGURATIONS, CHANGES IN SUPPORTS OR STRUCTURAL MEMBERS, ELECTRICAL REQUIREMENTS, AND COORDINATION OF OTHER TRADES THAT MAY BE AFFECTED BY THEIR USE. CONTRACTOR IS RESPONSIBLE FOR VERIFYING THE SAME WHEN USING LISTED APPROVED MANUFACTURERS OTHER THAN THE BASIS OF DESIGN.

P. THE CONTRACTOR SHALL PROVIDE ALL EQUIPMENT AND PERSONNEL REQUIRED FOR TESTING OF INSTALLED EQUIPMENT.

Q. THE CONTRACTOR SHALL DEMONSTRATE THE PROPER OPERATION AND CALIBRATION OF ALL SYSTEMS TO THE OWNER, AT A TIME AS AGREED TO BY THE OWNER AND DIRECTED BY THE OWNER.

R. THE CONTRACTOR SHALL PROVIDE THE OWNER WITH OPERATION AND MAINTENANCE MANUALS FOR ALL SYSTEMS WITHIN 15 DAYS OF THE COMPLETION OF THE PROJECT.

S. THE CONTRACTOR SHALL INCLUDE THE COST FOR COMMISSIONING TO VERIFY THE PERFORMANCE OF THE SYSTEM CONTROLS SHOWN ON THIS DRAWING. THIS INCLUDES PREPARING A COMMISSIONING PLAN, VERIFYING THE OPERATION OF ALL SYSTEMS PER CODE REQUIREMENTS, AND PROVIDING A FINAL COMMISSIONING REPORT. FINAL COMMISSIONING REPORT IS DUE UPON COMPLETION OF THE PROJECT.

CODES, REGULATIONS, AND STANDARDS:

1. ALL WORK SHALL BE IN STRICT ACCORD WITH LOCAL GOVERNING LAWS, ORDINANCES, AND REGULATIONS; ALL WORK MUST BE IN FULL ACCORDANCE WITH ALL CODES, ORDINANCES, AND CODE RULINGS. CONTRACTOR SHALL PROVIDE, WITHOUT EXTRA CHARGE, THE LABOR AND MATERIALS REQUIRED FOR FULL CODE COMPLIANCE.
2. ALL MATERIALS SHALL BE NEW AND SHALL COMPLY WITH THE SPECIFICATIONS ON DRAWINGS.
3. CONTRACTOR SHALL OBTAIN AND PAY FOR ALL LOCAL FEES, PERMITS, AND SERVICES OF INSPECTION AUTHORITIES REQUIRED BY THE WORK OF THE PROJECT. THE CONTRACTOR SHALL ARRANGE FOR ALL INSPECTIONS WHEN THEY BECOME DUE AND SHALL NOT COVER NEW WORK UNTIL APPROVED BY THE INSPECTION AUTHORITY.

GUARANTEE:

A. THE CONTRACTOR SHALL GUARANTEE ALL WORKMANSHIP, MATERIALS, AND EQUIPMENT PROVIDED FOR THE PROJECT AGAINST DEFECTS AND/OR FAULTY WORKMANSHIP FOR A PERIOD OF ONE YEAR FROM THE DATE OF FINAL ACCEPTANCE BY THE OWNER.

B. THE CONTRACTOR SHALL REPAIR AND/OR REPLACE DEFECTIVE OR FAULTY WORKMANSHIP, MATERIALS, OR EQUIPMENT, AND SHALL BE RESPONSIBLE FOR THE REPAIR AND/OR REPLACEMENT OF OTHER PROPERTY OR WORK DAMAGED AS A RESULT, WITHOUT CHARGE TO THE OWNER AND AS QUICKLY AS POSSIBLE, DURING THE GUARANTEE PERIOD.

PLUMBING DRAWING INDEX

DRAWING NUMBER	DRAWING TITLE	ISSUE DATE - DESCRIPTION: 08-20-2021 - 100% DD SET	11-19-2021 - CONSTRUCTION DOCUMENTS
P-001	PLUMBING LEGEND AND NOTES	●	●
P-002	PLUMBING CONTROLS AND NOTES	●	●
P-003	PLUMBING SCHEDULES	●	●
P-004	PLUMBING DETAILS	●	●
P-005	WASTE & VENT ISOMETRIC - LEVEL 01		●
P-006	WASTE & VENT ISOMETRIC - LEVEL 02		●
P-100	UNDERGROUND - PLUMBING PLAN	●	●
P-101	LEVEL 01 - PLUMBING DWV PLAN	●	●
P-102	LEVEL 02 - PLUMBING DWV PLAN	●	●
P-103	ROOF - PLUMBING PLAN	●	●
P-111	LEVEL 01 - PLUMBING SUPPLY PLAN	●	●
P-112	LEVEL 02 - PLUMBING SUPPLY PLAN	●	●
P-121	ENLARGED BATHROOMS - PLUMBING DWV		●
P-122	ENLARGED BATHROOMS - PLUMBING SUPPLY		●

KEY:
● FULL SHEET ISSUE.
○ PARTIAL SHEET ISSUE (SKETCH).

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BUILDING CODE DATA

DISCIPLINE	CODE	EDITION
GENERAL	INTERNATIONAL BUILDING CODE	2015
HVAC / MECHANICAL	INTERNATIONAL MECHANICAL CODE	2015
PLUMBING	INTERNATIONAL PLUMBING CODE	2015
ELECTRICAL	NATIONAL ELECTRIC CODE	2020
FIRE PROTECTION	INTERNATIONAL FIRE CODE	2015
	NFPA STANDARDS	CURRENT
FUEL	INTERNATIONAL FUEL GAS CODE	2015
ENERGY	INTERNATIONAL ENERGY CONSERVATION CODE	2015
ACCESSIBILITY	ICC/ANSI A117.1	2009
LOCAL AMENDMENTS	BOULDER COUNTY BUILDING CODE AMENDMENTS	2017

NOTES:
A. ALL WORK PERFORMED SHALL COMPLY WITH THE REQUIREMENTS OF THE LISTED CODES, LOCAL CODE AMENDMENTS, AND REFERENCED STANDARDS AS ENFORCED BY THE AUTHORITY HAVING JURISDICTION (AHJ).
B. ALL WORK SUBJECT TO INSPECTION BY THE AHJ AT THE PROJECT SITE FOR COMPLIANCE.

SPECIFICATION GENERAL NOTES CONTINUED

DEMOLITION NOTES:

1. VERIFY LOCATION OF EXISTING SYSTEMS AND EXISTING FIELD CONDITIONS.
2. REVIEW ALL SHEETS FOR OTHER DEMO AND REMOVAL REQUIREMENTS.
3. COORDINATE ALL DEMOLITION WORK WITH THE ARCHITECTURAL DRAWINGS.
4. ALL CONFLICTS, OMISSIONS, AND CONCERNS SHALL BE BROUGHT TO THE ATTENTION OF THE ENGINEER IN WRITING FOR A WRITTEN RESOLUTION, BEFORE PROCEEDING WITH WORK SO INVOLVED.
5. UNLESS SPECIFICALLY NOTED TO THE CONTRARY, REMOVED MATERIALS SHALL NOT BE REUSED IN THE WORK. SALVAGED MATERIALS THAT ARE TO BE REUSED SHALL BE STORED SAFE AGAINST DAMAGE AND TURNED OVER TO THE APPROPRIATE TRADE FOR REUSE.
6. WHERE INDICATED, SALVAGED MATERIALS SHALL REMAIN THE PROPERTY OF THE OWNER. THESE MATERIALS ARE TO BE REMOVED BY THE SUBCONTRACTOR AND TURNED OVER TO THE OWNER WITHOUT DAMAGE. ALL OTHER SALVAGED MATERIALS SHALL BECOME THE PROPERTY OF THE SUBCONTRACTOR, WHO SHALL REMOVE AND LEGALLY DISPOSE OF OR (PREFERABLY) RECYCLE THEM AWAY FROM THE PREMISES.
7. WORK THAT HAS BEEN CUT OR PARTIALLY REMOVED SHALL BE PROTECTED AGAINST DAMAGE UNTIL COVERED BY PERMANENT CONSTRUCTION.
8. CLEAN ALL EQUIPMENT AND ACCESSORIES THAT ARE TO BE REUSED. REMOVE ALL MUD, DEBRIS, RUST AND OTHER EXTRANEOUS MATERIALS SO THAT THE EXISTING EQUIPMENT AND ALL ACCESSORIES CAN BE REPAINTED AND REPAIRED AS REQUIRED TO PLACE IN FIRST CLASS WORKING CONDITION.
9. WHERE EXISTING EQUIPMENT IS REMOVED, PIPING OR CONDUIT SHALL BE CAPPED UNDER THE FLOOR OR BEHIND THE WALL FACE, UNLESS OTHERWISE NOTED.
10. REPAIR ALL WALL, FLOOR, AND CEILING PENETRATIONS TO MAINTAIN THE EXISTING FIRE RATING.

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pcd ENGINEERING
a Bowman company

COLORADO REGISTERED PETER C. DANTON 33293 PROFESSIONAL ENGINEER
11/19/21

PROJECT:
SOUTHEAST COUNTY SERVICE HUB
1755 S. PUBLIC RD
LAFAYETTE, CO 80026

PROJECT NO: 2007

#	ISSUE DATE	PHASE / REV NAME
	11/19/21	CONSTRUCTION DOCUMENTS

PLUMBING LEGEND & NOTES

P-001

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PLUMBING CONTROLS

1. THE PLUMBING SYSTEM CONTROLS ARE TO BE FULLY AUTOMATIC UNLESS OTHERWISE LISTED BELOW.

2. ALL CONTROL SYSTEMS SHALL BE DESIGNED AND PROVIDED BY A CONTROL MANUFACTURER WHO HAS BEEN IN THE BUSINESS OF MANUFACTURING, DESIGNING, AND INSTALLING CONTROL COMPONENTS FOR A MINIMUM OF TEN (10) YEARS.

3. COORDINATE WITH ELECTRICAL CONTRACTOR FOR INTERFACE WITH LINE VOLTAGE WIRING, CONNECTIONS, RELAYS, ETC.

4. SETPOINTS:
   - 4.1. WATER TEMPERATURE AT WATER HEATER DISCHARGE:
     - 4.1.1. 140 DEGREES FAHRENHEIT (ADJUSTABLE).
   - 4.1. MAXIMUM WATER TEMPERATURE AT LAVATORY OR HAND SINK FAUCET:
     - 4.1.1. 110 DEGREES FAHRENHEIT (ADJUSTABLE).
   - 4.1. WATER TEMPERATURE AT EMERGENCY EQUIPMENT DISCHARGE:
     - 4.1.1. 80 DEGREES FAHRENHEIT (ADJUSTABLE).

5. WATER HEATER:
   - 5.1. WATER HEATER SHALL HAVE INTEGRAL CONTROLS TO MAINTAIN TEMPERATURE SETPOINT.
   - 5.2. CONTROLS SHALL HAVE INTEGRAL FAULT DETECTION AND DIAGNOSTIC CAPABILITIES.

6. WATER HEATER CIRCULATION PUMP:
   - 6.1. PUMP SHALL BE CONTROLLED BY A TIMER TO RUN DURING BUILDING OCCUPIED PERIODS.
   - 6.2. AQUASTAT ON RETURN PIPE SHALL CYCLE PUMP TO MAINTAIN 135 DEGREES FAHRENHEIT (ADJUSTABLE, DURING OCCUPIED HOURS).

PLUMBING COMMISSIONING

1. A COMMISSIONING PLAN SHALL BE DEVELOPED BY A REGISTERED DESIGN PROFESSIONAL OR APPROVED AGENCY AND SHALL INCLUDE THE FOLLOWING ITEMS:
   - 1.1. A NARRATIVE DESCRIPTION OF THE ACTIVITIES THAT WILL BE ACCOMPLISHED DURING EACH PHASE OF COMMISSIONING, INCLUDING THE PERSONNEL INTENDED TO ACCOMPLISH EACH OF THE ACTIVITIES.
   - 1.2. A LISTING OF THE SPECIFIC EQUIPMENT, APPLIANCES, OR SYSTEMS TO BE TESTED AND A DESCRIPTION OF THE TESTS TO BE PERFORMED.
   - 1.3. FUNCTIONS TO BE TESTED INCLUDED, BUT NOT LIMITED TO, CALIBRATIONS AND ECONOMIZER CONTROLS.
   - 1.4. CONDITIONS UNDER WHICH THE TEST WILL BE PERFORMED. TESTING SHALL AFFIRM WINTER AND SUMMER DESIGN CONDITIONS AND FULL OUTSIDE AIR CONDITIONS.
   - 1.5. MEASURABLE CRITERIA FOR PERFORMANCE.

2. THE FOLLOWING PLUMBING SYSTEMS ARE TO BE COMMISSIONED:
   - 2.1. DOMESTIC HOT WATER HEATERS.
   - 2.2. DOMESTIC HOT WATER CIRCULATION SYSTEMS.

PLUMBING GENERAL NOTES

1. THE NEW PLUMBING SYSTEMS SHALL BE BY THE PLUMBING CONTRACTOR. THIS INCLUDES, BUT IS NOT LIMITED TO:
   - 1.1. THE PLUMBING FIXTURES AND EQUIPMENT AS SCHEDULED OR LISTED.
   - 1.2. THE WATER DISTRIBUTION SYSTEMS WITH: WATER SERVICE ENTRANCE, BACKFLOW PREVENTION, PRESSURE REGULATION, PIPING, VALVES, INSULATION, WATER HEATING EQUIPMENT, PUMPS, CONTROL SYSTEMS, ETC.
   - 1.3. THE WASTE AND VENT SYSTEMS WITH: PIPING, TRAPS, INTERCEPTORS, CLEANOUTS, VALVES, INSULATION, ETC.
   - 1.4. THE GAS DISTRIBUTION SYSTEMS WITH: GAS METER SERVICE ENTRANCE, PRESSURE REGULATION, PIPING, VALVES, EQUIPMENT CONNECTIONS, CONTROL SYSTEMS, ETC.
2. ALL PLUMBING SHALL BE IN ACCORDANCE WITH THE LOCAL PLUMBING CODES AND/OR ORDINANCES, INCLUDING, BUT NOT LIMITED TO PIPE SIZE.
3. CONTRACTOR SHALL MAINTAIN FULL RESPONSIBILITY FOR ALL DAMAGE CAUSED BY LEAKS IN PIPING SYSTEMS WHICH HE HAS BUILT OR MODIFIED IN ANY WAY. ALL DAMAGE SHALL BE REPAIRED OR REPLACED TO THE SATISFACTION OF THE OWNER.
4. PROJECT DESIGN CONDITIONS ARE:
   - 4.1. LOCATION: LAFAYETTE, COLORADO, BOULDER COUNTY.
   - 4.2. SITE ELEVATION: 5413 FEET.
   - 4.3. DOMESTIC WATER PROVIDED BY: CITY OF LAFAYETTE WATER DEPARTMENT.
     - 4.3.1. DESIGN CONDITIONS PER CITY WATER DEPARTMENT ARE:
       - 4.3.1.1. MINIMUM DESIGN WATER PRESSURE: 50 PSI.
       - 4.3.1.2. MAXIMUM DESIGN WATER PRESSURE: 75 PSI.
5. INSTALL ALL PIPING TRUE AND PLUMB, PARALLEL OR PERPENDICULAR TO BUILDING CONSTRUCTION. USE ONLY NEW MATERIALS, CLEAN AND FREE OF RUST.
6. PROVIDE DIELECTRIC UNIONS AT ALL PIPING CONNECTIONS OF DISSIMILAR METALS.
7. DOMESTIC WATER PIPING ABOVE GRADE;
   - 7.1. TYPE "L" HARD DRAWN COPPER WITH WROUGHT COPPER SWEAT FITTINGS. USE ONLY CANFIELD 100% WATERSAFE SOLDER (95% TIN, 4% COPPER, 1% SILVER) OR APPROVED EQUAL. DO NOT USE LEAD OR ANTIMONY SOLDERS.
8. DOMESTIC WATER PIPING BELOW GRADE - TYPE "K" SOFT DRAWN COPPER WITH WROUGHT COPPER BRAZED FITTINGS. USE ONLY CANFIELD BRAZESAFE 56 BRAZING ALLOY OR APPROVED EQUAL. DO NOT USE LEAD OR ANTIMONY BRAZING ALLOYS. INSTALL WITHOUT JOINTS WHERE POSSIBLE. IF JOINTS ARE REQUIRED, LOCATE THEM ON THE RECORD DRAWINGS WITH DIMENSIONS TO WALLS OR OTHER REFERENCE POINTS.
9. INSULATE DOMESTIC HOT WATER PIPING AND HOT WATER RECIRCULATION PIPING ABOVE GRADE WITH SNAP-ON TYPE FIBERGLASS PIPE INSULATION (1" THICK FOR PIPES 1-1/4" OR SMALLER AND 1-1/2" THICK FOR PIPES GREATER THAN OR EQUAL TO 1-1/2") WITH SELF SEALING ALL-SERVICE JACKET, FLAME RETARDANT. INSULATE DOMESTIC COLD WATER PIPING ABOVE GRADE WITH 1/2" THICK SNAP-ON TYPE FIBERGLASS PIPE INSULATION WITH SELF SEALING ALL-SERVICE JACKET, FLAME RETARDANT. ALL WATER VALVES AND FITTINGS SHALL BE INSULATED WITH MOLDED OR MITERED FIBERGLASS (SAME THICKNESS AS ASSOCIATED PIPING), FINISHED WITH A BRUSH COAT OF B.F. 30-35, 6 OZ. CANVAS AND A SECOND COAT OF SEALANT. NO STAPLES SHALL BE USED ON WATER PIPE INSULATION.
10. INTERIOR SOIL, WASTE, AND VENT PIPING ABOVE GRADE - SERVICE WEIGHT IRON SOIL PIPE AND NO-HUB FITTINGS, (PVC SCHEDULE-40 SOLID CORE PLASTIC PIPE AND FITTINGS MAY BE USED WHERE ALLOWED BY THE BUILDING DEPARTMENT AND NOT LOCATED IN NEW OR EXISTING RETURN AIR PLENUM.)
11. INTERIOR SOIL, WASTE, AND VENT PIPING BELOW GRADE - SERVICE WEIGHT CAST IRON HUB AND SPIGOT SOIL PIPE AND FITTINGS WITH NEOPRENE GASKETS. (PVC SCHEDULE-40 SOLID CORE PLASTIC PIPE AND FITTINGS MAY BE USED WHERE ALLOWED BY THE BUILDING DEPARTMENT.)
12. SLOPE ALL SANITARY WASTE LINES DOWN TOWARDS DRAIN. MINIMUM SLOPE EQUALS 1/4" PER LINEAR FOOT FOR PIPING 2-1/2" DIAMETER AND SMALLER; 1/8" PER LINEAR FOOT FOR ALL PIPING 3" DIAMETER AND LARGER. SLOPE ALL SANITARY VENT LINES TOWARD TRAP SERVED AT MINIMUM 1/10" PER LINEAR FOOT.
13. ALL REQUIRED SAWCUTTING, EXCAVATING, AND BACKFILLING SHALL BE PERFORMED BY PLUMBING CONTRACTOR FOR INSTALLATION OF NEW PLUMBING PIPING. CONCRETE FLOOR PATCHING SHALL BE PERFORMED BY G.C.
14. ALL CORE DRILLING THROUGH CONCRETE FLOORS, WALLS, OR ROOF SHALL BE PROCEED BY X-RAYING. THIS WORK IS THE RESPONSIBILITY OF THE CONTRACTOR.
15. GAS PIPING ABOVE GRADE 2" AND SMALLER SHALL BE THREADED SCHEDULE 40 STEEL PIPE WITH MALLEABLE IRON FITTINGS. ALL GAS PIPING ABOVE GRADE OVER 2" IN SIZE SHALL BE WELDED.
16. CONTRACTOR SHALL VERIFY GAS PRESSURE DELIVERED BY METER AT EXITING BUILDING (IF APPLICABLE). PROVIDE GAS PRESSURE REGULATOR AT GAS PIPING SUPPLY TO EACH PIECE OF CONNECTED EQUIPMENT IF GAS PRESSURE AT METER OUTLET EXCEEDS 7" W.C.
17. TEST THREADED NATURAL GAS PIPING AT 20 PSIG FOR A TEST PERIOD OF 2 HOURS. TEST PRESSURE SHALL NOT FALL OVER 5% DURING TEST PERIOD TO PASS. IF PIPING FAILS TEST, INVESTIGATE AND REPAIR THE SOURCE OF LEAKAGE AND REPEAT TEST.
18. ALL NEW EXTERIOR GAS PIPING SHALL BE PAINTED WITH AN ENAMEL CORROSION-RESISTANT PAINT BY THE M.C. FOLLOWING PRESSURE TESTING OF GAS PIPING. COLOR TO MATCH BUILDING EXTERIOR.
19. ALL NATURAL GAS PIPING SHALL BE BUILT AND SUPPORTED IN COMPLIANCE WITH THE LATEST EDITION OF NFPA PAMPHLET 54.
20. MOUNT LAVATORY AT REQUIRED ELEVATION FOR HANDICAP USAGE WHERE REQUIRED. INSULATE ALL EXPOSED PIPING PER CODE REQUIREMENTS. RE: ARCHITECTURAL DRAWINGS.
21. WEATHERPROOF ALL PLUMBING ROOF PENETRATIONS PER CODES AND ROOFING MANUFACTURER RECOMMENDATIONS (RE: ARCHITECTURAL DRAWINGS). PLUMBING VENT PENETRATIONS SHALL BE CAST IRON AND ONE SIZE LARGER THAN REQUIRED VENT SIZE.
22. PROVIDE LINE SIZE SHUT-OFF VALVE, MALLEABLE UNION, AND 6" DIRT LEG ON ALL GAS EQUIPMENT.
23. WATER HAMMER ARRESTERS SHALL BE PROVIDED AND INSTALLED ON WATER PIPING WITH QUICK CLOSING VALVES TO PREVENT PIPING SHOCK OR HAMMER.
24. ALL MATERIAL AND EQUIPMENT PROVIDED AND INSTALLED UNDER THIS SECTION SHALL BE NEW AND IN CLEAN AND BRIGHT CONDITION. THE CONTRACTOR SHALL TAKE ALL MEASURES NECESSARY TO ENSURE AND MAINTAIN THE QUALITY OF THE INSTALLATION. ALL PIPING SHALL BE FLUSHED WITH CLEAN WATER PRIOR TO BEING PLACED INTO SERVICE TO ENSURE THAT ALL RESIDUAL CUTTING OIL, SLAG, THREAD TAPE, FLUX OR DIRT HAS BEEN PURGED. IN ADDITION TO FLUSHING, THE DOMESTIC WATER PIPING SHALL BE STERILIZED TO ELIMINATE ALL CONTAMINATION IN ACCORDANCE WITH IPC RECOMMENDATIONS.
25. PROVIDE FREEZE PROTECTION FOR PIPING WITHIN UNHEATED SPACES.
26. ALL PIPING, EQUIPMENT, ETC. SHALL BE IDENTIFIED.
27. ALL SAFETY RELIEF VALVES SHALL BE PIPED TO NEAREST FLOOR SINK, OR OTHER APPROVED RECEPTOR. REDUCED PRESSURE BACKFLOW PREVENTORS SHALL BE PROVIDED WITH ATTACHED FUNNEL PIPED TO THE NEAREST FLOOR SINK, RECEPTOR, OR OUTSIDE WHERE A NUISANCE WILL NOT BE CREATED BY WATER OR ICE.
28. PRESSURE REDUCING VALVES SHALL BE INSTALLED ON ALL WATER SERVICES WHERE THE WATER PRESSURE EXCEEDS 80 PSI.
29. ALL PIPING TO BE HUNG ON ADJUSTABLE SPLIT RING HANGERS OF SIMILAR MATERIAL AS THE PIPE UNLESS OTHERWISE NOTED. PIPING RACKED ON WALLS SHALL BE RACKED ON UNI-STRUT TYPE SUPPORTS. PIPE HANGER SPACING PER THE PLUMBING CODE REQUIREMENTS.
30. PROVIDE ALL CURBS, SUPPORTS, AND ANCHORS FOR MECHANICAL WORK. NO CHAIN, TAPE OR WIRE MAY BE USED FOR HANGING OR SUPPORTING.
31. RECEIVE, UNCRATE, ASSEMBLE, ENSURE, AND INSTALL ALL EQUIPMENT FURNISHED BY THIS CONTRACT (AND FURNISHED BY THE OWNER) IN CONFORMANCE TO MANUFACTURER'S STANDARD INSTALLATION INSTRUCTIONS.
32. THIS CONTRACTOR SHALL COORDINATE ALL PIPING PRIOR TO INSTALLATION.
33. PROVIDE SLEEVES AND COLLARS FOR ALL PIPES THROUGH WALL, FLOORS, AND CEILINGS. SEAL ALL EXTERNAL PENETRATIONS OF FIRE RATED WALL, FLOORS, AND CEILINGS WITH APPROVED FIRE STOP MATERIAL IN COMPLIANCE WITH ASTM E814 AND UL 1479. PROVIDE I=PC ESCUTCHEON-CHROME PLATED AT ALL PIPING PENETRATIONS OF FINISHED WALLS EXPOSED TO VIEW.
34. A MINIMUM CLEARANCE OF 30 INCHES SHALL BE PROVIDED AROUND ANY EQUIPMENT (I.E., WATER HEATERS, PUMPS, BOILERS,, ETC.) FOR SERVICE AND MAINTENANCE.
35. TEST ALL PIPING SYSTEMS IN WHICH ANY ALTERATIONS HAVE BEEN MADE FOR COMPLIANCE WITH THE GOVERNING EDITION OF THE INTERNATIONAL PLUMBING AND FUEL/GAS CODE. DOMESTIC HOT AND COLD WATER PIPING SHALL BE SUBJECT TO 100 PSIG FOR A MINIMUM OF 24 HOURS, DOMESTIC WASTE AND VENT PIPING SHALL BE TESTED AT 10' STATIC HEAD FOR A PERIOD GREATER THAN 15 MINUTES. IF THE REQUIRED PRESSURE DROPS BY MORE THAN 5% DURING ITS TEST DURATION, INVESTIGATE THE SOURCE OF THE LEAK, REPAIR THE LEAK, AND RETEST THE SYSTEM FOR THE REQUIRED TEST PERIOD. INSPECT ALL W & V JOINTS WHILE UNDER PRESSURE AND REPAIR ALL LEAKS.

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COLORADO REGISTERED
PETER C. D'ANTONIO
33293
PROFESSIONAL ENGINEER
11/19/21

PROJECT:
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1755 S. PUBLIC RD
LAFAYETTE, CO 80026

PROJECT NO: 2007

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PLUMBING CONTROLS & NOTES

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PLUMBING FIXTURE SCHEDULE

TAG	FIXTURE	TYPE	MANUFACTURER/MODEL	FAUCET/FLUSH VALVE	WASTE (INCHES)	VENT (INCHES)	COLD WATER (INCHES)	HOT WATER (INCHES)	MISCELLANEOUS	NOTES	ELECTRICAL CONNECTION
EWC-1	ELEC. WATER COOLER	BI-LEVEL	ELKAY LMABFTL8WSSK	-	1-1/2	1-1/4	1/2	-	ADA, BARRIER FREE, LEAD-FREE, STAINLESS, BOTTLE FILLER, 8GPH, FILTERED, 115 V, 6.0 A	A	
FD-1	FLOOR DRAIN	IN SLAB	ZURN Z415B	-	SEE PLANS	SEE PLANS	-	-	COATED CAST IRON BODY, ADJUSTABLE POLISHED NICKEL BRONZE TOP, ASME 112.3.1, DEEP SEAL P-TRAP WITH PROSET SYSTEMS TRAP GUARD TG33ZURN	A	
FS-1	FLOOR SINK	IN SLAB	ZURN Z1901	-	SEE PLANS	SEE PLANS	-	-	12"x12" A.P.C. FLOOR SINK 6" SUMP DEPTH, ASME A112.6.7, DOME STRAINER, SEEPAGE FLANGE, DEEP SEAL P-TRAP WITH PROSET SYSTEMS TRAP GUARD TG33ZURN	A	
IMB-1	ICE MAKER	IN-WALL CONNECTION BOX	OATEY I2K	-	-	-	1/2	-		NONE	
LAV-1	LAVATORY	UNDERMOUNT, ACCESSIBLE	DUPONT 820	ZURN Z6913-XL WITH 0.35 GPM AERATOR	1-1/2	1-1/4	1/2	1/2	WATTS USG-B TEMPERING VALVE SET AT 105 DEGREES F. (ADJ.), CHROME PLATED FINISH P-TRAP WITH CLEANOUT AND OFFSET GRID STRAINER, CONCEALED ARM WALL SUPPORT, "TRUEBRO LAV GUARD" INSULATION KIT	A, E, F	YES
LAV-2	LAVATORY	WALL HUNG, ACCESSIBLE	KOHLER K-2031	ZURN Z6913-XL WITH 0.35 GPM AERATOR	1-1/2	1-1/4	1/2	1/2	WATTS USG-B TEMPERING VALVE SET AT 105 DEGREES F. (ADJ.), CHROME PLATED FINISH P-TRAP WITH CLEANOUT AND OFFSET GRID STRAINER, CONCEALED ARM WALL	A, E, F	YES
LAV-3	LAVATORY	WALL HUNG, CHILDREN'S	KOHLER K-2031	ZURN Z6913-XL WITH 0.35 GPM AERATOR	1-1/2	1-1/4	1/2	1/2	WATTS USG-B TEMPERING VALVE SET AT 105 DEGREES F. (ADJ.), CHROME PLATED FINISH P-TRAP WITH CLEANOUT AND OFFSET GRID STRAINER, CONCEALED ARM WALL MOUNT TOP OF BOWL AT MAX 22" AFF.	A, E, F	YES
MSB-1	MOP SERVICE BASIN	-	FIAT MSB2424	FIAT 830AA, THREADED SPOUT W/ VACUUM BREAKER, WALL BRACE	3	1-1/2	3/4	3/4	24"x24"x10" MOLDED STONE, DOME STRAINER, STAINLESS STEEL BUMPER GUARDS ON OPEN SIDES	NONE	
S-1	2-COMP SINK	COUNTERTOP, ACCESSIBLE	ELKAY LRADQ3322	DELTA 400LF-HDF, SINGLE HANDLE, 8" LONG SWING SPOUT, SPRAY HOSE, WITH 1.5 GPM AERATOR	2	1-1/4	1/2	1/2	INSINKERATOR EVOLUTION DISPOSAL (3/4 HP, 120 V), CHROME PLATED FINISH P-TRAP WITH CLEANOUT, "TRUEBRO LAV GUARD" INSULATION KIT	E, F	YES
SH-1	SHOWER	BARRIER-FREE, CENTER DRAIN	AQUATIC 1363BFSD	DELTA MODEL T17238-H2O, 1.5 GPM MAX	2	1-1/4	1/2	1/2	ENCLOSURE WITH ADA COMPLAINT SEAT AND GRAB BARS	NONE	
UR-1	URINAL	FLUSH VALVE, ACCESSIBLE	TOTO UT105UG	SLOAN OPTIMA PLUS 186 ES-S	2	1-1/4	3/4	-	-	F	YES
WB-1	WASHER BOX	-	OATEY 38331	-	2	1-1/4	3/4	3/4	1/4 TURN VALVES, INTEGRAL HAMMER ARRESTORS	NONE	
WC-1	WATER CLOSET	FLUSH VALVE, ACCESSIBLE WALL MOUNT	AMERICAN STANDARD 2257.528.020	AMERICAN STANDARD 6067.721.002	3	2	1	-	DUAL FLUSH 1.1/1.28 GPF, ADA COMPLAINT, WHITE VITREOUS CHINA, ELONGATED RIM BOWL. TOILET SEAT: 5901.100, OPEN FRONT, SEAT LESS COVER. FLUSH VALVE: AUTOMATIC, HARD WIRED DUAL FLUSH ACTIVATED BY USER TIME IN DETECTION ZONE. MOUNT TOP OF RIM AT 17" AFF.	E, F	YES
WC-2	WATER CLOSET	FLUSH VALVE WALL MOUNT	AMERICAN STANDARD 2257.528.020	AMERICAN STANDARD 6067.721.002	3	2	1	-	DUAL FLUSH 1.1/1.28 GPF, WHITE VITREOUS CHINA, ELONGATED RIM BOWL. TOILET SEAT: 5901.100, OPEN FRONT, SEAT LESS COVER. FLUSH VALVE: AUTOMATIC, HARD WIRED DUAL FLUSH ACTIVATED BY USER TIME IN DETECTION ZONE. MOUNT TOP OF RIM AT 15" AFF.	E, F	YES
WC-3	WATER CLOSET	FLUSH VALVE, CHILDREN'S FLOOR MOUNT	AMERICAN STANDARD 2282.001.020	AMERICAN STANDARD 6067.721.002	3	2	1	-	DUAL FLUSH 1.1/1.28 GPF, WHITE VITREOUS CHINA, ELONGATED RIM BOWL. TOILET SEAT INCLUDED, OPEN FRONT, SEAT LESS COVER. FLUSH VALVE: AUTOMATIC, HARD WIRED DUAL FLUSH ACTIVATED BY USER TIME IN DETECTION ZONE. MOUNT TOP OF RIM AT 10.25" AFF.	E, F	YES
WC-4	WATER CLOSET	FLUSH VALVE, ACCESSIBLE FLOOR MOUNT	AMERICAN STANDARD 2857.128.020	AMERICAN STANDARD 6067.721.002	3	2	1	-	DUAL FLUSH 1.1/1.28 GPF, ADA COMPLAINT, WHITE VITREOUS CHINA, ELONGATED RIM BOWL. TOILET SEAT: 5901.100, OPEN FRONT, SEAT LESS COVER. FLUSH VALVE: AUTOMATIC, HARD WIRED DUAL FLUSH ACTIVATED BY USER TIME IN DETECTION ZONE. MOUNT TOP OF RIM AT 17" AFF.	E, F	YES
WC-5	WATER CLOSET	FLUSH VALVE FLOOR MOUNT	AMERICAN STANDARD 2857.128.020	AMERICAN STANDARD 6067.721.002	3	2	1	-	DUAL FLUSH 1.1/1.28 GPF, WHITE VITREOUS CHINA, ELONGATED RIM BOWL. TOILET SEAT: 5901.100, OPEN FRONT, SEAT LESS COVER. FLUSH VALVE: AUTOMATIC, HARD WIRED DUAL FLUSH ACTIVATED BY USER TIME IN DETECTION ZONE. MOUNT TOP OF RIM AT 15" AFF.	E, F	YES
WH-1	WALL HYDRANT	-	WOODFORD MODEL 67	-	-	-	3/4	-	3/4" MALE HOSE THREAD, LOOSE KEY HANDLE, INTEGRAL FIELD TESTABLE BACKFLOW PREVENTER	C	

GENERAL NOTES:
1. PIPE SIZES SHOWN ARE MINIMUM SIZE TO A SINGLE FIXTURE.
2. ALL FIXTURES LISTED ARE NOT NECESSARILY USED ON THIS PROJECT.

KEY NOTES:
A. WASTE PIPING BELOW GRADE SHALL BE A MINIMUM OF 2".
B. PROVIDE PRV SET AT 20 PSI AND PDI SIZE "A" WATER HAMMER ARRESTOR.
C. PROVIDE INDIVIDUAL BALL VALVE AT EACH HYDRANT OR HOSE BIBB.
D. INDIRECT DRAIN LINE SHALL MATCH SIZE OF SINK BOWL CONNECTION OR GREATER.
E. LOOSE KEY 1/4 TURN ANGLE STOP VALVES WITH CHROME PLATED BRASS OR BRAIDED STAINLESS STEEL SUPPLIES.
F. ANSI 117.1 APPROVED.

GAS LOAD SCHEDULE

TAG	DESCRIPTION	INPUT EACH (SEA LEVEL MBH)	QUANTITY	TOTAL INPUT (SEA LEVEL MBH)	INLET PRESSURE	NOTES
B-1,2	BOILER	399	2	798	6"	C
DWH-1	NEW DOM. WATER HEATER	120	1	120	6"	C
			TOTAL CONNECTED LOAD =	918 MBH		A, B, C

NOTES:
A. CONTRACTOR SHALL VERIFY EXISTING METER IS SUFFICIENT TO SUPPORT NEW LOAD. COORDINATE METER OR SERVICE UPGRADE WITH UTILITY COMPANY AND INCLUDE ALL COSTS IN BID.
B. FARTHEST CONNECTED DEVICE DISTANCE BASED ON 100 FEET.
C. PIPE SIZING BASED ON PRESSURE AT METER OR PRV OUTLET PRESSURE OF 7 INCHES OF WATER COLUMN, 0.5" WC PRESSURE DROP, SCHEDULE 40 METALLIC PIPE.

DOMESTIC WATER HEATER SCHEDULE

TAG	MANUFACTURER	MODEL	CAPACITY (GALLONS)	RECOVERY		FUEL	GAS INPUT (MBH)	EFFICIENCY	STORAGE TEMP (DEG F)	ELECTRICAL REQUIREMENTS		DIMENSIONS DxH (IN.)	OPER. WEIGHT (LB.)	NOTES
				90°F RISE (GPH)	100°F RISE (GPH)					VOLTAGE/ PHASES	MCA			
DWH-1	AO SMITH	BTH-120 MXI	60	154	138	NAT. GAS	120	95%	140	120/1	7	27-3/4x53-1/2	990	A, B

NOTES:
A. ASME T&P RELIEF VALVE PIPED TO FLOOR SINK.
B. AMTROL ST-12 EXPANSION TANK.

EQUALS BY: AO SMITH, BOSCH, BRADFORD WHITE, LOCHINVAR, RHEEM, STATE.

PUMP SCHEDULE

TAG	MANUFACTURER	MODEL	SERVICE	LOCATION	TYPE	FLOW (GPM)	HEAD (FEET)	HORSE POWER OR WATTS	VOLTS/ PHASE	NOTES
RP-1	GRUNDFOS	UPS 26-99 SFC	DHW	MECH. ROOM	HW RECIRC	5	15	197 WATTS	120V/1P	1, 2, 3, 4

NOTES:
1. PROVIDE VIBRATION ISOLATION.
2. ALL BRONZE CONSTRUCTION.
3. PROVIDE PUMP WITH PROGRAMMABLE TIMER.
4. PROVIDE PUMP WITH CHECK VALVE.

EQUALS BY: TACO, WILO

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COLORADO REGISTERED PETER C. D'ANTONIO 33293 11/19/21 PROFESSIONAL ENGINEER

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PLUMBING SCHEDULES

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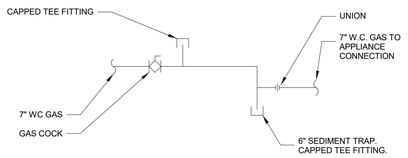

GAS CONNECTION DETAIL
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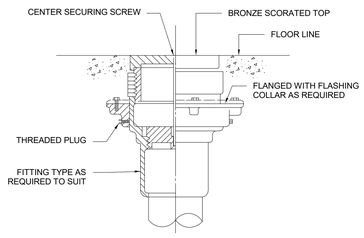

FLOOR CLEANOUT DETAIL
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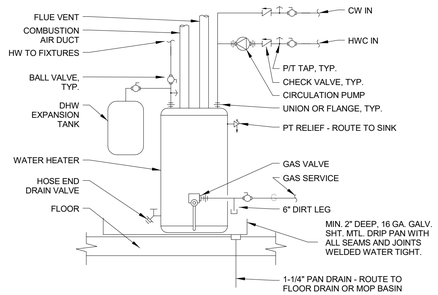

WATER HEATER DETAIL - GAS WITH CIRCULATION
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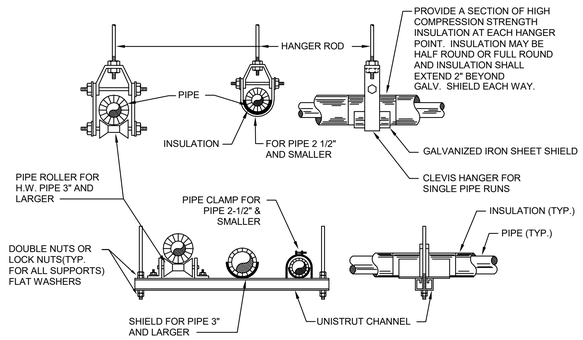

WATER PIPING HANGERS/SUPPORTS DETAIL
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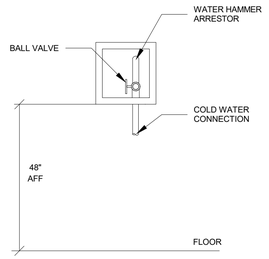

ICE MAKER BOX DETAIL
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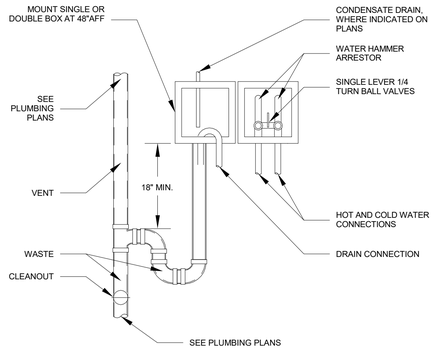

WASHER BOX DETAIL
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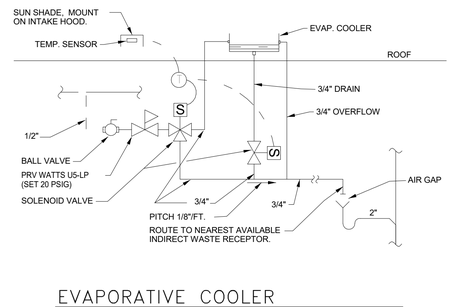
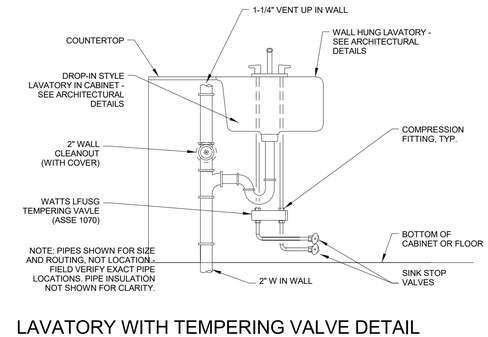
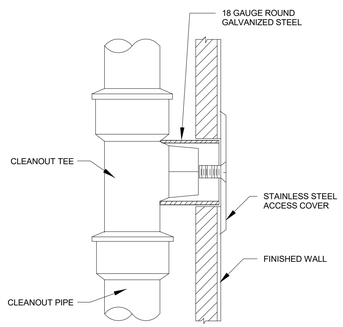


EVAPORATIVE COOLER AUTOMATIC FILL & DRAIN DETAIL
SCALE: NO SCALE



LAVATORY WITH TEMPERING VALVE DETAIL
SCALE: NO SCALE



WALL CLEANOUT DETAIL
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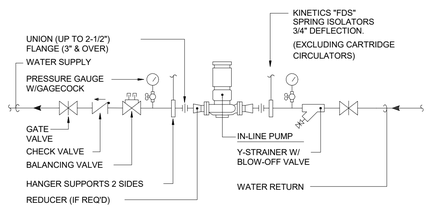

IN-LINE PUMP DETAIL
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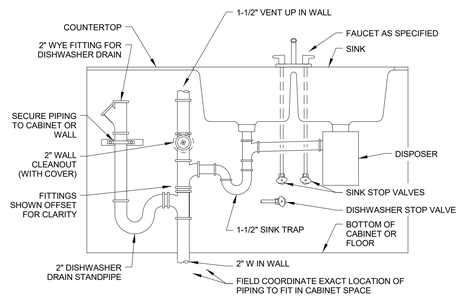

KITCHEN SINK WITH DISHWASHER PIPE CONNECTION DETAIL
SCALE: NO SCALE

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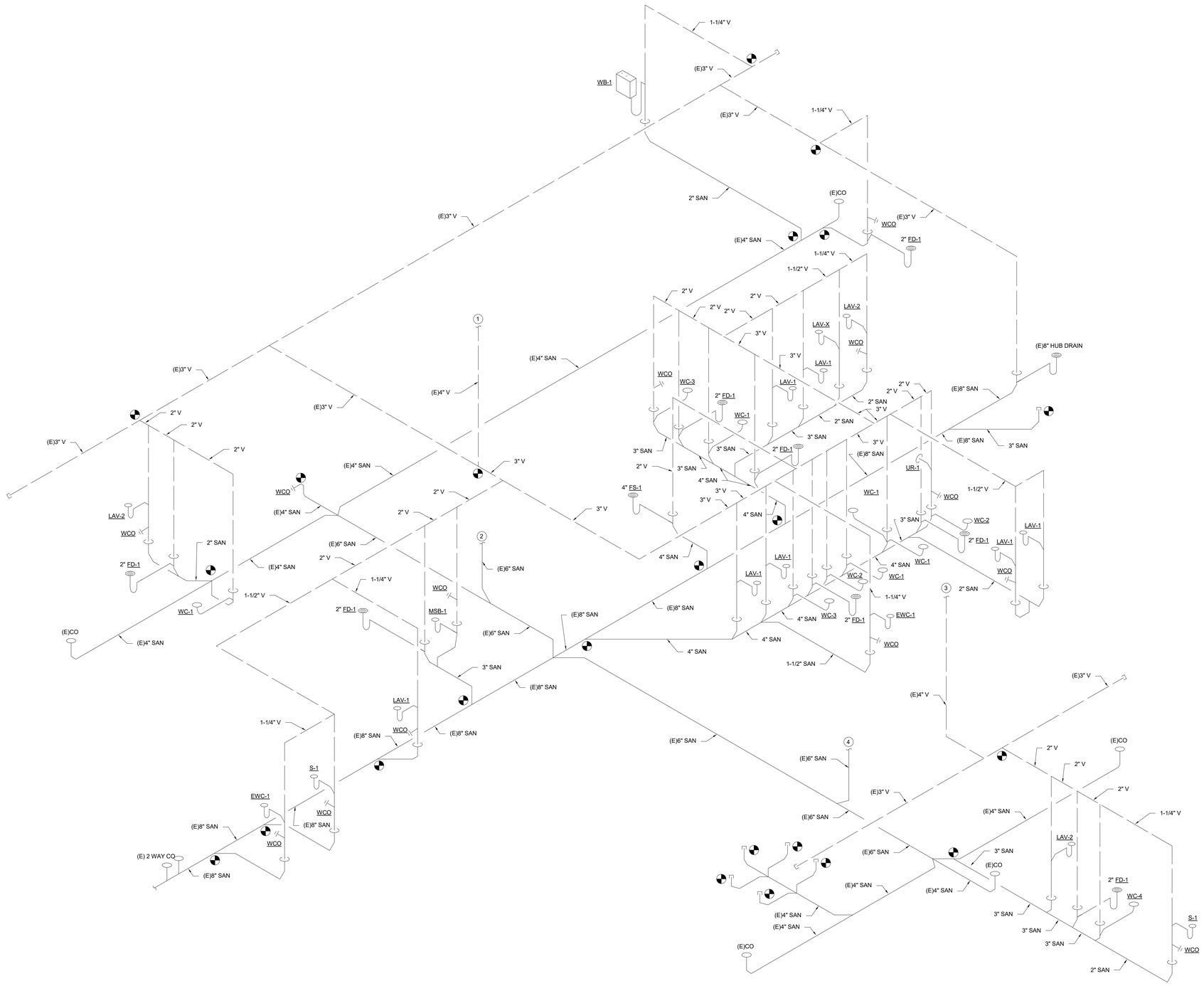

1 Plumbing Isometric - Level 01
12" = 1'-0"

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PROFESSIONAL ENGINEER
11/19/21

PROJECT:
SOUTHEAST COUNTY SERVICE HUB
1755 S. PUBLIC RD
LAFAYETTE, CO 80026

PROJECT NO: 2007

#	ISSUE DATE	PHASE / REV NAME
	11/19/21	CONSTRUCTION DOCUMENTS

WASTE & VENT ISOMETRIC
- LEVEL 01

P-005

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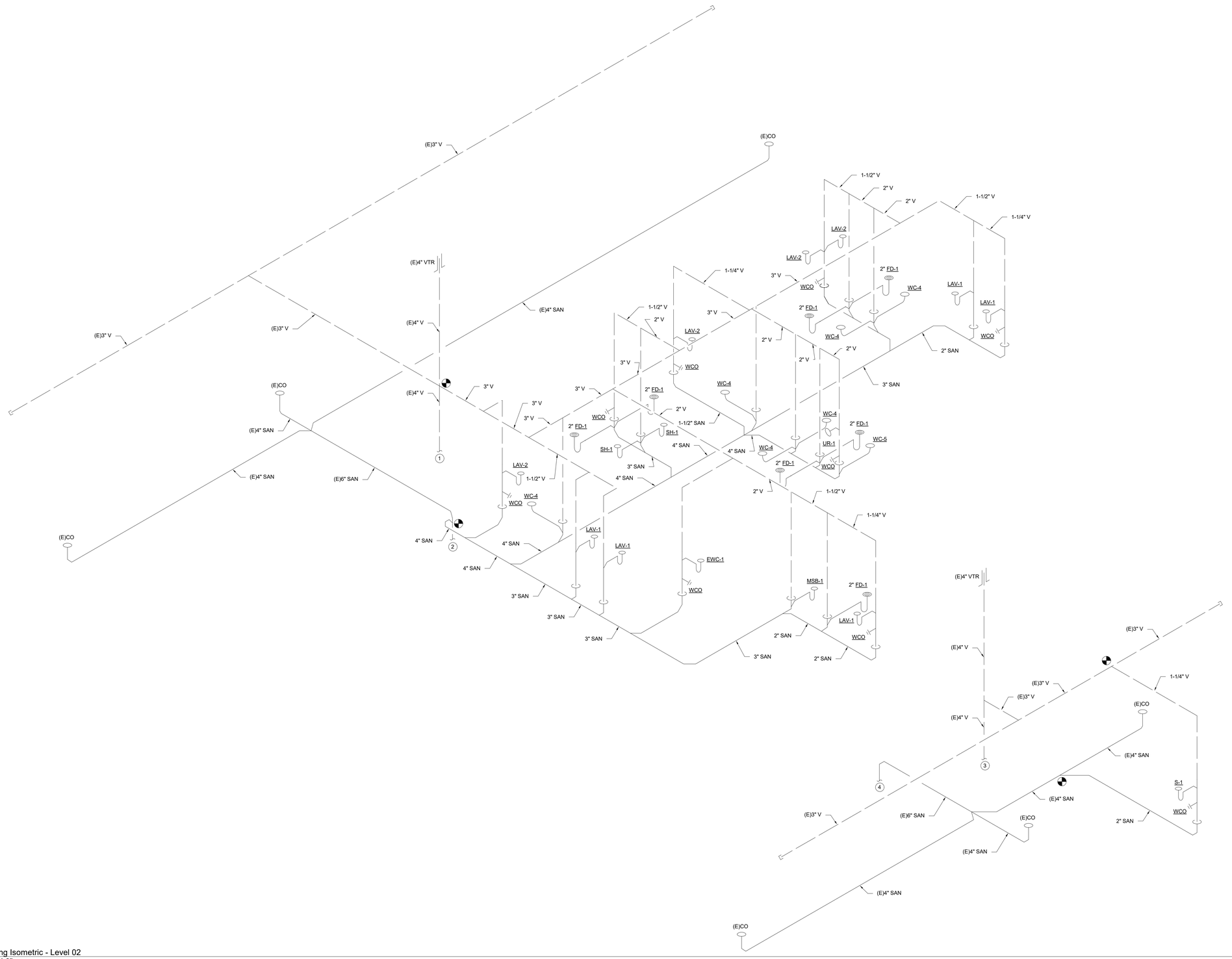

1 Plumbing Isometric - Level 02
12" = 1'-0"

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a Bowman company

COLORADO REGISTERED
PETER C. D'ANTONIO
33293
PROFESSIONAL ENGINEER
11/19/21

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WASTE & VENT ISOMETRIC
- LEVEL 02

P-006

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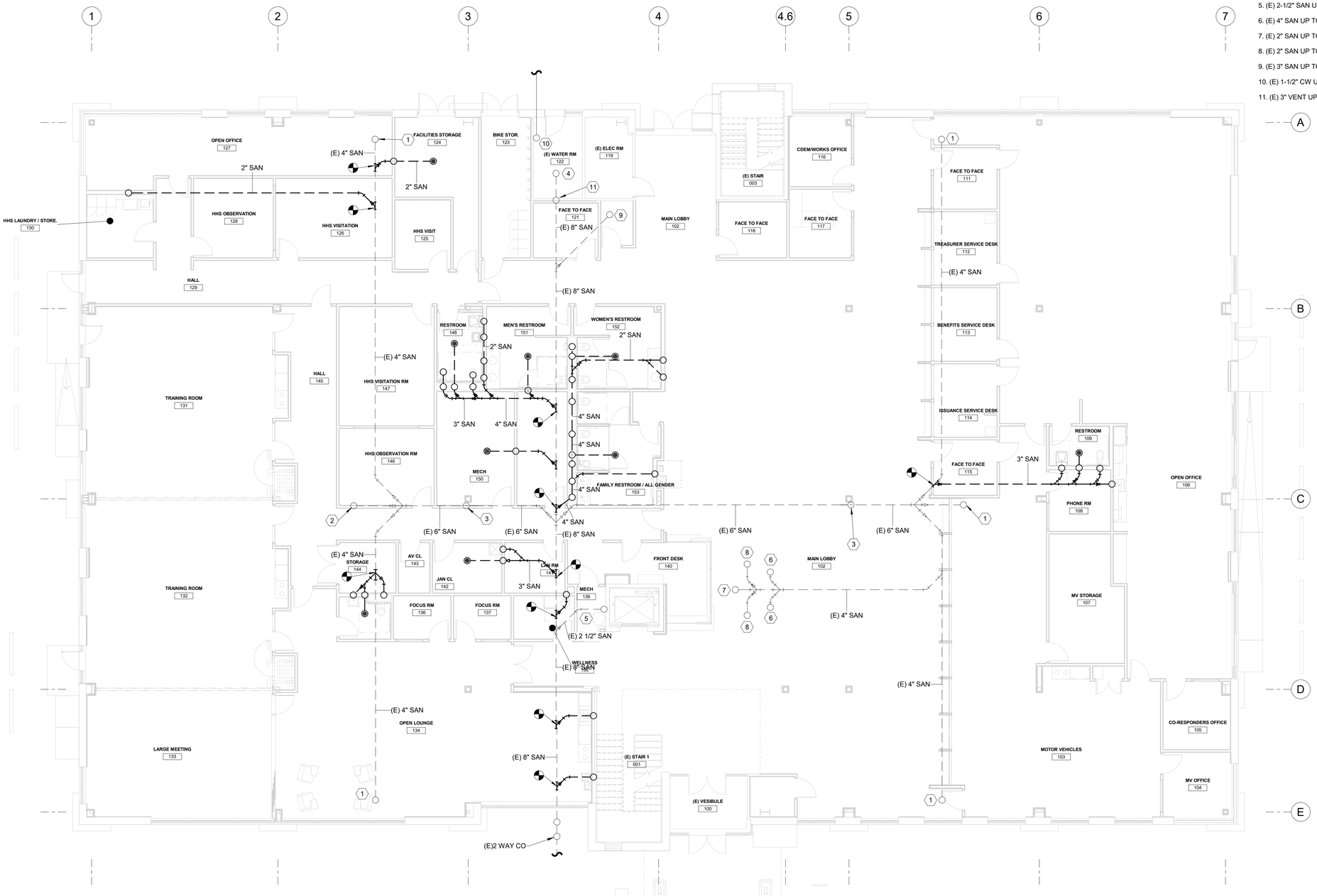
GENERAL NOTES:

1. REFER TO WASTE AND VENT ISOMETRIC AND PLUMBING FIXTURE SCHEDULE FOR ALL PIPE SIZES.

WORK NOTES:

1. (E) 4" SAN UP TO (E) FCO ON FIRST FLOOR.
2. (E) 4" SAN UP TO WCO ON FIRST FLOOR.
3. (E) 6" SAN UP TO FIRST FLOOR.
4. (E) 8" SAN UP TO (E) 8" HUB DRAIN IN WATER ENTRY ROOM.
5. (E) 2-1/2" SAN UP TO (E) SUMP PUMP DISCHARGE.
6. (E) 4" SAN UP TO (D) WC ON FIRST FLOOR.
7. (E) 2" SAN UP TO (D) EWC/ (D) LAV ON FIRST FLOOR.
8. (E) 2" SAN UP TO (D) FD ON FIRST FLOOR.
9. (E) 3" SAN UP TO (D) MSB ON FIRST FLOOR.
10. (E) 1-1/2" CW UP TO WATER ENTRY ROOM.
11. (E) 3" VENT UP THE FIRST FLOOR CEILING.



1 UNDERGROUND - PLUMBING PLAN
1/8" = 1'-0"

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UNDERGROUND - PLUMBING PLAN

P-100

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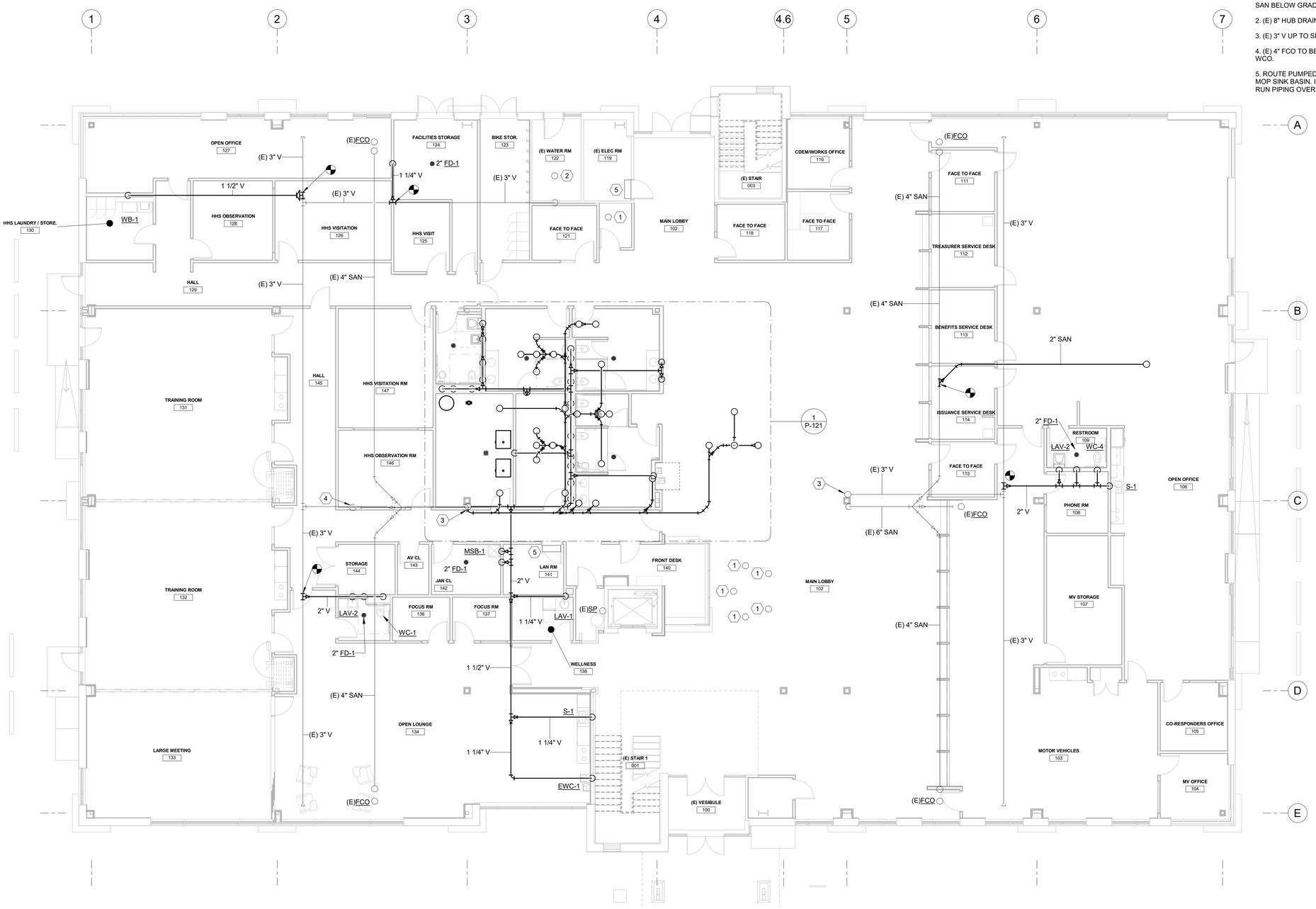
GENERAL NOTES:

1. REFER TO WASTE AND VENT ISOMETRIC AND PLUMBING FIXTURE SCHEDULE FOR ALL PIPE SIZES.

WORK NOTES:

1. EXISTING PLUMBING FIXTURE TO BE DEMOLISHED. PERMANTELY CAP (E) SAN BELOW GRADE.
2. (E) 8" HUB DRAIN EXISTING TO REMAIN.
3. (E) 3" V UP TO SECOND FLOOR.
4. (E) 4" FCO TO BE DEMOED. EXTEND (E) 4" SAN UP INTO WALL TO NEW 4" WCO.
5. ROUTE PUMPED CONDENSATE FROM AC TO NEAREST FLOOR SINK OR MOP SINK BASIN. INDIRECT CONNECTION WITH MIN. 1" AIR GAP. DO NOT RUN PIPING OVER ELECTRICAL EQUIPMENT.



1 LEVEL 01 - PLUMBING DWV PLAN
1/8" = 1'-0"

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LEVEL 01 - PLUMBING DWV PLAN

P-101

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GENERAL NOTES:

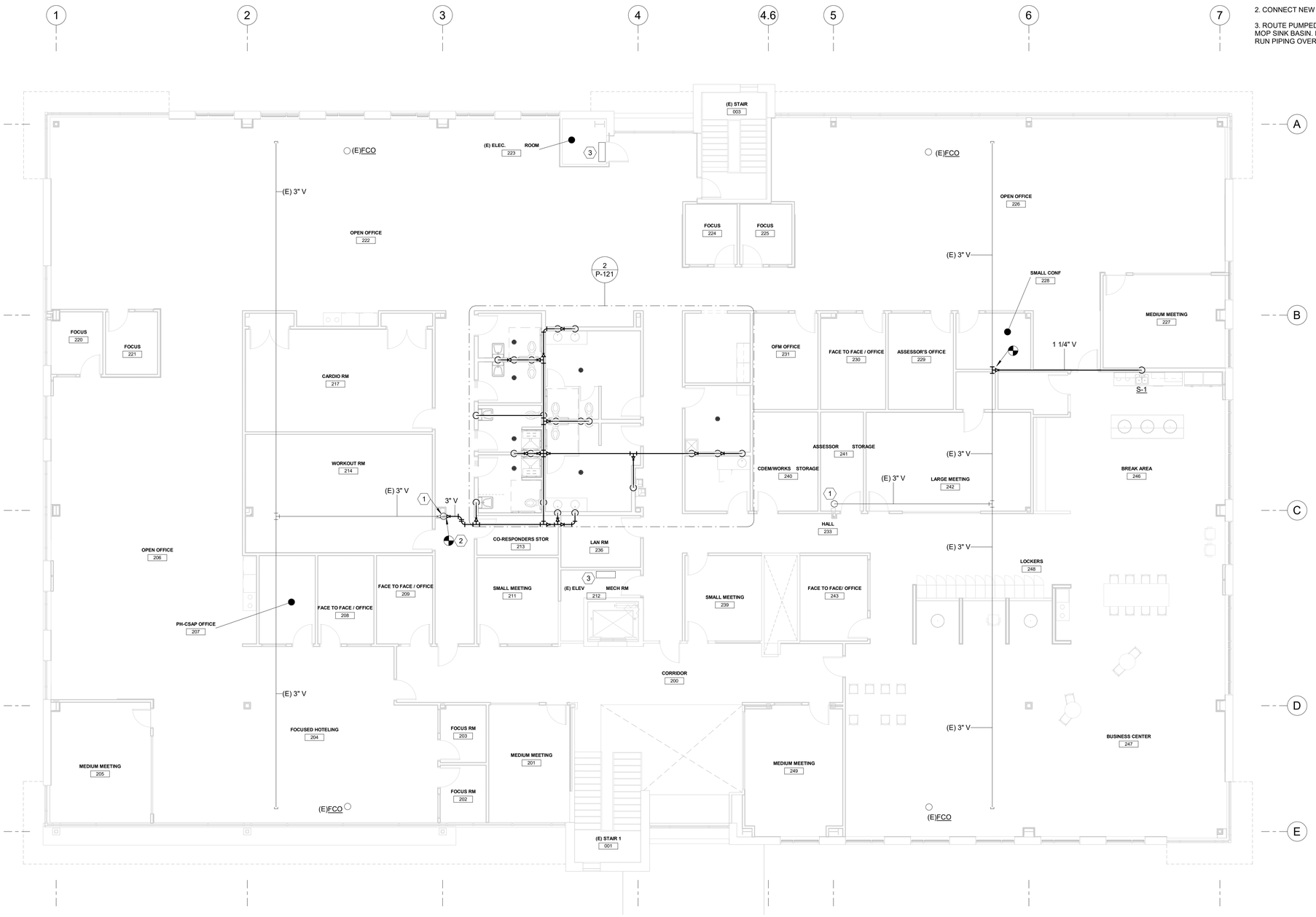
1. REFER TO WASTE AND VENT ISOMETRIC AND PLUMBING FIXTURE SCHEDULE FOR ALL PIPE SIZES.

WORK NOTES:

1. (E) 3" V DN TO FIRST FLOOR/ 4" V UP THROUGH ROOF.

2. CONNECT NEW 3" V TO (E) 4" VTR.

3. ROUTE PUMPED CONDENSATE FROM AC TO NEAREST FLOOR SINK OR MOP SINK BASIN. INDIRECT CONNECTION WITH MIN. 1" AIR GAP. DO NOT RUN PIPING OVER ELECTRICAL EQUIPMENT.



1 LEVEL 02 - PLUMBING DWV PLAN
1/8" = 1'-0"

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LEVEL 02 - PLUMBING DWV PLAN

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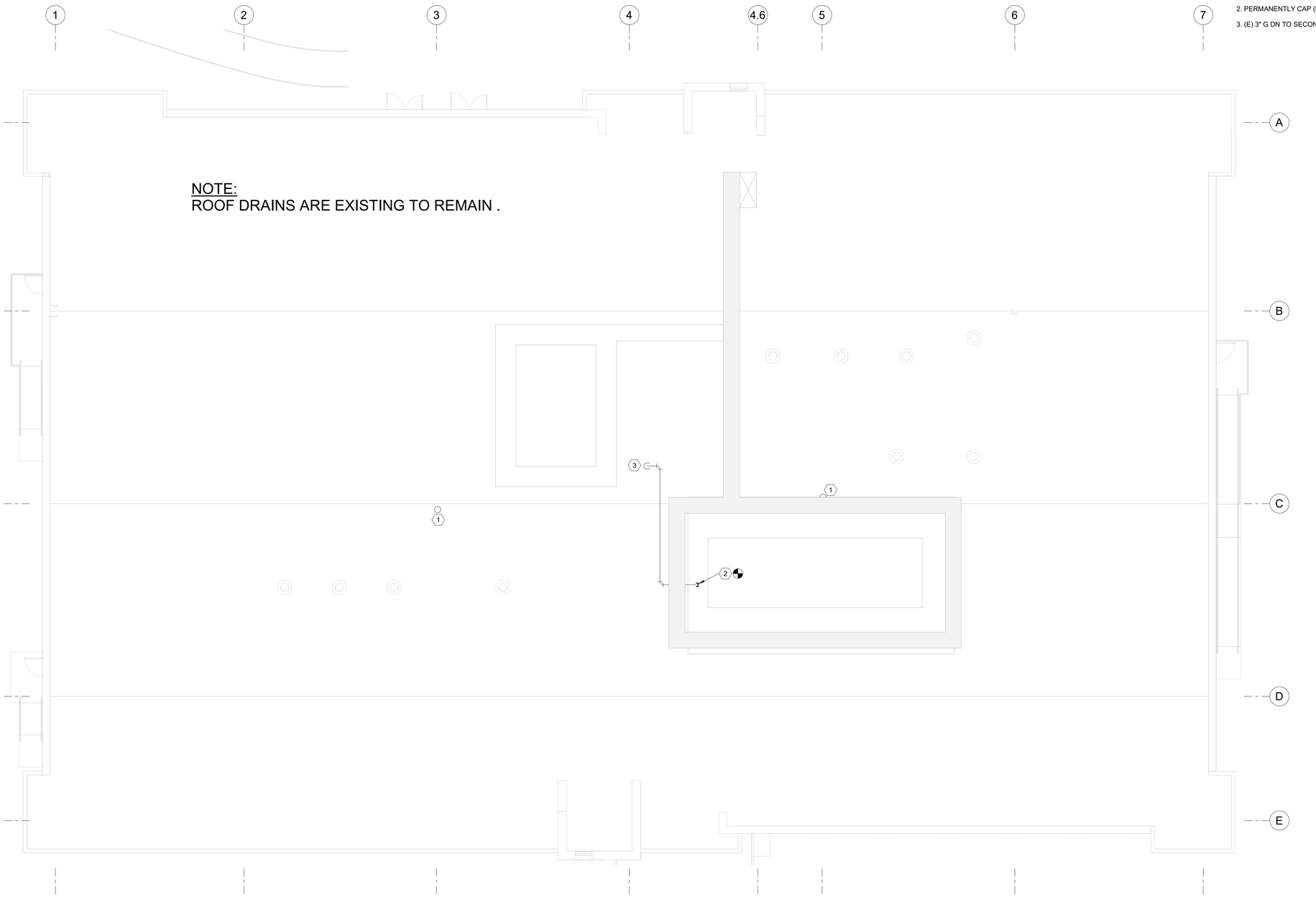
GENERAL NOTES:

1. NOT YET USED.

WORK NOTES:

1. (E) 4" VTR
2. PERMANENTLY CAP (E) 3" G.
3. (E) 3" G DN TO SECOND FLOOR.



NOTE:
ROOF DRAINS ARE EXISTING TO REMAIN .

1 ROOF - PLUMBING PLAN
1/8" = 1'-0"

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ROOF - PLUMBING PLAN

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GENERAL NOTES:

1. UNLESS OTHERWISE NOTED, ALL CW/HW MAINS ARE 3/4" AND BRANCHS ARE 1/2".

WORK NOTES:

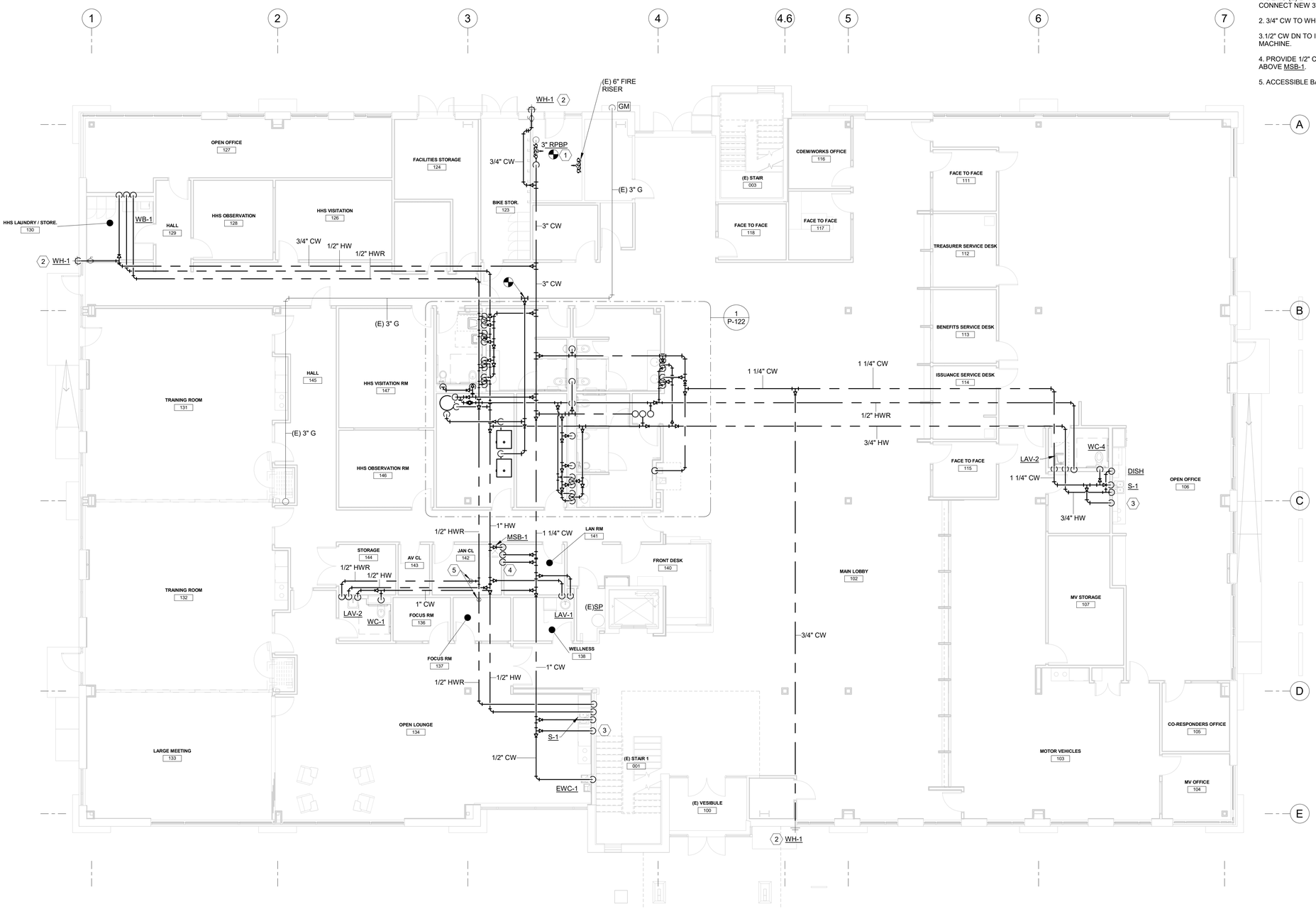
1. DEMO (E) 2" RPBP AND ASSOCIATED 2" CW WITHIN BUILDING ENVELOPE. CONNECT NEW 3" RPBP TO (E) 2" CW CITY SERVICE.

2. 3/4" CW TO WH-1 W/ ACCESSIBLE SHUTOFF VALVE.

3. 1/2" CW DN TO IMB-1 LOCATED IN WALL ABOVE COUNTER FOR COFFEE MACHINE.

4. PROVIDE 1/2" CW DN TO CHEMICAL DISPENSER LOCATED ON WALL ABOVE MSB-1.

5. ACCESSIBLE BALANCE VALVE SET TO 0.5 GPM.



1 LEVEL 01 - PLUMBING SUPPLY PLAN
1/8" = 1'-0"

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LEVEL 01 - PLUMBING SUPPLY PLAN

P-111

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GENERAL NOTES:

1. UNLESS OTHERWISE NOTED, ALL CW/HW MAINS ARE 3/4" AND BRANCHS ARE 1/2".

WORK NOTES:

1. (E) 3" G DN TO FIRST FLOOR.

2. 1/2" CW DN TO IMB-1 LOCATED IN WALL ABOVE COUNTER FOR COFFEE MACHINE.

3. FILL AND DRAIN VALVES TO BE BELOW ROOF FOR FREEZE PROTECTION. ROUTE DRAIN TO INDIRECT WASTE INTO MOP SERVICE BASIN. SEE DETAIL FOR FILL/DRAIN CONNECTION PIPING.

1 LEVEL 02 - PLUMBING SUPPLY PLAN
1/8" = 1'-0"

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LEVEL 02 - PLUMBING SUPPLY PLAN

P-112

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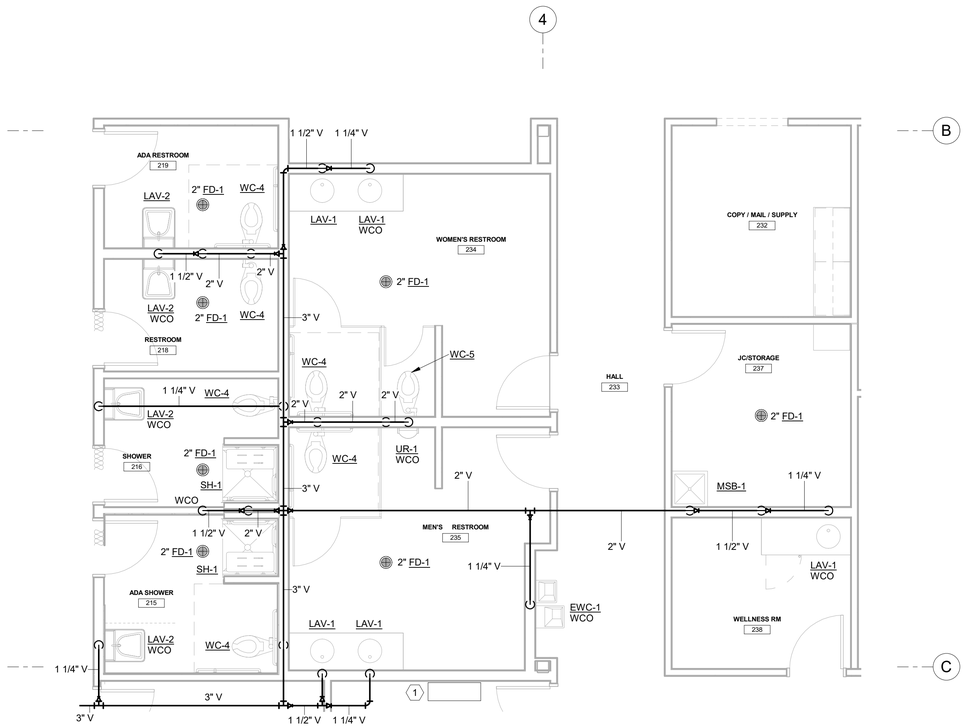
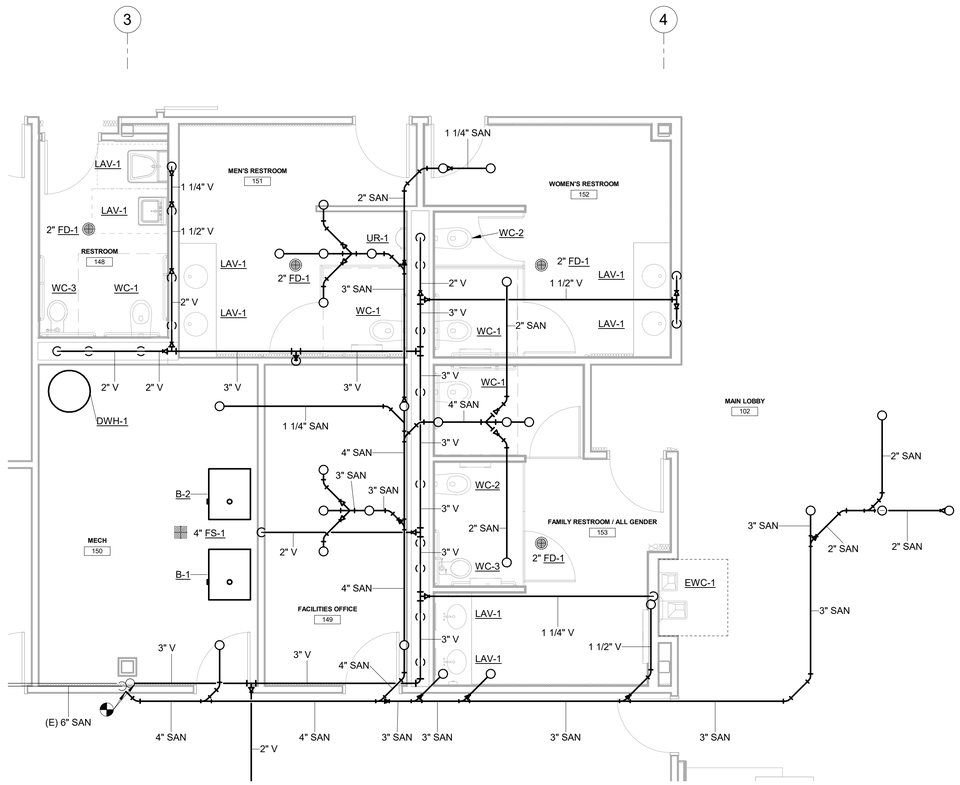
WORK NOTES:

1. ROUTE PUMPED CONDENSATE FROM AC TO NEAREST FLOOR SINK OR MOP SINK BASIN. INDIRECT CONNECTION WITH MIN. 1" AIR GAP. DO NOT RUN PIPING OVER ELECTRICAL EQUIPMENT.



2 P121 LEVEL 02 - PLUMBING DWV PLAN - ENLARGED BATHROOMS
1/4" = 1'-0"



1 P121 LEVEL 01 - PLUMBING DWV PLAN - ENLARGED BATHROOMS
1/4" = 1'-0"

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ENLARGED BATHROOMS - PLUMBING DWV

P-121

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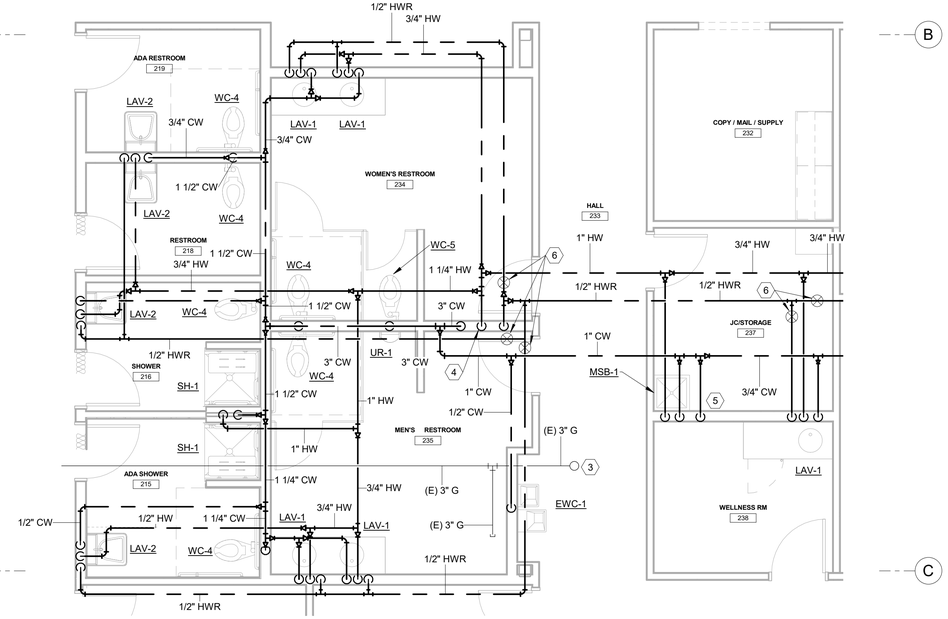
GENERAL NOTES:

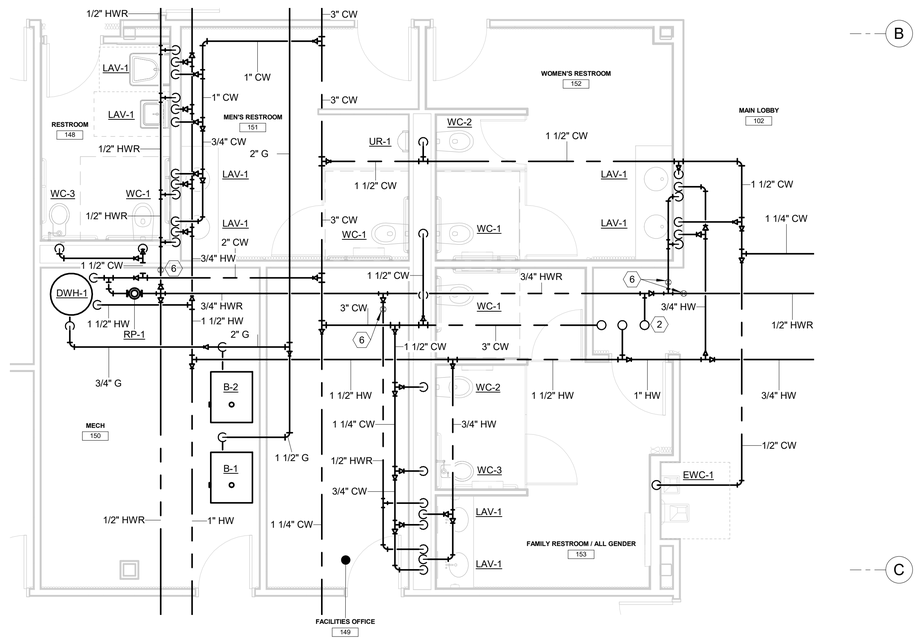
1. PIPE HWR WITHIN 2' OF ALL LAVS HOT WATER SUPPLY. PROVIDE ACCESSIBLE BALANCE VALVE SET 0.5 GPM.

WORK NOTES:

1. CONNECT NEW 2" CW TO (E) 2" CW.
2. 3" CW, 1-1/2" HW, 3/4" HWC UP TO SECOND FLOOR.
3. (E) 3" G UP THROUGH ROOF.
4. 3" CW, 1-1/2" HW, 3/4" HWC UP FROM FIRST FLOOR.
5. PROVIDE 1/2" CW DN TO CHEMICAL DISPENSER LOCATED ON WALL ABOVE MSB-1.
6. ACCESSIBLE BALANCE VALVE SET TO 0.5 GPM.



2 P122 LEVEL 02 - PLUMBING SUPPLY PLAN - ENLARGED BATHROOMS
1/4" = 1'-0"



1 P122 LEVEL 01 - PLUMBING SUPPLY PLAN - ENLARGED BATHROOMS
1/4" = 1'-0"

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ENLARGED BATHROOMS - PLUMBING SUPPLY

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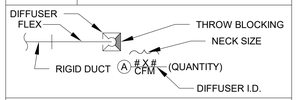
MECHANICAL LEGEND

SYMBOL	ABBREVIATION	DESCRIPTION
———	(E)	EXISTING (LIGHT LINE)
———	(D) DEMO	TO BE DEMOLISHED
———	(N)	NEW (HEAVY LINE)
—CHR—	CHR	DUAL TEMPERATURE RETURN
—CHS—	CHS	DUAL TEMPERATURE SUPPLY
—CR—	CR	CHILLED WATER RETURN
—CS—	CS	CHILLED WATER SUPPLY
—CWR—	CWR	CONDENSER WATER RETURN
—CWS—	CWS	CONDENSER WATER SUPPLY
—HWR—	HWR	HEATING WATER RETURN
—HWS—	HWS	HEATING WATER SUPPLY
—HPC—	HPC	HIGH PRESSURE CONDENSATE
—HPS—	HPS	HIGH PRESSURE STEAM
—LPC—	LPC	LOW PRESSURE CONDENSATE
—LPS—	LPS	LOW PRESSURE STEAM
—MPC—	MPC	MEDIUM PRESSURE CONDENSATE
—MPS—	MPS	MEDIUM PRESSURE STEAM
—PC—	PC	PUMPED CONDENSATE
—RD—	RD	REFRIGERANT DISCHARGE
—RL—	RL	REFRIGERANT LIQUID
—RS—	RS	REFRIGERANT SUCTION
—— — ——	CW	DOMESTIC COLD WATER
— — — —	HW	DOMESTIC HOT WATER
— — — —	HWC	DOMESTIC HOT WATER CIRCULATION
—A—	A	AIR PIPING (COMPRESSED)
—D—	D	DRAIN
—DIC—	DIC	**DE-IONIZED WATER** CIRCULATION
—F—	F	FIRE
—FOR—	FOR	FUEL OIL RETURN
—FOS—	FOS	FUEL OIL SUPPLY
—FOV—	FOV	FUEL OIL VENT
—G—	G	GAS
—GW—	GW	GREASE WASTE
—IW—	IW	INDIRECT WASTE
—MA—	MA	MEDICAL AIR
—N—	N	NITROGEN
—ORDL—	ORDL	OVERFLOW ROOF DRAIN LEADER
—O—	OXY	OXYGEN
—RDL—	RDL	ROOF DRAIN LEADER
—SAN—	SAN	SANITARY WASTE
—SMS—	SMS	SNOW MELT SUPPLY
—SMR—	SMR	SNOW MELT RETURN
—SOD—	SOD	SAND AND OIL DRAIN
—ST—	ST	STORM
—VAC—	VAC	VACUUM
—V—	V	VENT
—W—	W	WASTE
	AFF	ABOVE FINISHED FLOOR
	AFG	ABOVE FINISHED GRADE
	EC	ELECTRICAL CONTRACTOR
	EOR	ENGINEER OF RECORD
	GC	GENERAL CONTRACTOR
	MC	MECHANICAL CONTRACTOR
	PC	PLUMBING CONTRACTOR
	ER	EXISTING RETURN AIR DEVICE
	ES	EXISTING SUPPLY AIR DEVICE
	ET	EXISTING TRANSFER AIR DEVICE
	RR	RELOCATED RETURN AIR DEVICE
	RS	RELOCATED SUPPLY AIR DEVICE
	RT	RELOCATED TRANSFER AIR DEVICE
	DWV	DOMESTIC WASTE & VENT

SYMBOL	DESCRIPTION
	PIPE UP AND DOWN ELBOW
	PIPE DOWN TEE
	PIPE CONTINUATION
	PIPE FLOW DIRECTION (SHOWN TO RIGHT)
	PIPE REDUCER
	PIPE UNION AND CAP
	BALL VALVE, GATE VALVE
	MOTORIZED VALVE - 2-WAY
	MOTORIZED VALVE - 3-WAY
	PRESSURE REDUCING VALVE
	CHECK VALVE
	BUTTERFLY VALVE, GLOBE VALVE
	BALANCE VALVE
	STRAINER
	HOSE-END DRAIN VALVE
	STRAINER WITH BLOW-OFF
	VENTURI
	GAS COCK
	PUMP
	DUAL CHECK BACKFLOW PREVENTOR
	REDUCED PRESSURE BACKFLOW PREVENTOR
	PRESSURE-TEMPERATURE TAP
	PRESSURE-TEMPERATURE RELIEF VALVE
	AIR VENT
	PIPE GUIDE OR SLEEVE
	PIPE EXPANSION JOINT
	PIPE ANCHOR
	VACUUM RELIEF VALVE
	THERMOMETER
	PRESSURE GAUGE
	FLOW SENSOR
	FLOOR DRAIN
	FLOOR SINK-FULL-3/4-HALF GRATE
	DRAIN ABOVE
	ROOF DRAIN
	ROOF DRAIN - OVERFLOW
	DOWNSPOUT NOZZLE
	CLEANOUT - VERTICAL
	CLEANOUT - HORIZONTAL
W H	WALL HYDRANT, HOSE BIBB

SYMBOL	DESCRIPTION
	SMOKE DETECTOR
20/16	DUCT SIZE INDICATING SHEET METAL DIMENSIONS. FIRST NUMBER WIDTH AND SECOND IS DEPTH (INCHES).
	DUCT ELBOW WITH TURNING VANE
	DUCT TEE WITH TURNING VANES
	MANUAL DAMPER WITH LOCKING QUADRANT.
M	MOTORIZED DAMPER
	FLEXIBLE DUCT CONNECTOR
	SPIN-IN FITTING WITH DAMPER
	45° DUCT TAKE-OFF
	RECTANGULAR SUPPLY AIR DUCT UP
	RECTANGULAR RETURN AIR DUCT UP
	RECTANGULAR EXHAUST AIR DUCT UP
	ROUND DUCT UP
LLC. SIZE	DOOR UNDERCUT
	FIRE DAMPER
	FIRE AND SMOKE DAMPER
	SMOKE DAMPER
	EXISTING FIRE DAMPER
	SUPPLY DIFFUSER
	RETURN OR TRANSFER GRILLE
	EXHAUST GRILLE
CO	CARBON MONOXIDE SENSOR
T xxx	THERMOSTAT OR TEMPERATURE SENSOR FOR DEVICE "XXX"
H xxx	HUMIDISTAT OR HUMIDITY SENSOR FOR DEVICE "XXX"
CO2	CARBON DIOXIDE SENSOR
	CONNECTION NEW TO EXISTING



NOTE: NOT ALL SYMBOLS ON THIS LEGEND ARE NECESSARILY USED ON THIS PROJECT.

PROJECT DESCRIPTION

THIS PROJECT INVOLVES A MULTI-PHASE WORKPLACE IMPROVEMENT. AS FIRST PHASE, THERE WILL BE TENANT IMPROVEMENT ON LEVEL 01 AND 02 OF THIS CORE AND SHELL BUILDING. SPACES WILL INCLUDE WORKSPACES, CONFERENCE ROOMS, COLLABORATION AREAS, COMMON AREAS, STAFF KITCHEN, SUPPORT ROOMS AND STORAGE. THIS BUILDING WILL BE DESIGNED FOR LEED GOLD CERTIFICATION.

THE MECHANICAL WORK CONSISTS OF A NEW VARIABLE AIR VOLUME SYSTEM WITH NEW ROOTOP UNIT, VAV BOXES, BOILERS, AND AIR COOLED CHILLER.

SPECIFICATION GENERAL NOTES

GENERAL NOTES:

A. REVIEW THE CONTRACT CONDITIONS AND GENERAL REQUIREMENTS FOR INFORMATION THAT APPLIES.

B. THE WORD "PROVIDE" IS USED TO MEAN "FURNISH AND INSTALL."

C. PROVIDE ALL ITEMS FOR A COMPLETE AND SUCCESSFUL OPERATION OF ALL SYSTEMS SHOWN ON THESE DRAWINGS.

D. THE DRAWINGS ARE DIAGRAMMATIC AND INDICATE GENERAL ARRANGEMENT OF THE WORK. LOCATIONS ARE APPROXIMATE UNLESS DIMENSIONED. MINOR MODIFICATIONS IN LOCATION TO MEET SITE REQUIREMENTS ARE ACCEPTABLE. REFER TO LATEST ARCHITECTURAL DRAWINGS FOR EXACT WALL LOCATIONS AND DIMENSIONS.

E. THE ARCHITECTURAL AND ENGINEERING DRAWINGS ARE COMPLEMENTARY. GENERAL CONTRACTORS, SUBCONTRACTORS, AND VENDORS SHALL ACKNOWLEDGE ALL THE ARCHITECTURAL AS WELL AS ALL THE ENGINEERING DRAWINGS AND INCLUDE ALL WORK NECESSARY TO ACHIEVE A COMPLETE WORKING INSTALLATION FOR ALL DEVICES OR EQUIPMENT WHICH MAY BE SHOWN ON ONE DRAWING BUT NOT SHOWN ON ANOTHER. WHERE ELEMENTS ARE INDICATED OR DESCRIBED IN ANY DRAWING, IT IS THE INTENT THAT ALL RELATED CONSTRUCTION ASSOCIATED WITH SUCH ELEMENTS IS TO BE INCLUDED IN ORDER TO OBTAIN A COMPLETE INSTALLATION. FOR INSTANCE, IF A PIECE OF EQUIPMENT IS IDENTIFIED IN THE ARCHITECTURAL AND/OR MECHANICAL DRAWINGS, BUT THE ELECTRICAL CIRCUIT FOR SUCH EQUIPMENT IS NOT IDENTIFIED IN THE ELECTRICAL DRAWINGS, THE CONTRACTOR IS TO PROVIDE SUCH CIRCUIT IN ORDER TO HAVE FULLY OPERATIONAL EQUIPMENT. FOR ANOTHER EXAMPLE, IF A SINK IS INDICATED, IT IS THE INTENT THAT RELATED PLUMBING WORK INCLUDING DRAINS, VENT, PIPING, VALVES, ETC. ARE TO BE INCLUDED IN ORDER TO RESULT IN A FULLY OPERATIONAL SYSTEM. NO SUBCONTRACTOR SHALL BE ALLOWED TO EXCLUDE PORTIONS OF THE COMPLIMENTARY DRAWING SET.

F. LAY OUT ALL WORK IN ADVANCE. DO NOT DEFACE THE WORK OF OTHER TRADES OR THE EXISTING BUILDING.

G. LOCATION OF PIPES, DUCTS, SWITCHES, PANELS, EQUIPMENT, AND FIXTURES SHALL BE ADJUSTED TO ACCOMMODATE THE WORK OR INTERFERENCES ANTICIPATED AND ENCOUNTERED. DETERMINE THE EXACT ROUTE AND LOCATION OF EACH PIPE AND DUCT PRIOR TO FABRICATION.
   G.A. RIGHT-OF-WAY: LINES WHICH PITCH SHALL HAVE THE RIGHT-OF-WAY OVER THOSE WHICH DO NOT PITCH. LINES WHOSE ELEVATIONS CANNOT BE CHANGED SHALL HAVE THE RIGHT-OF-WAY OVER LINES WHOSE ELEVATIONS CAN BE CHANGED.
   G.B. OFFSETS, TRANSITIONS, AND CHANGES IN DIRECTION: OFFSETS, TRANSITIONS, AND CHANGES IN DIRECTION OF PIPES AND DUCTS SHALL BE MADE AS REQUIRED TO MAINTAIN PROPER HEADROOM AND PITCH OF SLOPING LINES WHETHER OR NOT INDICATED ON THE DRAWINGS.
   G.C. FURNISH AND INSTALL ALL TRAPS, AIR VENTS, SANITARY VENTS, AND DEVICES AS REQUIRED TO EFFECT THESE OFFSETS, TRANSITIONS, AND CHANGES IN DIRECTION.

H. ALL PENETRATIONS OF FIRE RATED WALLS, FLOORS, AND CEILINGS SHALL HAVE THE SPACE AROUND PENETRATIONS SEALED WITH A FIRE BARRIER SEALANT MEETING THE REQUIREMENTS OF U.L. STANDARD 1479 AND ASTM-E 814. INSTALL SEALANT IN FULL COMPLIANCE WITH MANUFACTURER'S STANDARD INSTALLATION INSTRUCTIONS.

I. ALL MATERIALS LOCATED ABOVE CEILING SHALL BE SUITABLE FOR USE WITHIN A RETURN AIR PLENUM AS REQUIRED BY THE ADOPTED EDITION OF THE INTERNATIONAL MECHANICAL CODE.

J. WHEN USING A TORCH OR OTHER FLAME-PRODUCING DEVICE ON THIS PROJECT, CONTRACTOR SHALL PROVIDE ONE APPROVED FIRE EXTINGUISHER OR WATER HOSE EQUIPPED WITH A SUITABLE NOZZLE, SUFFICIENT IN LENGTH TO REACH ALL PORTIONS OF THE BUILDING AND CONNECTED TO A WATER SUPPLY ON THE PREMISES WHERE SAID BURNING OPERATION IS PERFORMED. COMBUSTIBLE MATERIAL IN THE CLOSE PROXIMITY OF OPEN FLAME SHALL BE PROTECTED AGAINST IGNITION BY SHIELDING, WETTING, OR OTHER MEANS. IN ALL CASED, A FIRE WATCH SHALL BE MAINTAINED IN THE VICINITY OF THE OPERATION BY THE CONTRACTOR FOR ONE-HALF HOUR AFTER THE TORCH OR FLAME-PRODUCING DEVICE HAS BEEN USED.

K. THE CONTRACTOR SHALL VISIT THE SITE PRIOR TO BIDDING THE PROJECT AND TAKE INTO CONSIDERATION CONDITIONS THAT MAY AFFECT THE WORK. NO ADDITIONAL COMPENSATION WILL BE APPROVED FOR FAILURE TO VISIT THE SITE PRIOR TO PRICING THE WORK.

L. MAINTAIN A CONTRACT SET OF THESE DRAWINGS AT THE SITE, WITH ALL CHANGES OR DEVIATIONS FROM THE ORIGINAL DRAWINGS NEATLY MARKED ON THEM IN RED COLOR. THIS SHALL BE A SEPARATE SET OF DRAWINGS NOT USED FOR CONSTRUCTION PURPOSES, WHICH SHALL BE KEPT UP TO DATE AS THE JOB PROGRESSES AND SHALL BE MADE AVAILABLE FOR INSPECTION BY THE ENGINEER AT ALL TIMES. UPON COMPLETION OF THE CONTRACT, THIS SET OF "AS-BUILTS" SHALL BE DELIVERED TO THE ENGINEER WITHIN 15 DAYS OF COMPLETION OF THE PROJECT.

M. MATERIAL SHALL BE AS SPECIFIED. SUBSTITUTIONS WILL BE CONSIDERED IF SUBMITTED FOR PRIOR APPROVAL AT LEAST ONE (1) WEEK PRIOR TO THE CONTRACT BID DATE. SUBSTITUTIONS SHOULD BE SUBMITTED SEPARATELY FOR EACH PRODUCT WITH SUPPORTING DATA, DRAWINGS AND SAMPLES AS APPROPRIATE, INCLUDING: 1.) COMPARISON OF THE QUALITIES OF THE PROPOSED SUBSTITUTION WITH THAT SPECIFIED. 2.) CHANGES REQUIRED IN OTHER ELEMENTS OF THE WORK BECAUSE OF THE SUBSTITUTION. 3.) COST DATA COMPARING THE PROPOSED SUBSTITUTION WITH THE PRODUCT SPECIFIED. THE ENGINEER WILL DETERMINE THE ACCEPTABILITY OF THE PROPOSED SUBSTITUTION.

N. SUBMIT ELECTRONIC PDF OF MANUFACTURER'S SHOP DRAWINGS FOR EQUIPMENT AND DEVICES. PRIOR TO SUBMITTING THE SHOP DRAWINGS FOR REVIEW, THE CONTRACTOR SHALL REVIEW AND CERTIFY SAME AS TO COMPLIANCE WITH THE PLANS AND SPECIFICATIONS AND FOR DIMENSIONAL SUITABILITY FOR THE APPLICATIONS.

O. WHEN ALTERNATE OR SUBSTITUTED EQUIPMENT IS USED, CONTRACTOR IS RESPONSIBLE FOR COORDINATING SPACE REQUIREMENTS, CONFIGURATIONS, CHANGES IN SUPPORTS OR STRUCTURAL MEMBERS, ELECTRICAL REQUIREMENTS, AND COORDINATION OF OTHER TRADES THAT MAY BE AFFECTED BY THEIR USE. CONTRACTOR IS RESPONSIBLE FOR VERIFYING THE SAME WHEN USING LISTED APPROVED MANUFACTURERS OTHER THAN THE BASIS OF DESIGN.

P. THE CONTRACTOR SHALL PROVIDE ALL EQUIPMENT AND PERSONNEL REQUIRED FOR TESTING OF INSTALLED EQUIPMENT.

Q. THE CONTRACTOR SHALL DEMONSTRATE THE PROPER OPERATION AND CALIBRATION OF ALL SYSTEMS TO THE OWNER, AT A TIME AS AGREED TO BY THE OWNER AND DIRECTED BY THE OWNER.

R. THE CONTRACTOR SHALL PROVIDE THE OWNER WITH OPERATION AND MAINTENANCE MANUALS FOR ALL SYSTEMS WITHIN 15 DAYS OF THE COMPLETION OF THE PROJECT.

S. THE CONTRACTOR SHALL INCLUDE THE COST FOR COMMISSIONING BY PCD ENGINEERING TO VERIFY THE PERFORMANCE OF THE SYSTEM CONTROLS SHOWN ON THIS DRAWING. THIS INCLUDES PREPARING A COMMISSIONING PLAN, VERIFYING THE OPERATION OF ALL SYSTEMS PER CODE REQUIREMENTS, AND PROVIDING A FINAL COMMISSIONING REPORT. FINAL COMMISSIONING REPORT IS DUE UPON COMPLETION OF THE PROJECT.

CODES, REGULATIONS, AND STANDARDS:

1. ALL WORK SHALL BE IN STRICT ACCORD WITH LOCAL GOVERNING LAWS, ORDINANCES, AND REGULATIONS; ALL WORK MUST BE IN FULL ACCORDANCE WITH ALL CODES, ORDINANCES, AND CODE RULINGS. CONTRACTOR SHALL PROVIDE, WITHOUT EXTRA CHARGE, THE LABOR AND MATERIALS REQUIRED FOR FULL CODE COMPLIANCE.
2. ALL MATERIALS SHALL BE NEW AND SHALL COMPLY WITH THE SPECIFICATIONS ON DRAWINGS.
3. CONTRACTOR SHALL OBTAIN AND PAY FOR ALL LOCAL FEES, PERMITS, AND SERVICES OF INSPECTION AUTHORITIES REQUIRED BY THE WORK OF THE PROJECT. THE CONTRACTOR SHALL ARRANGE FOR ALL INSPECTIONS WHEN THEY BECOME DUE AND SHALL NOT COVER NEW WORK UNTIL APPROVED BY THE INSPECTION AUTHORITY.

GUARANTEE:

A. THE CONTRACTOR SHALL GUARANTEE ALL WORKMANSHIP, MATERIALS, AND EQUIPMENT PROVIDED FOR THE PROJECT AGAINST DEFECTS AND/OR FAULTY WORKMANSHIP FOR A PERIOD OF ONE YEAR FROM THE DATE OF FINAL ACCEPTANCE BY THE OWNER.

B. THE CONTRACTOR SHALL REPAIR AND/OR REPLACE DEFECTIVE OR FAULTY WORKMANSHIP, MATERIALS, OR EQUIPMENT, AND SHALL BE RESPONSIBLE FOR THE REPAIR AND/OR REPLACEMENT OF OTHER PROPERTY OR WORK DAMAGED AS A RESULT, WITHOUT CHARGE TO THE OWNER AND AS QUICKLY AS POSSIBLE, DURING THE GUARANTEE PERIOD.

MECHANICAL DRAWING INDEX

DRAWING NUMBER	DRAWING TITLE	ISSUE DATE - DESCRIPTION: 11-19-2021 - CONSTRUCTION DOCUMENTS
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M-006	MECHANICAL CONTROLS	●
M-101	LEVEL 01 - MECHANICAL PLAN	●
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M-103	ROOF - MECHANICAL PLAN	●
M-201	LEVEL 01 - MECHANICAL PIPING PLAN	●
M-202	LEVEL 02 - MECHANICAL PIPING PLAN	●

KEY:
● FULL SHEET ISSUE.
○ PARTIAL SHEET ISSUE (SKETCH).

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BUILDING CODE DATA

DISCIPLINE	CODE	EDITION
GENERAL	INTERNATIONAL BUILDING CODE	2015
HVAC / MECHANICAL	INTERNATIONAL MECHANICAL CODE	2015
PLUMBING	INTERNATIONAL PLUMBING CODE	2015
ELECTRICAL	NATIONAL ELECTRIC CODE	2020
FIRE PROTECTION	INTERNATIONAL FIRE CODE	2015
	NFPA STANDARDS	CURRENT
FUEL	INTERNATIONAL FUEL GAS CODE	2015
ENERGY	INTERNATIONAL ENERGY CONSERVATION CODE	2015
ACCESSIBILITY	ICC/ANSI A117.1	2009
LOCAL AMENDMENTS	CITY OF LAFAYETTE BUILDING CODE AMENDMENTS	2017

NOTES:
A. ALL WORK PERFORMED SHALL COMPLY WITH THE REQUIREMENTS OF THE LISTED CODES, LOCAL CODE AMENDMENTS, AND REFERENCED STANDARDS AS ENFORCED BY THE AUTHORITY HAVING JURISDICTION (AHJ).
B. ALL WORK SUBJECT TO INSPECTION BY THE AHJ AT THE PROJECT SITE FOR COMPLIANCE.

SPECIFICATION GENERAL NOTES CONTINUED

DEMOLITION NOTES:

1. VERIFY LOCATION OF EXISTING SYSTEMS AND EXISTING FIELD CONDITIONS.
2. REVIEW ALL SHEETS FOR OTHER DEMO AND REMOVAL REQUIREMENTS.
3. COORDINATE ALL DEMOLITION WORK WITH THE ARCHITECTURAL DRAWINGS.
4. ALL CONFLICTS, OMISSIONS, AND CONCERNS SHALL BE BROUGHT TO THE ATTENTION OF THE ENGINEER IN WRITING FOR A WRITTEN RESOLUTION, BEFORE PROCEEDING WITH WORK SO INVOLVED.
5. UNLESS SPECIFICALLY NOTED TO THE CONTRARY, REMOVED MATERIALS SHALL NOT BE REUSED IN THE WORK. SALVAGED MATERIALS THAT ARE TO BE REUSED SHALL BE STORED SAFE AGAINST DAMAGE AND TURNED OVER TO THE APPROPRIATE TRADE FOR REUSE.
6. WHERE INDICATED, SALVAGED MATERIALS SHALL REMAIN THE PROPERTY OF THE OWNER. THESE MATERIALS ARE TO BE REMOVED BY THE SUBCONTRACTOR AND TURNED OVER TO THE OWNER WITHOUT DAMAGE. ALL OTHER SALVAGED MATERIALS SHALL BECOME THE PROPERTY OF THE SUBCONTRACTOR, WHO SHALL REMOVE AND LEGALLY DISPOSE OF OR (PREFERABLY) RECYCLE THEM AWAY FROM THE PREMISES.
7. WORK THAT HAS BEEN CUT OR PARTIALLY REMOVED SHALL BE PROTECTED AGAINST DAMAGE UNTIL COVERED BY PERMANENT CONSTRUCTION.
8. CLEAN ALL EQUIPMENT AND ACCESSORIES THAT ARE TO BE REUSED. REMOVE ALL MUD, DEBRIS, RUST AND OTHER EXTRANEOUS MATERIALS SO THAT THE EXISTING EQUIPMENT AND ALL ACCESSORIES CAN BE REPAINTED AND REPAIRED AS REQUIRED TO PLACE IN FIRST CLASS WORKING CONDITION.
9. WHERE EXISTING EQUIPMENT IS REMOVED, PIPING OR CONDUIT SHALL BE CAPPED UNDER THE FLOOR OR BEHIND THE WALL FACE, UNLESS OTHERWISE NOTED.
10. REPAIR ALL WALL, FLOOR, AND CEILING PENETRATIONS TO MAINTAIN THE EXISTING FIRE RATING.

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pcd ENGINEERING
a Bowman company
COLORADO REGISTERED PETER C. DANTON 33293 11/19/21 PROFESSIONAL ENGINEER

PROJECT:
SOUTHEAST COUNTY SERVICE HUB
1755 S. PUBLIC RD
LAFAYETTE, CO 80026

PROJECT NO: 2007

ISSUE DATE	PHASE / REV NAME
11/19/21	CONSTRUCTION DOCUMENTS

MECHANICAL LEGEND & NOTES

M-001

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AIR DEVICE SCHEDULE

TAG	MANUFACTURER	MODEL	MATERIAL	COLOR	FACE SIZE (INCHES)	NECK SIZE (INCHES)	OPPOSED BLADE DAMPER	SERVICE	MAX. NOISE CRITERIA (NC)	NOTES
S1	TITUS	TMS	STEEL	NOTE G	24x24	SEE PLAN	NO	SUPPLY	35	A, B, D
S2	TITUS	TMS	STEEL	NOTE G	24x24	SEE PLAN	NO	SUPPLY	35	A, B, C
S3	TITUS	CT480	STEEL	NOTE G	NECK+1	SEE PLAN	NO	SUPPLY	35	A, B, C
R1	TITUS	PAR	STEEL	NOTE G	24X24	22X22	NO	RETURN	35	A, B, D
R2	TITUS	PAR	STEEL	NOTE G	24X12	22X10	NO	RETURN	35	A, B, C
R3	TITUS	PAR	STEEL	NOTE G	24X48	22X46	NO	RETURN	35	A, B, D
E1	TITUS	PAR	ALUMINUM	NOTE G	12X12	SEE PLAN	NO	EXHAUST	35	A, B, C

NOTES:
- A. MAXIMUM STATIC PRESSURE DROP ALLOWED: 0.15" W.C. UNLESS OTHERWISE NOTED.
- B. SEE PLANS FOR SIZES AND QUANTITIES.
- C. SURFACE MOUNTING BORDER.
- D. LAY-IN TYPE BORDER.
- E. HEAVY DUTY FLOOR MOUNTING FRAME.
- F. GRAVITY HOOD TO BE FURNISHED WITH BIRD SCREEN AND MOTORIZED DAMPER.
- G. COLOR AS SPECIFIED BY ARCHITECT.

EQUALS BY: ANEOMOSTAT, J & J, KRUEGER, METAL-AIRE, PRICE, TITUS, TUTTLE & BAILEY, OR ENGINEER APPROVED EQUAL.

BOILER SCHEDULE

TAG	MANUFACTURER	MODEL	TYPE	OPERATING ELEVATION	FLUID TYPE	S.L. INPUT MBH	OUTPUT MBH	FUEL TYPE	FLUE SIZE INCHES	OPER. PRESS. PSI	ELECTRICAL VOLT/□/A	WEIGHT LBS.	NOTES
B-1	TRIANGLE TUBE	PRESTIGE SOLO 399	CONDENSING	5200	100% WATER	399	339	N.G.	4"	12	120/1/10	833	1-5
B-2	TRIANGLE TUBE	PRESTIGE SOLO 399	CONDENSING	5200	100% WATER	399	339	N.G.	4"	12	120/1/10	833	1-5

NOTES:
1. OUTPUT IS AT ALTITUDE.
2. FLUE VENTING AND OSA COMBUSTION INTAKE MUST BE IN ACCORDANCE WITH MANUFACTURER AND ALL APPLICABLE CODES. PROVIDE NEW DISCHARGE AND INTAKE.
3. PROVIDE 45 PSIG RELIEF VALVE, 200 DEG.F HIGH LIMIT, AIR VENT, LOW WATER CUT-OUT AS REQUIRED, SAFETY DEVICES.
4. FLUE VENTING (WITH VENT CAP) MUST BE IN ACCORDANCE WITH MANUFACTURER AND ALL APPLICABLE CODES.
5. WITH PRESTIGE CASCADE SYSTEM CPS800 WITH INTEGRAL MANIFOLDS AND HYDRAULIC SEPARATOR.

EQUALS BY: LAARS, LOCHINVAR, TRIANGLE TUBE, WEIL MCLAIN, OR ENGINEER APPROVED EQUAL.

FAN SCHEDULE

TAG	MANUFACTURER	MODEL	SERVICE	LOCATION	FAN DATA							MOTOR DATA			OP. WT. (LBS)	NOTES
					AIR FLOW (CFM)	E.S.P. (IN. W.C.)	OPER. ELEV. (FEET)	TYPE	MAX. RPM	MAX. SONES	MOUNT	DRIVE	H.P. OR WATTS	VOLTS/PH.		
EF-1	PANASONIC	FV-30VQ3	VENTILATION	STORAGE 124	257	0.25	5200	CENTRIFUGAL	990	N/A	CEILING	DIRECT	62 W	120V/1PH	18.2	A, D

NOTES:
- A. PROVIDE WALL CAP, BACKDRAFT DAMPER, AND BIRD SCREEN.
- B. CONTROLLED BY BAS TO RUN CONTINUOUSLY DURING ALL BUILDING OCCUPIED HOURS (OWNER DETERMINED).
- C. CFM LISTED IS CODE REQUIRED MINIMUM. BALANCE TO LISTED CFM OR UP TO 10% HIGHER.
- D. CONTROLLED BY MANUAL WALL SWITCH.

EQUALS BY: ACME, BROAN, COOK, GREENHECK, PENN, OR ENGINEER APPROVED EQUAL.

VARIABLE AIR VOLUME ROOF-TOP UNIT SCHEDULE

TAG	MANUFACTURER/ MODEL	SERVICE	OPER. ELEV. (FEET)	SUPPLY FAN DATA (2 FANS)				MIN. OUTSIDE AIR FLOW (CFM)	RETURN FAN DATA (2 FANS)			EXHAUST FAN DATA			UNIT ELECTRICAL DATA			COOLING				DIMENSIONS			UNIT WEIGHT (LBS.)	NOTES
				MAX. AIR FLOW (CFM)	MIN. AIR FLOW (CFM)	E.S.P. (IN. W.C.)	HORSE POWER		AIR FLOW (CFM)	E.S.P. (IN. W.C.)	HORSE POWER	AIR FLOW (CFM)	E.S.P. (IN. W.C.)	HORSE POWER	VOLTAGE/ PHASES	MIN. CIRCUIT AMPS	MAX. OCP	FLUID	MBH (TOTAL)	EWT (F)	LWT (F)	LENGTH (IN.)	WIDTH (IN.)	HEIGHT (IN.)		
RTU-1	ANNEXAIRE ERP-E-40-EC-EW05-H-C	BUILDING	5200	40,000	14,400	1.5	40 (PER FAN)	8325	40,000	0.75	25 (PER FAN)	1105	0.75	1.0	460/3	227	250	40% P.G.	912	54	44	390	219	147	31,000	A-H

NOTES:
- A. WITH 12" HIGH ROOF CURB.
- B. WITH ECONOMIZER (DRY BULB CONTROL).
- C. WITH POWER EXHAUST FAN.
- D. WITH HAIL GUARDS.
- E. WITH NEW ROOF CURB, COORDINATE WITH STRUCTURAL.
- F. WITH SENSIBLE HEAT WHEEL WITH VFD.
- G. WITH INDIRECT EVAPORATIVE COOLER, PUMP, PIPING W/ BLOWDOWN, QUICK FILL, FILL/DRAIN VALVE, SS SUMP/DRAIN PAN.
- H. MERV 14 FINAL FILTER.

EQUALS BY: BOULDER COUNTY AND ENGINEER APPROVED EQUAL.

SPLIT SYSTEM AIR CONDITIONER SCHEDULE

TAG	MANUFACTURER	MODEL	SERVICE	OPERATING CONDITIONS			ELECTRICAL DATA				COOLING			OP. WT. (LBS)	NOTES
				OAT DB (DEG. F.)	OAT WB (DEG. F.)	COIL EAT (DEG. F.)	NOMINAL CAPACITY	VOLTS/PH.	MOP	MCA	SEER	EER	CAPACITY (MBH)		
CU-1	MITSUBISHI	MUY-GL12NA (OUTDOOR)	AC-1	91	59	-	1 TON	208-230/1PH	15	7.0	23.1	13.0	10.1	81.0	A-H, J,K
AC-1	MITSUBISHI	MSY-GL12NA (INDOOR)	LAN RM 141	-	-	75	1 TON	208-230/1PH	N/A	1.0	23.1	13.0	10.1	22.0	B,H-K
CU-2	MITSUBISHI	MUY-GL12NA (OUTDOOR)	AC-2	91	59	-	1 TON	208-230/1PH	15	7.0	23.1	13.0	10.1	81.0	A-H, J,K
AC-2	MITSUBISHI	MSY-GL12NA (INDOOR)	LAN RM 236	-	-	75	1 TON	208-230/1PH	N/A	1.0	23.1	13.0	10.1	22.0	B,H-K
CU-3	MITSUBISHI	MUY-GL12NA (OUTDOOR)	AC-3	91	59	-	1 TON	208-230/1PH	15	7.0	23.1	13.0	10.1	81.0	A-H, J,K
AC-3	MITSUBISHI	MSY-GL12NA (INDOOR)	ELEV MECH RM	-	-	75	1 TON	208-230/1PH	N/A	1.0	23.1	13.0	10.1	22.0	B,H-K
CU-4	MITSUBISHI	MUY-GL12NA (OUTDOOR)	AC-4	91	59	-	1 TON	208-230/1PH	15	7.0	23.1	13.0	10.1	81.0	A-H, J,K
AC-4	MITSUBISHI	MSY-GL12NA (INDOOR)	ELEC RM 119	-	-	75	1 TON	208-230/1PH	N/A	1.0	23.1	13.0	10.1	22.0	B,H-K
CU-5	MITSUBISHI	MUY-GL12NA (OUTDOOR)	AC-5	91	59	-	1 TON	208-230/1PH	15	7.0	23.1	13.0	10.1	81.0	A-H, J,K
AC-5	MITSUBISHI	MSY-GL12NA (INDOOR)	ELEC RM 223	-	-	75	1 TON	208-230/1PH	N/A	1.0	23.1	13.0	10.1	22.0	B,H-K

NOTES:
- A. LOW AMBIENT KIT TO -5 DEGREES FAHRENHEIT.
- B. REFRIGERANT LINE SET, SIZED BY MANUFACTURER.
- C. ANTI-SHORT CYCLE TIMER, COMPRESSOR HARD START, CRANKCASE HEATER, OR EQUIVALENT FUNCTIONS/FEATURES.
- D. UNIT STAND, 24" HIGH.
- E. LEVEL 4" CONCRETE PAD BY M.C.
- F. WIND BAFFLE.
- G. HAIL GUARD.
- H. INDOOR UNIT POWERED BY OUTDOOR UNIT.
- I. DRAIN PAN LEVEL SENSOR AND SHUT-OFF CONTROL.
- J. HEAT PUMP SIZE TO BE CONFIRMED WITH FINAL EQUIPMENT HEAT OUTPUT (BY OTHERS).
- K. DO NOT EXCEED MANUFACTURER REQUIRED MAXIMUM REFRIGERANT LINESET LENGTH.

EQUALS BY: DAIKIN, LG, SAMSUNG, OR ENGINEER APPROVED EQUAL.

UNIT HEATER SCHEDULE

TAG	MANUFACTURER	MODEL	SERVICE	AIR FLOW (CFM)	ELECTRICAL DATA		HEAT		OP. WT. (LBS)	OPTIONS	NOTES
					WATTS OR AMPS	VOLTS/PH.	FUEL	INPUT (MBH/KW)			
UH-1	QMARK/MARLEY	CDF-548	VESTIBULE	300	9.6 A	208V/1PH	ELECT.	2 KW	27.0	1, 2	A
UH-2	QMARK/MARLEY	AWH3150F	STORAGE 124	100	12.5 A	120V/1PH	ELECT.	1.5 KW	25.0	1, 2	B
UH-3	QMARK/MARLEY	AWH3150F	STORAGE 123	100	12.5 A	120V/1PH	ELECT.	1.5 KW	25.0	1, 2	B

NOTES:
- A. WITH RECESSED CEILING MOUNTING KIT.
- B. WITH WALL MOUNTING KIT.

EQUALS BY: CHROMALOX, FEDERAL PACIFIC, INDEECO, LENNOX, TRANE, OR REZNOR.

OPTIONS (SOME FIELD INSTALLED):
1. UNIT DISCONNECT SWITCH
2. HEATING THERMOSTAT

VAV BOX SCHEDULE

TAG	AREA SERVED	MANUF.	MODEL	INLET DIAMETER (INCHES)	CFM MINIMUM (VENTILATION)	CFM MAXIMUM (COOLING)	HEATING COIL DATA					DIMENSIONS LxWxH (INCHES)	ELECTRICAL			NOTES
							CFM	LAT (°F)	GPM	ROWS	MBH		VOLT./ PHASE	MCA	MOCP	
VAV 1-1	SEE PLANS	TRANE	VCWF12	12	240	1735	1255	95	6.75	2	54.4	24x24x15.5	277/1	6.4	15	A-D
VAV 1-2	SEE PLANS	TRANE	VCWF8	8	210	535	330	95	1.75	2	14.3	18x22x11.5	277/1	6.4	15	A-D
VAV 1-3	SEE PLANS	TRANE	VCWF10	10	550	1130	675	95	2.5	2	29.3	22x24x13.5	277/1	6.4	15	A-D
VAV 1-4	SEE PLANS	TRANE	VCWF10	10	550	1095	630	95	2.25	2	27.3	22x24x13.5	277/1	6.4	15	A-D
VAV 1-5	SEE PLANS	TRANE	VCWF12	12	350	1520	825	95	3.50	2	35.8	24x24x15.5	277/1	6.4	15	A-D
VAV 1-6	SEE PLANS	TRANE	VCWF6	6	110	425	190	95	2.75	2	8.24	18x22x9.5	277/1	6.4	15	A-D
VAV 1-7	SEE PLANS	TRANE	VCWF6	6	220	460	170	95	1.75	2	7.37	18x22x9.5	277/1	6.4	15	A-D
VAV 1-8	SEE PLANS	TRANE	VCWF14	14	320	2100	1090	95	4.00	2	47.3	26x24x19.5	277/1	6.4	15	A-D
VAV 1-9	SEE PLANS	TRANE	VCWF8	8	115	615	270	95	1.50	2	11.7	18x22x11.5	277/1	6.4	15	A-D
VAV 1-10	SEE PLANS	TRANE	VCWF8	8	120	735	495	95	3.25	2	21.5	18x22x11.5	277/1	6.4	15	A-D
VAV 1-11	SEE PLANS	TRANE	VCWF12	12	380	1525	880	95	3.75	2	38.2	24x24x15.5	277/1	6.4	15	A-D
VAV 1-12	SEE PLANS	TRANE	VCWF12	12	380	1525	880	95	3.75	2	38.2	24x24x15.5	277/1	6.4	15	A-D
VAV 1-13	SEE PLANS	TRANE	VCWF12	12	270	1950	1350	95	8.00	2	58.6	24x24x15.5	277/1	6.4	15	A-D
VAV 1-14	SEE PLANS	TRANE	VCWF12	12	270	1950	1350	95	8.00	2	58.6	24x24x15.5	277/1	6.4	15	A-D
VAV 1-15	SEE PLANS	TRANE	VCWF6	6	110	425	190	95	1.75	2	7.59	18x22x9.5	277/1	6.4	15	A-D
VAV 1-16	SEE PLANS	TRANE	VCWF10	10	190	1335	650	95	2.5	2	28.2	22x24x13.5	277/1	6.4	15	A-D
VAV 1-17	SEE PLANS	TRANE	VCWF8	8	105	780	555	95	4.00	2	24.1	18x22x11.5	277/1	6.4	15	A-D
VAV 2-1	SEE PLANS	TRANE	VCWF12	12	240	1835	950	95	4.00	2	41.2	24x24x15.5	277/1	6.4	15	A-D
VAV 2-2	SEE PLANS	TRANE	VCWF12	12	240	1835	950	95	4.00	2	41.2	24x24x15.5	277/1	6.4	15	A-D
VAV 2-3	SEE PLANS	TRANE	VCWF10	10	265	1225	895	95	4.25	2	38.8	22x24x13.5	277/1	6.4	15	A-D
VAV 2-4	SEE PLANS	TRANE	VCWF16	16	420	3415	1200	95	4.00	2	47.3	30x26x19.5	277/1	6.4	15	A-D
VAV 2-5	SEE PLANS	TRANE	VCWF10	10	175	1230	480	95	1.5	2	20.8	22x24x13.5	277/1	6.4	15	A-D
VAV 2-6	SEE PLANS	TRANE	VCWF12	12	1050	1465	1050	95	4.25	2	38.8	24x24x15.5	277/1	6.4	15	A-D
VAV 2-7	SEE PLANS	TRANE	VCWF5	5	40	310	250	95	1.00	2	10.8	18x24x9.5	277/1	6.4	15	A-D
VAV 2-8	SEE PLANS	TRANE	VCWF6	6	210	475	210	95	0.75	2	9.11	18x22x9.5	277/1	6.4	15	A-D
VAV 2-9	SEE PLANS	TRANE	VCWF12	12	255	1690	650	95	2.5	2	28.2	24x24x15.5	277/1	6.4	15	A-D
VAV 2-10	SEE PLANS	TRANE	VCWF14	14	320	2170	975	95	3.50	2	42.3	26x24x19.5	277/1	6.4	15	A-D
VAV 2-11	SEE PLANS	TRANE	VCWF14	14	320	2170	975	95	3.50	2	42.3	26x24x19.5	277/1	6.4	15	A-D
VAV 2-12	SEE PLANS	TRANE	VCWF8	8	255	715	255	95	2.75	2	11.1	18x22x11.5	277/1	6.4	15	A-D
VAV 2-13	SEE PLANS	TRANE	VCWF8	8	300	645	355	95	2.00	2	15.4	18x22x11.5	277/1	6.4	15	A-D
VAV 2-14	SEE PLANS	TRANE	VCWF8	8	190	535	190	95	1.00	2	8.24	18x22x11.5	277/1	6.4	15	A-D
VAV 2-15	SEE PLANS	TRANE	VCWF8	8	165	525	190	95	1.00	2	8.24	18x22x11.5	277/1	6.4	15	A-D
VAV 2-16	SEE PLANS	TRANE	VCWF5	5	225	350	225	95	0.75	2	9.76	18x24x9.5	277/1	6.4	15	A-D
VAV 2-17	SEE PLANS	TRANE	VCWF14	14	415	2270	990	95	3.50	2	42.9	26x24x19.5	277/1	6.4	15	A-D
VAV 2-18	SEE PLANS	TRANE	VCWF14	14	415	2270	990	95	3.50	2	42.9	26x24x19.5	277/1	6.4	15	A-D

NOTES:
- A. DURING POWER OUTAGES, BOX TO FAIL OPEN.
- B. 100% WATER.
- C. 160 DEGREES F ENTERING COIL WATER TEMPERATURE.
- D. PROVIDE 10 FEET OF LINED SUPPLY DUCT BEFORE FIRST TAKEOFF.

EQUALS BY: ENGINEER APPROVED EQUAL.

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COLORADO REGISTERED PETER C. D'ANTONIO 33293 11/19/21 PROFESSIONAL ENGINEER

PROJECT: SOUTHEAST COUNTY SERVICE HUB
1755 S. PUBLIC RD
LAFAYETTE, CO 80026

PROJECT NO: 2007

ISSUE DATE	PHASE / REV NAME
11/19/21	CONSTRUCTION DOCUMENTS

MECHANICAL SCHEDULES

M-002

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VENTILATION CALCULATIONS

VENTILATION CALCULATIONS COMPLY WITH: ASHRAE 62.1/2015 IMC

ROOM NAME	ROOM AREA	ROOM TYPE	NUMBER OF PEOPLE	CFM/PERSON	CFM/SQ FT	TOTAL REQUIRED OA CFM
VAV 1-1						
127 - OPEN OFFICE	505	OFFICE SPACES	3	5	0.06	57
130 - HHS LAUNDRY/STORE	105	OCCUPIABLE STORAGE ROOMS	1	5	0.06	15
Total						**72**
VAV 1-2						
121 - FACE TO FACE	95	OFFICE SPACES	2	5	0.06	20
125 - HHS VISIT	100	OFFICE SPACES	2	5	0.06	20
126 - HHS VISITATION	230	OFFICE SPACES	2	5	0.06	30
129 - HALL	555	CORRIDORS	0	0	0.06	42
128 - HHS OBSERVATION	160	OFFICE SPACES	2	5	0.06	25
Total						**137**
VAV 1-3						
131 - TRAINING ROOM	935	CONFERENCE ROOMS	47	5	0.06	364
Total						**364**
VAV 1-4						
132 - TRAINING ROOM	925	CONFERENCE ROOMS	47	5	0.06	364
Total						**364**
VAV 1-5						
133 - LARGE MEETING	600	CONFERENCE ROOMS	30	5	0.06	233
Total						**233**
VAV 1-6						
147 - HHS VISITATION ROOM	280	OFFICE SPACES	2	5	0.06	34
146 - HHS OBSERVATION ROOM	175	OFFICE SPACES	1	5	0.06	20
149 - FACILITIES OFFICE	145	OFFICE SPACES	1	5	0.06	18
153 - FAMILY/ALL GENDER RR	200	TOILET ROOMS - PUBLIC	150 CFM CONTINUOUS EXHAUST			
152 - WOMEN'S RR	170	TOILET ROOMS - PUBLIC	100 CFM CONTINUOUS EXHAUST			
151 - MEN'S RR	165	TOILET ROOMS - PUBLIC	100 CFM CONTINUOUS EXHAUST			
148 - RR	80	TOILET ROOMS - PUBLIC	100 CFM CONTINUOUS EXHAUST			
Total						**72**
VAV 1-7						
145 - HALL	635	CORRIDORS	0	0	0.06	48
135 - RESTROOM	50	TOILET ROOMS - PUBLIC	50 CFM CONTINUOUS EXHAUST			
136 - FOCUS ROOM	65	OFFICE SPACES	1	5	0.06	12
137 - FOCUS ROOM	65	OFFICE SPACES	1	5	0.06	12
138 - WELLNESS	65	OFFICE SPACES	1	5	0.06	12
140 - FRONT DESK	210	RECEPTION AREAS	7	5	0.06	60
Total						**144**
VAV 1-8						
134 - OPEN LOUNGE	1300	MAIN ENTRY LOBBIES	13	5	0.06	179
Total						**179**
VAV 1-9						
111 - FACE TO FACE	100	OFFICE SPACES	2	5	0.06	20
116 - CDEM/WORKS OFFICE	115	OFFICE SPACES	1	5	0.06	15
117 - FACE TO FACE	110	OFFICE SPACES	2	5	0.06	21
118 - FACE TO FACE	95	OFFICE SPACES	2	5	0.06	20
Total						**76**
VAV 1-10						
102 - LOBBY CORRIDOR	1040	CORRIDORS	0	0	0.06	78
Total						**78**
VAV 1-11/VAV 1-12						
001 - (E) STAIR	520	CORRIDORS	0	0	0.06	39
102 - MAIN LOBBY	3295	MAIN ENTRY LOBBIES	33	5	0.06	454
101 - DROP BOX	45	OFFICE SPACES	1	5	0.06	10
Total						**503**
VAV 1-13/VAV 1-14						
110 - FLEX HOTEL, COFFEE, MIXED FUNCTION	2030	MAIN ENTRY LOBBIES	21	5	0.06	284
106 - OPEN OFFICE	665	OFFICE SPACES	4	5	0.06	75
Total						**359**
VAV 1-15						
115 - FACE TO FACE	90	OFFICE SPACES	2	5	0.06	20
114 - ISSUANCE SERVICE DESK	120	RECEPTION AREAS	2	5	0.06	22
113 - BENEFITS SERVICE DESK	120	RECEPTION AREAS	2	5	0.06	22
112 - TREASURER SERVICE DESK	120	RECEPTION AREAS	2	5	0.06	22
109 - RESTROOM	55	TOILET ROOMS - PUBLIC	50 CFM CONTINUOUS EXHAUST			
108 - PHONE ROOM	95	OFFICE SPACES	1	5	0.06	14
107 - MV STORAGE	100	OCCUPIABLE STORAGE ROOMS	1	5	0.06	14
Total						**114**
VAV 1-16						
103 - MOTOR VEHICLES	1160	OFFICE SPACES	6	5	0.06	125
Total						**125**
VAV 1-17						
105 - CO-RESPONDERS OFFICE	115	OFFICE SPACES	1	5	0.06	15
104 - MV OFFICE	120	OFFICE SPACES	1	5	0.06	16
Total						**31**
VAV 2-1/VAV 2-2						
222 - OPEN OFFICE	2835	OFFICE SPACES	15	5	0.06	307
221 - FOCUS	75	OFFICE SPACES	1	5	0.06	12
Total						**319**
VAV 2-3						
220 - FOCUS	75	OFFICE SPACES	1	5	0.06	12
206 - OPEN OFFICE	1505	OFFICE SPACES	8	5	0.06	163
Total						**175**

AIR COOLED CHILLER SCHEDULE

TAG	MANUFACTURER	MODEL	SERVES	NOMINAL TONS	AMBIENT TEMP. (°F)	WATER FLOW (GPM)	E.W.T. (°F)	L.W.T. (°F)	% PROP. GLYCOL	REFRIG. TYPE	ELECTRICAL			DIMENSIONS (IN)			OPERATING WEIGHT (LBS)	NOTES
											VOLTS	PHASE	MCA	LENGTH	WIDTH	HEIGHT		
ACC-1	TRANE	CGAM	RTU-1	65.5	91DB/59WB	172	54	44	40	R410A	460	3	145	150	88	85	5194	A

NOTES:
A. 175A MOP.
B. WITH PACKAGED PUMP P-4 (LOCATED WITHIN CHILLER FRAME), 136 GALLON BUFFER TANK AND 4.8 GALLON EXPANSION TANK.

EQUALS BY: BOULDER COUNTY AND ENGINEER APPROVED EQUAL.

ROOM NAME	ROOM AREA	ROOM TYPE	NUMBER OF PEOPLE	CFM/PERSON	CFM/SQ FT	TOTAL REQUIRED OA CFM
VAV 2-4						
203 - FACE TO FACE	65	OFFICE SPACES	2	5	0.06	18
202 - FOCUS ROOM	65	OFFICE SPACES	1	5	0.06	12
204 - FOCUS HOTELING	1125	OFFICE SPACES	6	5	0.06	122
Total						**152**
VAV 2-5						
205 - MEDIUM MEETING	285	CONFERENCE ROOMS	15	5	0.06	116
Total						**116**
VAV 2-6						
217 - CARDIO ROOM	455	HEALTH CLUB/AEROBICS ROOM	19	20	0.06	510
214 - WORKOUT ROOM	510	HEALTH CLUB/WEIGHT ROOM	6	20	0.06	189
Total						**699**
VAV 2-7						
210 - HALL	325	CORRIDORS	0	0	0.06	25
219 - RESTROOM	65	TOILET ROOMS - PUBLIC	50 CFM CONTINUOUS EXHAUST			
218 - RESTROOM	64	TOILET ROOMS - PUBLIC	50 CFM CONTINUOUS EXHAUST			
216 - SHOWER	80	SHOWER ROOM	70 CFM CONTINUOUS EXHAUST			
215 - SHOWER	80	SHOWER ROOM	70 CFM CONTINUOUS EXHAUST			
234 - WOMENS RESTROOM	205	TOILET ROOMS - PUBLIC	100 CFM CONTINUOUS EXHAUST			
235 - MENS RESTROOM	190	TOILET ROOMS - PUBLIC	100 CFM CONTINUOUS EXHAUST			
Total						**25**
VAV 2-8						
207 - PH CSAP OFFICE	115	OFFICE SPACES	1	5	0.06	15
208 - FACE TO FACE	125	OFFICE SPACES	2	5	0.06	22
209 - FACE TO FACE	110	OFFICE SPACES	2	5	0.06	21
211 - SMALL MEETING	165	CONFERENCE ROOMS	9	5	0.06	69
213 - CO-RESPONDERS STOR	80	OCCUPIABLE STORAGE ROOMS	1	5	0.06	13
Total						**140**
VAV 2-9						
200 - CORRIDOR	595	CORRIDORS	0	0	0.06	45
201 - MEDIUM MEETING	315	CONFERENCE ROOMS	16	5	0.06	124
Total						**169**
VAV 2-10/VAV 2-11						
226 - OPEN OFFICE	2100	OFFICE SPACES	11	5	0.06	227
Total						**227**
VAV 2-12						
225 - FOCUS	75	OFFICE SPACES	1	5	0.06	12
224 - FOCUS	75	OFFICE SPACES	1	5	0.06	12
232 - COPY MAIL SUPPLY	235	OFFICE SPACES	1	5	0.06	24
231 - OFM OFFICE	150	OFFICE SPACES	1	5	0.06	18
230 - FACE TO FACE/OFFICE	150	OFFICE SPACES	2	5	0.06	24
229 - ASSESSOR'S OFFICE	150	OFFICE SPACES	1	5	0.06	18
228 - SMALL CONFERENCE	100	CONFERENCE ROOMS	5	5	0.06	39
244 - STORAGE	35	OCCUPIABLE STORAGE ROOMS	1	5	0.06	9
245 - FOCUS ROOM	70	OFFICE SPACES	1	5	0.06	12
Total						**168**
VAV 2-13						
INTERIOR HALL	690	CORRIDORS	0	0	0.06	52
238 - WELLNESS	85	OFFICE SPACES	1	5	0.06	13
237 - JC/STORAGE	105	OCCUPIABLE STORAGE ROOMS	1	5	0.06	15
240 - CDEM/WORKS STORAGE	155	OCCUPIABLE STORAGE ROOMS	1	5	0.06	18
241 - ASSESSOR STORAGE	100	OCCUPIABLE STORAGE ROOMS	1	5	0.06	14
239 - SMALL MEETING	155	CONFERENCE ROOMS	8	5	0.06	62
243 - FACE TO FACE/OFFICE	140	OFFICE SPACES	2	5	0.06	23
Total						**197**
VAV 2-14						
249 - MEDIUM MEETING	315	CONFERENCE ROOMS	16	5	0.06	124
Total						**124**
VAV 2-15						
227 - MEDIUM MEETING	280	CONFERENCE ROOMS	14	5	0.06	109
Total						**109**
VAV 2-16						
242 - LARGE MEETING	380	CONFERENCE ROOMS	19	5	0.06	148
Total						**148**
VAV 2-17/VAV 2-18						
246 - BREAK AREA	605	BREAK ROOMS	31	5	0.06	240
247 - BUSINESS CENTER	2850	OFFICE SPACES	15	5	0.06	308
Total						**548**
TOTALS						
LEVEL 01 TOTAL						**2927**
LEVEL 02 TOTAL						**3316**
BUILDING TOTAL (Vou)						**6243**
Vot (RTU-1 OUTSIDE AIR SETTING)	(Vot = Vou/Ev) (Ev = 0.75)					**8324**

PUMP SCHEDULE

TAG	MANUF.	MODEL	SERVICE	LOCATION	TYPE	FLOW (GPM)	HEAD (FEET)	HORSE POWER OR WATTS	VOLTS/ PHASE	NOTES
P-1	GRUNDFOS	UPS 26-99 FC	B-1	MECH RM	CIRC.	31.5	2	197 W	115V/1P	1
P-2	GRUNDFOS	UPS 26-99 FC	B-2	MECH RM	CIRC.	31.5	2	197 W	115V/1P	1
P-3	GRUNDFOS	TPE350-240SAGABQQEICC	VAV BOXES	MECH RM	VARIABLE	110	60	3.0 HP	460V/3P	1,2,4
P-4	TRANE	PACKAGED	ACC-1	ROOF	VARIABLE	172	32.5	7.6 HP	208-230V/1P	1,2,4,18

NOTES:
1. PROVIDE VIBRATION ISOLATION.
2. PROVIDE VARIABLE SPEED MOTOR.
3. PROVIDE NEMA PREMIUM EFFICIENCY MOTOR.
4. VERIFY HEAD LOSS WITH FINAL SYSTEM INSTALL.
5. ALL BRONZE CONSTRUCTION.
6. CAST IRON CONSTRUCTION.
7. LEAD/LAG OPERATION.
11. PROVIDE PUMP WITH PROGRAMMABLE TIMER.
12. FURNISH WITH PUMP ALTERNATOR SYSTEM AND PUMP FAIL ALARM TO BAS AND AUDIBLE ALARM AT FRONT DESK.
13. PROVIDE PUMP WITH CHECK VALVE.
14. PUMP SUPPLIED WITH BOILER. SEE BOILER SCHEDULE.
15. PUMP WITH OIL-MINDER CONTROL TO PREVENT OPERATION IF OIL IS PRESENT.
16. WITH SUCTION DIFFUSER.
17. WITH TRIPLE DUTY VALVE.
18. PACKAGED PUMP WITH CHILLER.

EQUALS BY: STANCOR, SWABY, TACO, WIEL, WILO, ZOELLER.

COMcheck Software Version 4.1.5.3

Mechanical Compliance Certificate

Project Information

Energy Code: 2015 IECC
Project Title: SOUTHEAST COUNTY SERVICES HUB
Location: Lafayette, Colorado
Climate Zone: 5b
Project Type: Alteration

Construction Site:
1755 S. PUBLIC RD
LAFAYETTE, CO 80026

Owner/Agent:
BOULDER COUNTY

Designer/Contractor:
Peter D Antonio
PCD Engineering
323-3rd Ave.
Suite 100
Longmont, CO 80501
303-678-1108
peter@pcdengineering.com

Mechanical Systems List

Quantity System Type & Description

1 RTU-1 (Multiple-Zone):
Cooling: 1 each - Hydronic Coil, Capacity = 912 kBtu/h, Air Economizer:
No minimum efficiency requirement applies
Fan System: None

1 AC-1/CU-1 - AC-5/CU-5 (Single Zone):
Cooling: 5 each - Split System, Capacity = 12 kBtu/h, Air Cooled Condenser, No Economizer, Economize exception: None
Proposed Efficiency = 20.00 SEER, Required Efficiency = 13.00 SEER
Fan System: None

1 UH-1 (Single Zone):
Heating: 1 each - Unit Heater, Electric, Capacity = 7 kBtu/h
No minimum efficiency requirement applies
Fan System: None

2 UH-2/UH-3 (Single Zone):
Heating: 1 each - Unit Heater, Electric, Capacity = 5 kBtu/h
No minimum efficiency requirement applies
Fan System: None

2 B-1/B-2:
Heating: Hot Water Boiler, Capacity 396 kBtu/h, Gas
Proposed Efficiency: 95.10 % Et, Required Efficiency: 80.00 % Et

1 ACC-1:
Cooling: Water Chiller, Capacity 60 tons, Condenser Air-Cooled, Standard Centrifugal Chiller
Proposed Efficiency: 10.24 EER-FL (Refer to mech. plans for proposed IPLV).
Required Efficiency: 10.100 EER-FL + 13.700 EER-IPLV or 9.700 EER-FL + 15.800 EER-IPLV

1 Water Heater 1:
Gas Storage Water Heater, Capacity: 60 gallons, Input Rating: 76 kBtu/h w/ Circulation Pump
No minimum efficiency requirement applies

Project Title: SOUTHEAST COUNTY SERVICES HUB
Data filename: Y:\Shared_Projects\2021\21015 P20090 Boulder County HUB\Calculations & Design Data\HVAC\COMcheck\21015-Comcheck.cck
Report date: 11/17/21
Page: 1 of 14

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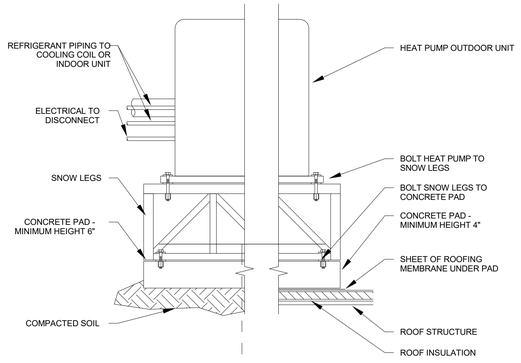
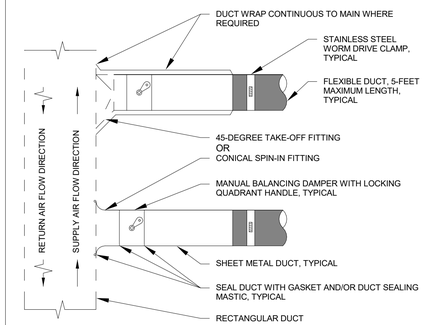


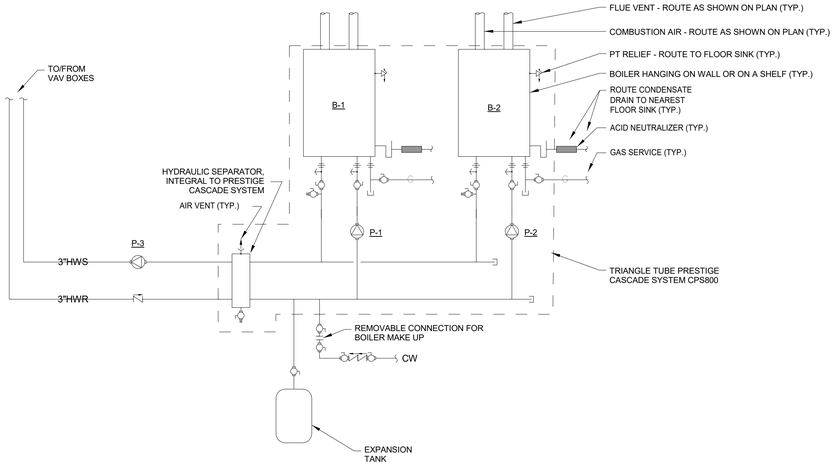
HEAT PUMP ON SNOW LEGS DETAIL

SCALE: NO SCALE



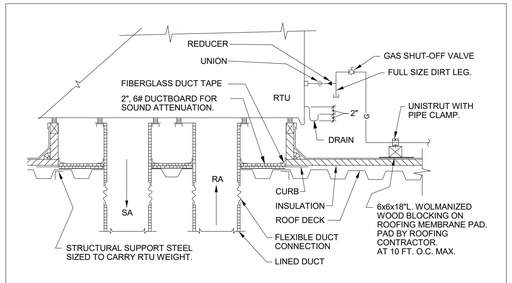
DUCT TAKE-OFF DETAIL - ROUND

SCALE: NO SCALE



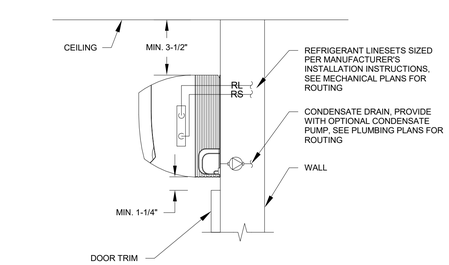
BOILER SYSTEM PIPING SCHEMATIC

SCALE: NO SCALE



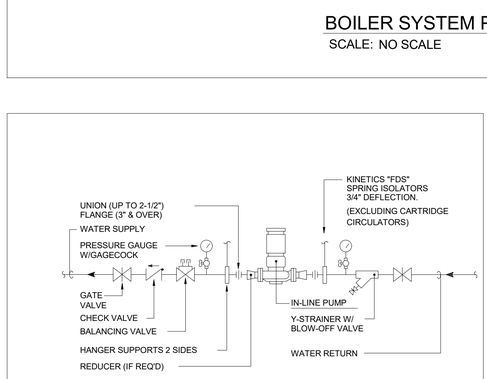
RTU MOUNTING & GAS CONNECTION DETAIL

SCALE: NO SCALE



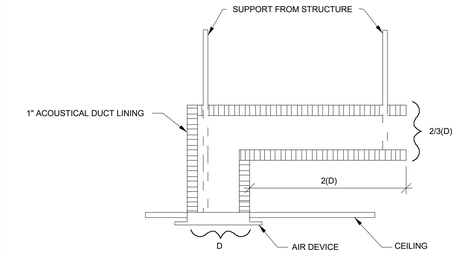
INDOOR HEAT PUMP DETAIL - WALL MOUNTED

SCALE: NO SCALE



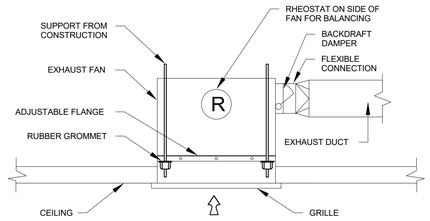
IN-LINE PUMP DETAIL

SCALE: NO SCALE



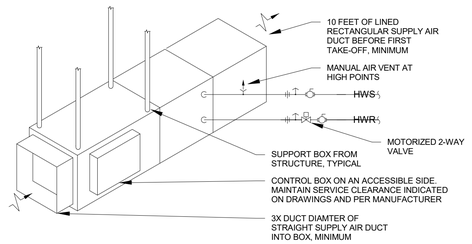
SOUND BOOT DETAIL

SCALE: NO SCALE



CEILING EXHAUST FAN DETAIL

SCALE: NO SCALE



VARIABLE AIR VOLUME BOX DETAIL

SCALE: NO SCALE

SOUND ATTENUATION SCHEDULE (SHOWN FOR REFERENCE ONLY)

												Minimum Dynamic Insertion Loss							Maximum Generated Sound Power						
Type	Mark	Manufacturer	Model	Type	Width (in.)	Height (in.)	Length (in.)	Fan System	Airflow (cfm)	Velocity (fpm)	Pressure Drop (in. w.g.)	63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz
SA	S1A	PRICE	RH60/WA	RECTANGULAR	36	20	60	SUPPLY RTU-1	10,000	2,000	0.12	6	7	12	16	12	10	8	47	33	28	27	36	35	34
SA	S1B	PRICE	RH60/WA	RECTANGULAR	36	20	60	SUPPLY RTU-1	10,000	2,000	0.12	6	7	12	16	12	10	8	47	33	28	27	36	35	34
SA	S1C	PRICE	RH60/7C	RECTANGULAR	26	42	60	SUPPLY RTU-1	15,000	1,978	0.18	6	9	15	25	20	15	12	55	42	38	36	42	43	43
SA	R1A	PRICE	RM60/YF	RECTANGULAR	46	46	60	RETURN RTU-1	10,000	681	0.18	15	22	27	36	30	20	16	46	23	27	41	45	45	44
SA	R1B	PRICE	RM36/YC	RECTANGULAR	46	46	36	RETURN RTU-1	10,000	681	0.04	8	9	12	15	12	10	9	29	20	15	29	35	29	24
SA	R1C	PRICE	RH36/YA	RECTANGULAR	46	28	36	RETURN RTU-1	10,000	1,118	0.05	5	6	8	12	11	9	7	36	20	15	16	29	34	31
SA	R1D	PRICE	RH36/YA	RECTANGULAR	46	28	36	RETURN	10,000	1,118	0.05	5	6	8	12	11	9	7	36	20	15	16	29	34	31

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MECHANICAL DETAILS

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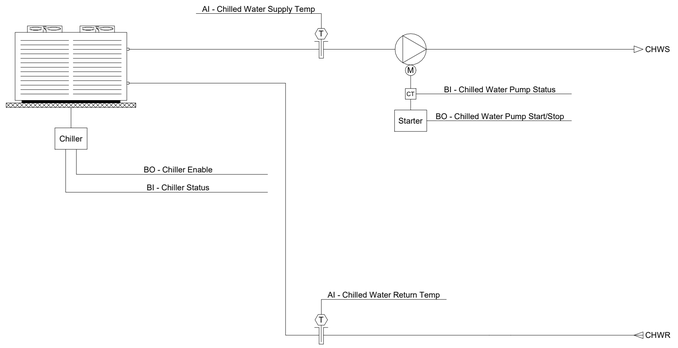
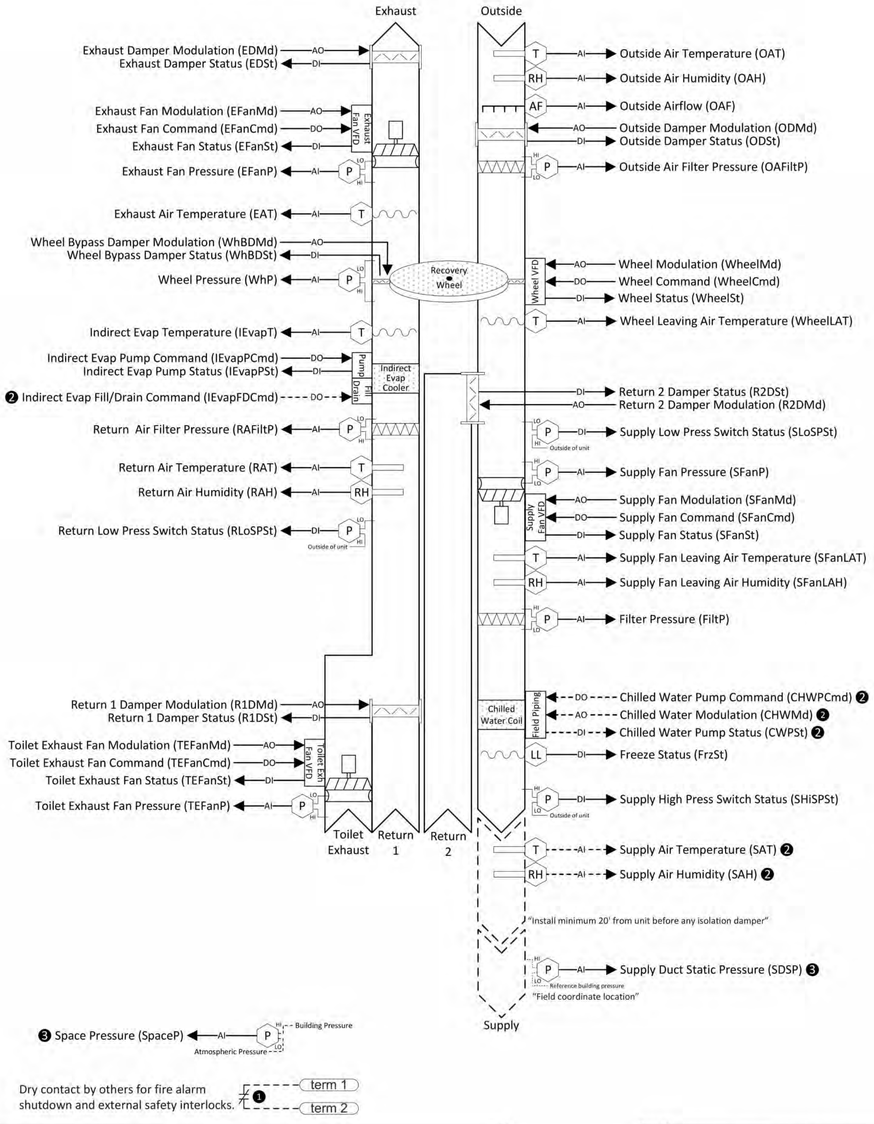


	Hardware Points						Software Points				
Point Name	**AI**	**AO**	**BI**	**BO**	**AV**	**BV**	**Loop**	**Sched**	**Trend**	**Alarm**	**Show On Graphic**
Chilled Water Return Temp	x								x		x
Chilled Water Supply Temp	x								x		x
Chilled Water Pump Status			x						x		x
Chiller Status			x						x		x
Chilled Water Pump Start/Stop				x							x
Chiller Enable				x							x
Outside Air Temp					x						x
Chilled Water Pump Failure										x	
Chilled Water Pump Running in Hand										x	
Chilled Water Pump Runtime Exceeded										x	
Chiller Failure										x	
Chiller Running in Hand										x	
Chiller Runtime Exceeded										x	
High Chilled Water Supply Temp										x	
Low Chilled Water Supply Temp										x	
Totals	**2**	**0**	**2**	**2**	**1**	**0**	**0**	**0**	**4**	**8**	**7**

ACC-1 CONTROL SCHEMATIC AND POINTS LIST

SCALE: NO SCALE



PROJECT : Boulder County Hub	
UNIT TAG # : DOAS-1	
PROJECT # : Pre-Sale	DATE : 11/18/2021
PAGE NAME : Unit Layout	REV # : 0
PAGE # : 1 OF 1	DRAWN BY : EJ Ressler

Legend:
- IO-## — JENE controller terminal
- ### — Factory terminal
- Internal Unit wiring or tubing
- Remote field wiring or tubing by others

Notes:
1. Field supplied parts, installed and wired by others
2. Factory supplied, field installed and wired by others
3. Factory supplied, field tubing supplied and installed by others

RTU-1 CONTROL SCHEMATIC AND POINTS LIST

SCALE: NO SCALE

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COLORADO REGISTERED PETER C. D'ANTONIO PROFESSIONAL ENGINEER 33293 11/19/21

PROJECT: **SOUTHEAST COUNTY SERVICE HUB**
1755 S. PUBLIC RD
LAFAYETTE, CO 80026

PROJECT NO: 2007

	ISSUE DATE	PHASE / REV NAME
1	11/19/21	CONSTRUCTION DOCUMENTS

MECHANICAL CONTROLS

M-005

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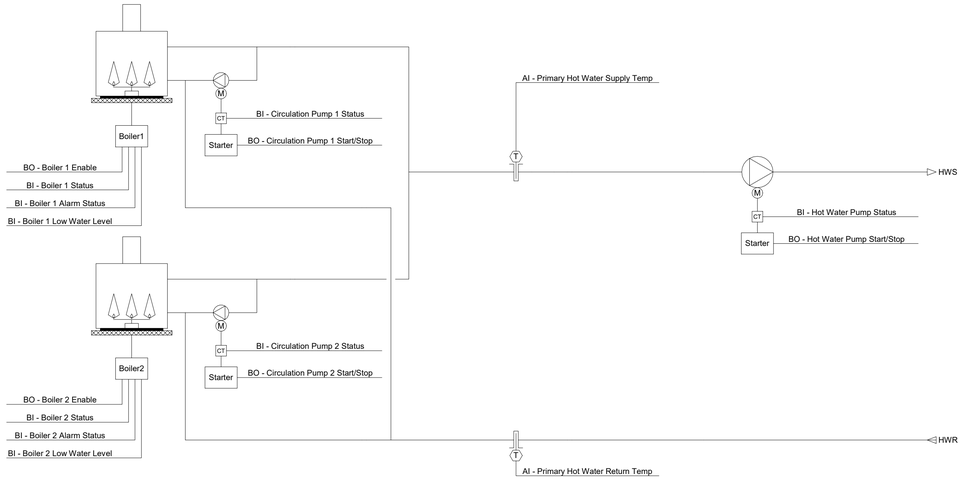
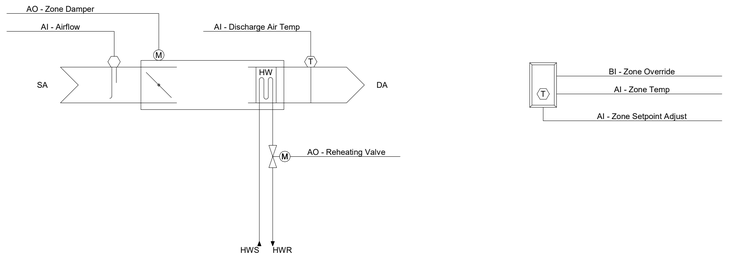


	Hardware Points						Software Points					
Point Name	**AI**	**AO**	**BI**	**BO**	**AV**	**BV**	**Loop**	**Sched**	**Trend**	**Alarm**	**Show On Graphic**	
Primary Hot Water Return Temp	x								x		x	
Primary Hot Water Supply Temp	x								x		x	
Boiler 1 Alarm Status			x						x	x	x	
Boiler 1 Low Water Level			x						x	x	x	
Boiler 1 Status			x						x		x	
Boiler 2 Alarm Status			x						x	x	x	
Boiler 2 Low Water Level			x						x	x	x	
Boiler 2 Status			x						x		x	
Circulation Pump 1 Status			x						x		x	
Circulation Pump 2 Status			x						x		x	
Hot Water Pump Status			x						x		x	
Boiler 1 Enable				x							x	
Boiler 2 Enable				x							x	
Circulation Pump 1 Start/Stop				x					x		x	
Circulation Pump 2 Start/Stop				x					x		x	
Hot Water Pump Start/Stop				x					x		x	
Outside Air Temp					x						x	
Boiler 1 Failure										x		
Boiler 1 Running in Hand										x		
Boiler 1 Runtime Exceeded										x		
Boiler 2 Failure										x		
Boiler 2 Running in Hand										x		
Boiler 2 Runtime Exceeded										x		
Circulation Pump 1 Failure										x		
Circulation Pump 1 Running in Hand										x		
Circulation Pump 1 Runtime Exceeded										x		
Circulation Pump 2 Failure										x		
Circulation Pump 2 Running in Hand										x		
Circulation Pump 2 Runtime Exceeded										x		
High Primary Hot Water Supply Temp										x		
Hot Water Pump Failure										x		
Hot Water Pump Running in Hand										x		
Hot Water Pump Runtime Exceeded										x		
Lead Boiler Failure										x	x	
Low Primary Hot Water Supply Temp										x		
Totals	**2**	**0**	**9**	**5**	**1**	**0**	**0**	**0**	**14**	**22**	**18**	

BOILER SYSTEM CONTROL SCHEMATIC AND POINTS LIST

SCALE: NO SCALE



	Hardware Points						Software Points					
Point Name	**AI**	**AO**	**BI**	**BO**	**AV**	**BV**	**Loop**	**Sched**	**Trend**	**Alarm**	**Show On Graphic**	
Airflow	x								x		x	
DischargeAir Temp	x								x		x	
Zone Setpoint Adjust	x										x	
Zone Temp	x								x		x	
Reheating Valve		x							x		x	
Zone Dampe		x							x		x	
Zone Override			x						x		x	
Airflow Setpoint					x				x		x	
Cooling Setpoint					x				x		x	
DAT Heatig Limit					x							
Heating Setpoint					x				x		x	
Heating Mde						x			x			
Schedule							x					
HighDischarge Air Temp										x		
High Zone Temp										x		
Low Discharge Air Temp										x		
Low Zone Temp										x		
Totals	**4**	**2**	**1**	**0**	**4**	**1**	**0**	**1**	**10**	**4**	**10**	

VAV BOX CONTROL SCHEMATIC AND POINTS LIST

SCALE: NO SCALE

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COLORADO REGISTERED PETER C. D'ANTONIO PROFESSIONAL ENGINEER 33293 11/19/21

PROJECT:
SOUTHEAST COUNTY SERVICE HUB
1755 S. PUBLIC RD
LAFAYETTE, CO 80026

PROJECT NO: 2007

ISSUE DATE	PHASE / REV NAME
11/19/21	CONSTRUCTION DOCUMENTS

MECHANICAL CONTROLS

M-006

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GENERAL NOTES:

1. REMOVE ALL EXISTING VAV BOXES AND ASSOCIATED DUCTWORK/AIR DEVICES BACK TO MAIN.
2. PROVIDE SOUND BOOT ON ALL RETURN AIR GRILLES.
3. ALL BRANCH DUCTWORK TO BE SIZED TO MATCH SUPPLY DIFFUSER NECK SIZE LISTED.
4. PROVIDE 10 FEET OF LINED SUPPLY DUCTWORK BEFORE FIRST BRANCH TAKE-OFF, TYPICAL ALL VAV BOXES.
5. PROVIDE 3 FEET OF STRAIGHT PRIMARY AIR DUCT BEFORE VAV BOX CONNECTION, TYPICAL ALL VAV BOXES.

WORK NOTES:

1. EXISTING TO REMAIN.
2. EXISTING UNIT HEATER TO REMAIN.
3. DEMO EXISTING 18" ROUND DUCTWORK AND CONNECT NEW 26"x20" DUCT TO EXISTING 38"x20" DUCT.
4. DEMO EXISTING MAIN SUPPLY AND RETURN DUCTS IN CHASE. RE-CONNECT EXISTING 36"x20" DUCT TO NEW MAIN SUPPLY WITH NEW 7'-0" SOUND ATTENUATION.
5. SCREENED FULL SIZE TOP RETURN OPENING.
6. UNIT HEATER RECESSED IN CEILING WITH INTEGRAL HEATING THERMOSTAT.
7. VAV BOX SERVICE CLEARANCE SHOWN DASHED. THIS AREA TO BE KEPT CLEAR OF ALL PIPING, DUCTWORK, SPRINKLERS, LIGHTING, ETC. COORDINATE WITH ALL TRADES TO KEEP SERVICE AREA CLEAR.
8. RETURN AIR TRANSFER OPENING IN WALL AT 11'-0" AFF (ABOVE CEILING). PROVIDE RETURN AIR PATH FROM ALL ROOMS BACK TO RETURN DUCT MAIN.

1 LEVEL 01 - MECHANICAL PLAN
N.T.S.

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COLORADO REGISTERED PETER C. D'ANTONIO 33293 PROFESSIONAL ENGINEER 11/19/21

PROJECT:
SOUTHEAST COUNTY SERVICE HUB
1755 S. PUBLIC RD
LAFAYETTE, CO 80026

PROJECT NO: 2007

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LEVEL 01 - MECHANICAL PLAN

M-101

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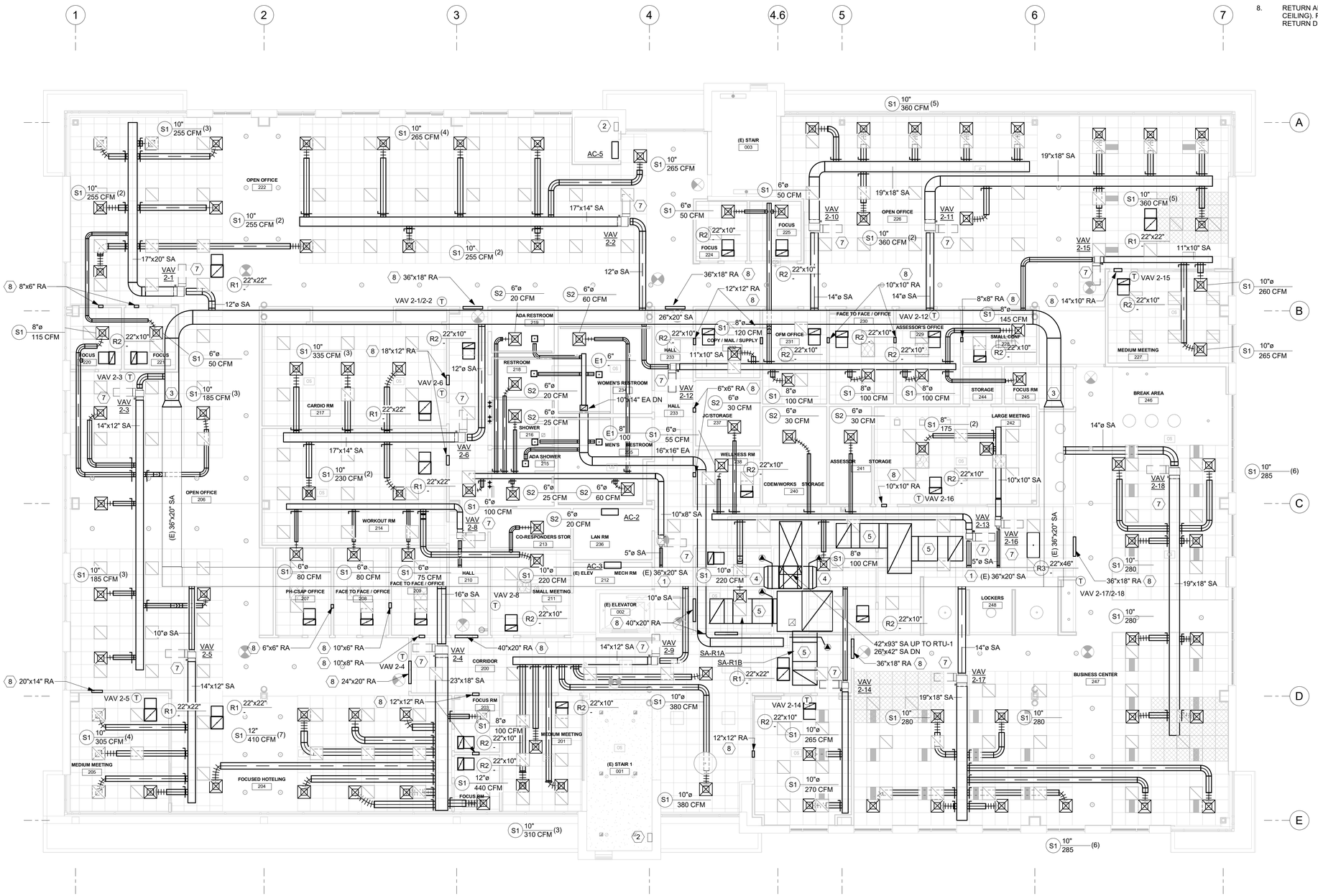
GENERAL NOTES:

1. REMOVE ALL EXISTING VAV BOXES AND ASSOCIATED DUCTWORK/AIR DEVICES BACK TO MAIN.
2. PROVIDE SOUND BOOT ON ALL RETURN AIR GRILLES.
3. ALL BRANCH DUCTWORK TO BE SIZED TO MATCH SUPPLY DIFFUSER NECK SIZE LISTED.
4. PROVIDE 10 FEET OF LINED SUPPLY DUCTWORK BEFORE FIRST BRANCH TAKE-OFF, TYPICAL ALL VAV BOXES.
5. PROVIDE 3 FEET OF STRAIGHT PRIMARY AIR DUCT BEFORE VAV BOX CONNECTION, TYPICAL ALL VAV BOXES.

WORK NOTES: (#)

1. EXISTING TO REMAIN.
2. EXISTING UNIT HEATER TO REMAIN.
3. DEMO EXISTING 18" ROUND DUCTWORK AND CONNECT NEW 26"x20" DUCT TO EXISTING 38"x20" DUCT.
4. DEMO EXISTING MAIN SUPPLY AND RETURN DUCTS IN CHASE. RE-CONNECT EXISTING 36"x20" DUCT TO NEW MAIN SUPPLY WITH NEW 7'-0" SOUND ATTENUATION.
5. SCREENED FULL SIZE TOP RETURN OPENING.
6. UNIT HEATER RECESSED IN CEILING WITH INTEGRAL HEATING THERMOSTAT.
7. VAV BOX SERVICE CLEARANCE SHOWN DASHED. THIS AREA TO BE KEPT CLEAR OF ALL PIPING, DUCTWORK, SPRINKLERS, LIGHTING, ETC. COORDINATE WITH ALL TRADES TO KEEP SERVICE AREA CLEAR.
8. RETURN AIR TRANSFER OPENING IN WALL AT 11'-0" AFF (ABOVE CEILING). PROVIDE RETURN AIR PATH FROM ALL ROOMS BACK TO RETURN DUCT MAIN.



1 LEVEL 02 - MECHANICAL PLAN
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PROJECT:
SOUTHEAST COUNTY SERVICE HUB
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LAFAYETTE, CO 80026

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LEVEL 02 - MECHANICAL PLAN

M-102

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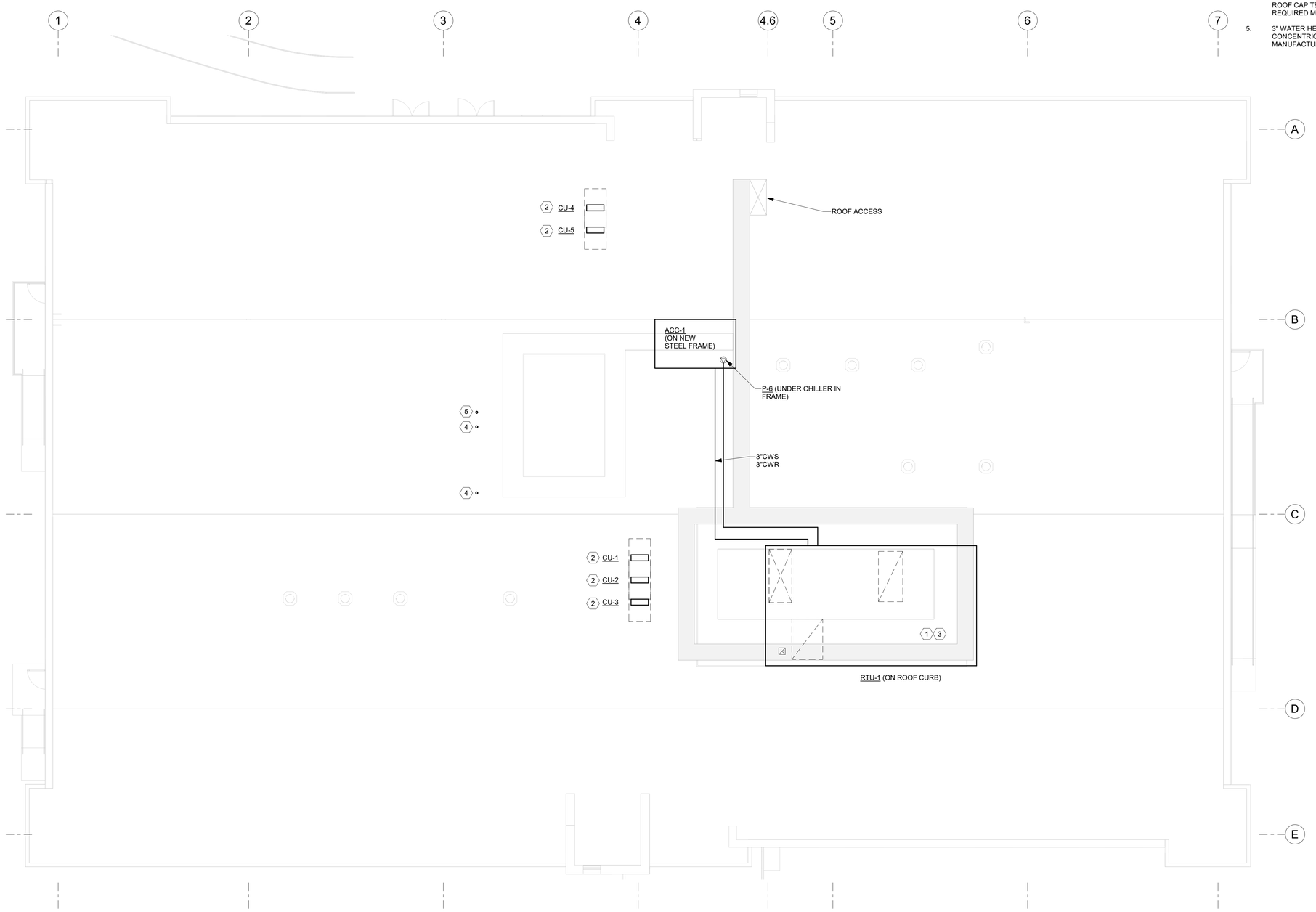
WORK NOTES:

1. EXISTING ROOF TOP UNIT TO BE REMOVED.
2. CONDENSING UNIT ON CONCRETE PAD. INSTALL MINIMUM 10'-0" FROM ROOF EDGE. ROUTE REFRIGERANT LINESET (SIZED BY MANUFACTURER) TO ASSOCIATED INDOOR UNIT. DO NOT EXCEED MANUFACTURER REQUIRED MAXIMUM LINESET LENGTH (65 FEET FOR SCHEDULED MODEL). PROVIDE MANUFACTURER REQUIRED CLEARANCE, SHOWN DASHED.
3. ROOFTOP UNIT ON NEW ROOF CURB. COORDINATE EXACT INSTALLATION LOCATION WITH ARCHITECTRUAL AND STRUCTURAL. SEE ARCHITECTURAL FOR SCREENING REQUIREMENT.
4. 4" BOILER FLUE VENT AND COMBUSTION AIR INTAKE CONCENTRIC ROOF CAP TERMINATION. DO NOT EXCEED MANUFACTURER REQUIRED MAXIMUM LENGTHS.
5. 3" WATER HEATER FLUE VENTA ND COMBUSTION AIR INTAKE CONCENTRIC ROOF CAP TERMINATION. DO NOT EXCEED MANUFACTURER REQUIRED MAXIMUM LENGTHS.



1 ROOF - MECHANICAL PLAN
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COLORADO REGISTERED
PETER C. D'ANTONIO
33293
PROFESSIONAL ENGINEER
11/19/21

PROJECT:
SOUTHEAST COUNTY SERVICE HUB
1755 S. PUBLIC RD
LAFAYETTE, CO 80026

PROJECT NO: 2007

#	ISSUE DATE	PHASE / REV NAME
	11/19/21	CONSTRUCTION DOCUMENTS

ROOF - MECHANICAL PLAN

M-103

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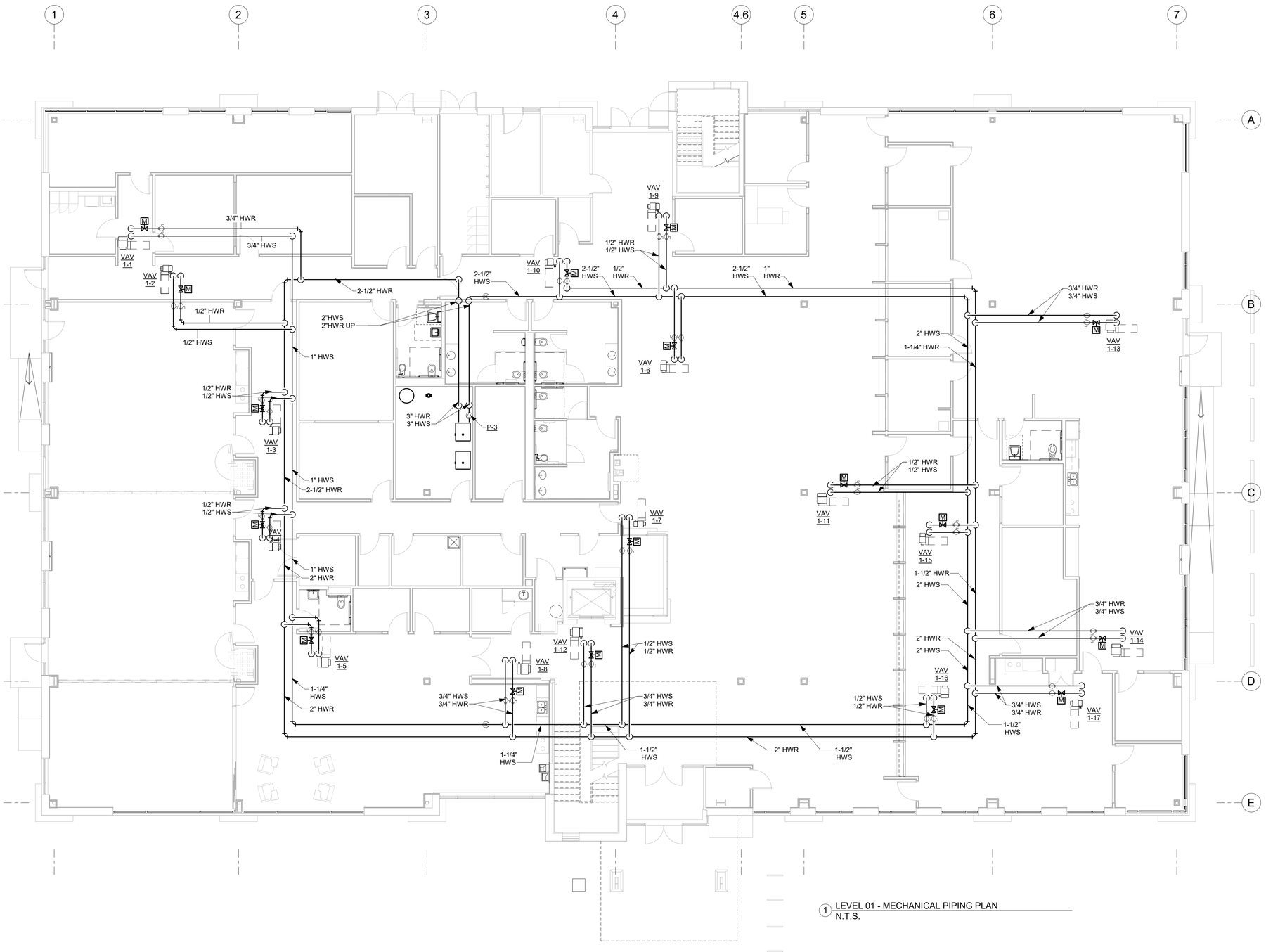
GENERAL NOTES:

1. AVOID CREATING HIGH POINTS IN HOT WATER PIPING WHENEVER POSSIBLE. PROVIDE AIR VENTS ON ALL HIGH POINTS.



1 LEVEL 01 - MECHANICAL PIPING PLAN
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COLORADO REGISTERED
PETER C. D'ANTONIO
33293
11/19/21
PROFESSIONAL ENGINEER

PROJECT:
SOUTHEAST COUNTY SERVICE HUB
1755 S. PUBLIC RD
LAFAYETTE, CO 80026

PROJECT NO: 2007

#	ISSUE DATE	PHASE / REV NAME
	11/19/21	CONSTRUCTION DOCUMENTS

LEVEL 01 - MECHANICAL PIPING PLAN

M-201

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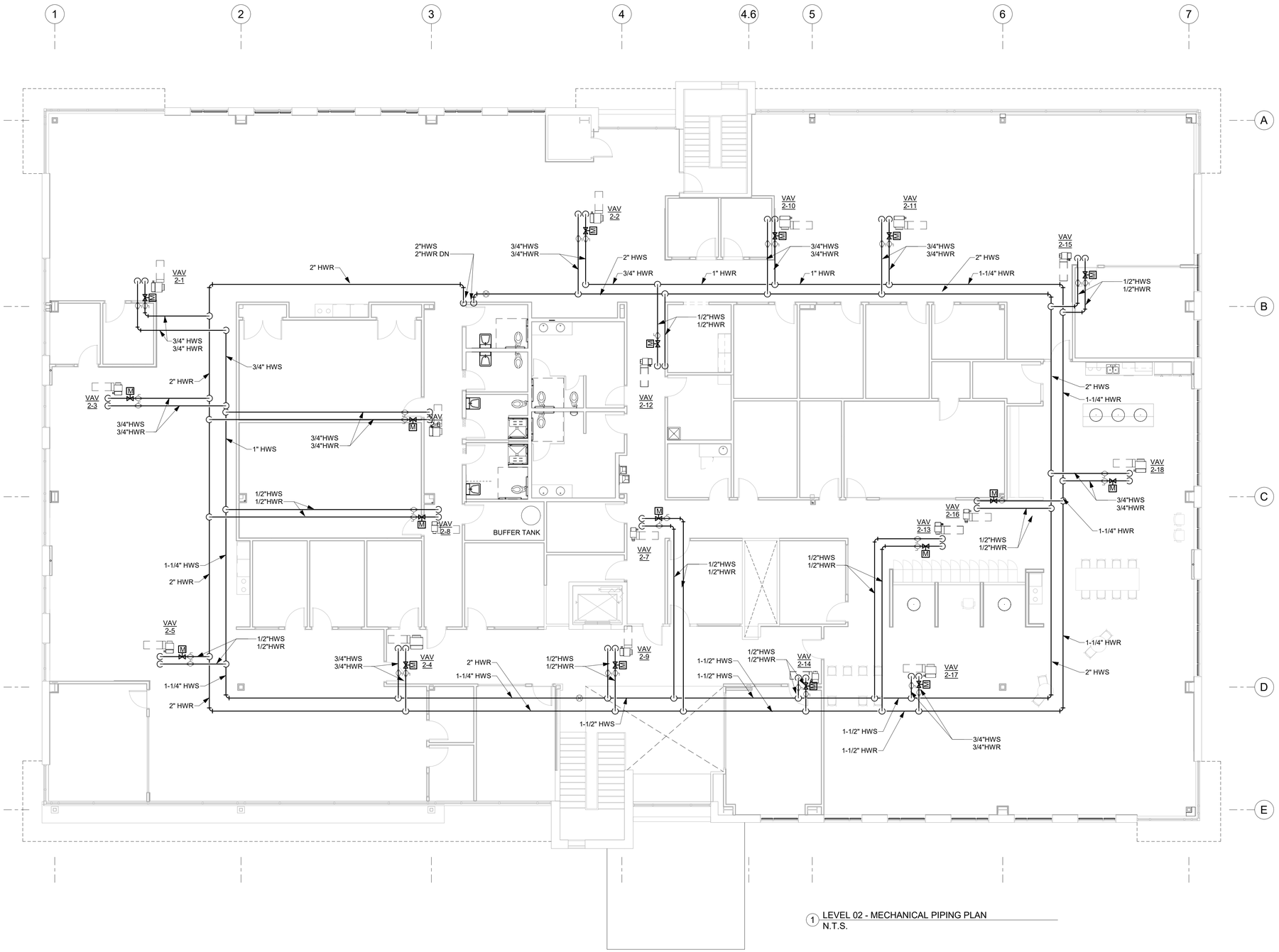
GENERAL NOTES:

1. AVOID CREATING HIGH POINTS IN HOT WATER PIPING WHENEVER POSSIBLE. PROVIDE AIR VENTS ON ALL HIGH POINTS.



1 LEVEL 02 - MECHANICAL PIPING PLAN
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PETER C. D'ANTONIO
33293
11/19/21
PROFESSIONAL ENGINEER

PROJECT:
SOUTHEAST COUNTY SERVICE HUB
1755 S. PUBLIC RD
LAFAYETTE, CO 80026

PROJECT NO: 2007

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LEVEL 02 - MECHANICAL PIPING PLAN

M-202

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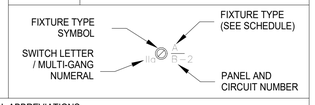
PROJECT DESCRIPTION

THIS PROJECT INVOLVES A MULTI-PHASE WORKPLACE IMPROVEMENT. AS FIRST PHASE, THERE WILL BE TENANT IMPROVEMENT ON LEVEL 01 AND 02 OF THIS CORE AND SHELL BUILDING. SPACES WILL INCLUDE WORKSPACES, CONFERENCE ROOMS, COLLABORATION AREAS, COMMON AREAS, STAFF KITCHEN, SUPPORT ROOMS AND STORAGE. THIS BUILDING WILL BE PURSUING LEED GOLD CERTIFICATION.

ELECTRICAL WORK INVOLVES PROVIDING POWER FOR REPLACED NEW VAV RTU UNIT, VAV BOXES, AND NEW GAS-FIRED BOILER. THERE WILL ALSO BE A ROOF-MOUNTED AIR-COOLED CHILLER. PROVIDE NEW POWER OUTLETS AS DIRECTED AND NEW LIGHTING AND CONTROLS LAYOUT PER NEW REFLECTED CEILING PLAN. THERE WILL ALSO BE A NEW BACKUP GENERATOR PROPOSED FOR THIS TENANT IMPROVEMENT.

ELECTRICAL LEGEND

SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
	PANELBOARD (NEW/EXISTING)		WALL MOUNTED EMERGENCY BATTERY BACK-UP
	NEW WORK UNDER THIS CONTRACT		CEILING MOUNTED EMERGENCY BATTERY BACK-UP
	WORK DEMOLISHED UNDER THIS CONTRACT		EXIT SIGN WITH DUAL FROG EYE
	WORK EXISTING TO REMAIN UNDER THIS CONTRACT		EXIT SIGN WITH DIRECTIONAL ARROWS HATCH INDICATES ILLUMINATED FACES, ARROWS INDICATE DIRECTIONS
	UNDERGROUND/FLOOR CIRCUIT	(S)	SMOKE DETECTOR (CEILING MOUNTED)
	WIREMOLD/PLUGMOLD (SURFACE RACEWAY)	(S) CO	SMOKE DETECTOR WITH CARBON MONOXIDE (CEILING MOUNTED)
	CONDUIT TURNS UP	OS	OCCUPANCY SENSOR - CEILING/WALL
	CONDUIT TURNS DOWN	VS	VACANCY SENSOR - CEILING/WALL
	ELECTRIC SERVICE METER	DS	DAYLIGHT SENSOR - CEILING/WALL
	JUNCTION BOX		
	MOTOR DEVICE		
	FUSED SAFETY DISCONNECT SWITCH		
	NON-FUSED SAFETY DISCONNECT SWITCH		
	RECEPTACLE - DUPLEX		
	RECEPTACLE - DUPLEX WITH ISOLATED GROUND		
	RECEPTACLE - DUPLEX WITH GFCI PROTECTION		
	RECEPTACLE - DUPLEX SPLIT WIRE		
	RECEPTACLE - QUADRAPLEX (DOUBLE DUPLEX)		
	RECEPTACLE - SPECIAL PURPOSE - SINGLE PHASE		
	RECEPTACLE - SPECIAL PURPOSE - THREE PHASE		
	RECEPTACLE - RANGE		
	RECEPTACLE - DUPLEX - FLOOR MOUNTED		
	RECEPTACLE - QUADRAPLEX - FLOOR MOUNTED		
	RECEPTACLE - SINGLE - CEILING MOUNTED		
	RECEPTACLE - DUPLEX - CEILING MOUNTED		
	RECEPTACLE - QUADRAPLEX - CEILING MOUNTED		
	DATA OUTLET		
	TELEPHONE OUTLET		
	COMBINATION DATA/TELE. OUTLET		
	TELEVISION OUTLET		



GENERAL ELECTRICAL ABBREVIATIONS

AC - ABOVE COUNTER
AFF - ABOVE FINISHED FLOOR
BAS - BUILDING AUTOMATION SYSTEM
BLDG - BUILDING
BMS - BUILDING MANAGEMENT SYSTEM
CR - CARD READER
D - DEMO EXISTING
E - EXISTING
EF - EXHAUST FAN
EM - EMERGENCY FIXTURE
EPO - EMERGENCY POWER OFF
EWC - ELECTRIC WATER COOLER
FACP - FIRE ALARM CONTROL PANEL
GFI - GROUND FAULT INTERRUPTER
GFCI - GROUND FAULT CIRCUIT INTERRUPTER
J - JUNCTION BOX
OS - OCCUPANCY SENSOR
TC - TIME CLOCK
TV - TELEVISION
VS - VACANCY SENSOR
XFMR - TRANSFORMER
WP - WEATHERPROOF

NOTE: NOT ALL SYMBOLS OR ABBREVIATIONS ON THIS LEGEND ARE NECESSARILY USED ON THIS PROJECT.

ELECTRICAL DRAWING INDEX

DRAWING NUMBER	DRAWING TITLE	ISSUE DATE - DESCRIPTION: 11/19/2021 - CD SET
E-001	ELECTRICAL LEGEND AND NOTES	●
E-002	ELECTRICAL ONE-LINE DIAGRAM	●
E-003	ELECTRICAL PANEL SCHEDULES	●
E-004	ELECTRICAL PANEL SCHEDULES	●
E-006	LUMINAIRE SCHEDULES	●
E-007	LUMINAIRE SCHEDULES & COMCHECKS	●
ED-101	LEVEL 01 - DEMO POWER FLOOR PLAN	●
ED-102	LEVEL 02 - DEMO POWER FLOOR PLAN	●
ED-111	LEVEL 01 - DEMO LIGHTING FLOOR PLAN	●
ED-112	LEVEL 02 - DEMO LIGHTING FLOOR PLAN	●
E-100	SITE ELECTRICAL PLAN	●
E-101	LEVEL 01 - POWER FLOOR PLAN	●
E-102	LEVEL 02 - POWER FLOOR PLAN	●
E-103	ROOF - ELECTRICAL PLAN	●
E-111	LEVEL 01 - LIGHTING FLOOR PLAN	●
E-112	LEVEL 02 - LIGHTING FLOOR PLAN	●

KEY:
● FULL SHEET ISSUE.
○ PARTIAL SHEET ISSUE (SKETCH).

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BUILDING CODE DATA

DISCIPLINE	CODE	EDITION
GENERAL	INTERNATIONAL BUILDING CODE	2015
HVAC / MECHANICAL	INTERNATIONAL MECHANICAL CODE	2015
PLUMBING	INTERNATIONAL PLUMBING CODE	2015
ELECTRICAL	NATIONAL ELECTRIC CODE	2020
FIRE PROTECTION	INTERNATIONAL FIRE CODE	2015
	NFPA STANDARDS	CURRENT
FUEL	INTERNATIONAL FUEL GAS CODE	2015
ENERGY	INTERNATIONAL ENERGY CONSERVATION CODE	2015
ACCESSIBILITY	ICC/ANSI A117.1	2009
LOCAL AMENDMENTS	BOULDER COUNTY BUILDING CODE AMENDMENTS	2017

NOTES:
A. ALL WORK PERFORMED SHALL COMPLY WITH THE REQUIREMENTS OF THE LISTED CODES, LOCAL CODE AMENDMENTS, AND REFERENCED STANDARDS AS ENFORCED BY THE AUTHORITY HAVING JURISDICTION (AHJ).
B. ALL WORK SUBJECT TO INSPECTION BY THE AHJ AT THE PROJECT SITE FOR COMPLIANCE.

ELECTRICAL GENERAL NOTES

1. THE ELECTRICAL CONTRACTOR SHALL VERIFY THAT ALL ELECTRICAL ITEMS TO REMAIN OR BE RELOCATED AND REUSED ARE IN WORKING ORDER PRIOR TO ANY DEMOLITION WORK. IF THE EXISTING MATERIAL IS FOUND TO BE INOPERABLE, CONTRACTOR SHALL INFORM THE OWNER. ONCE ANY DEMOLITION WORK HAS BEGUN, ANY INOPERABLE OR DAMAGED MATERIAL SHALL BE REPAIRED OR REPLACED AT THE CONTRACTOR'S EXPENSE.
2. VERIFICATION OF EXISTING CONDITIONS. "INASMUCH AS THE REMODELING AND/OR REHABILITATION OF THE EXISTING BUILDING REQUIRES THAT CERTAIN ASSUMPTIONS BE MADE REGARDING EXISTING CONDITIONS, AND BECAUSE SOME OF THESE ASSUMPTIONS MAY NOT BE VERIFIABLE WITHOUT DESTROYING OTHERWISE ADEQUATE OR SERVICEABLE PORTIONS OF THE BUILDING, THE GENERAL CONTRACTOR AGREES THAT, EXCEPT FOR NEGLIGENCE ON THE PART OF THE DESIGN PROFESSIONAL THE CONTRACTOR WILL HOLD HARMLESS, INDEMNIFY AND DEFEND THE DESIGN PROFESSIONAL FROM AND AGAINST ANY AND ALL CLAIMS ARISING OUT OF THE PROFESSIONAL SERVICES PROVIDED."
3. ANY ELECTRICAL ITEMS SHOWN OR NOT SHOWN ON THE PLANS, OR WHERE CIRCUITS IN EXISTING WALLS ARE REMOVED BY DEMOLITION, SHALL UPON COMPLETION OF REMODEL WORK BE LEFT IN WORKING CONDITION.
4. ALL PHASES OF THE ELECTRICAL WORK SHALL BE COORDINATED WITH THE ARCHITECT. WORK SHALL BE DONE IN A FASHION TO CAUSE AS LITTLE INCONVENIENCE AS POSSIBLE TO THE OWNER.
5. ELECTRICAL DEVICES NOTED TO BE REMOVED SHALL BE REMOVED BACK TO A POINT WHERE EXISTING CONDUIT CAN BE ABANDONED IN CONCEALED SPACES. REMOVE ALL WIRING FROM ABANDONED CONDUIT. ALL BOXES TO BE REMOVED SHALL BE TAKEN OUT OF WALLS AND HAVE HOLES REFINISHED TO MATCH WALL FINISH.
6. ELECTRICAL CONTRACTOR SHALL NOT DEFACE ANY AREAS OF THE BUILDING WHERE REMODELING IS NOT BEING DONE.
7. RACEWAYS: ALL CONDUIT SHALL BE CONCEALED WHEREVER POSSIBLE. CONDUIT SHALL NOT BE EXPOSED IN FINISHED AREAS (EXCLUDES MECHANICAL ROOMS, STORAGE CLOSETS, AND SIMILAR AREAS). EXPOSED RACEWAYS SHALL BE SURFACE RACEWAYS PER SPECIFICATIONS. RACEWAYS MAY BE THE FOLLOWING (SUBJECT TO NEC REQUIREMENTS); ELECTRICAL METALLIC TUBING, GALVANIZED POLYVINYL CHLORIDE CONDUIT, SCHEDULE 40.
8. CABLE ASSEMBLIES MAY BE THE FOLLOWING (SUBJECT TO NEC REQUIREMENTS): METALCLAD CABLE.
9. PROVIDE COMPLETE SYSTEMS OF CONDUCTORS AND RACEWAYS USING CONDUIT AND/OR CABLE ASSEMBLIES APPROPRIATE TO THE FUNCTION & LOCATION AND APPROVED PER NEC REQUIREMENTS. CONDUCTORS MUST BE DERATED PER CODE.
10. ROUTING OF EXISTING CONCEALED CONDUIT NOT KNOWN. LOCATION DETERMINED BY ELECTRICAL CONTRACTOR. ELECTRICAL CONTRACTOR SHALL RECIRCUIT AS NOTED UTILIZING ANY EXISTING CONDUIT. HE SHALL REMOVE EXISTING WIRE AND REPULL NEW. ALL NEW CONDUIT ADDED SHALL BE CONCEALED WHEREVER POSSIBLE.
11. SURFACE RACEWAY: WHEREVER CONCEALED CONDUIT IN FINISHED AREAS IS NOT POSSIBLE, ELECTRICAL CONTRACTOR SHALL INSTALL SURFACE MOUNTED RACEWAYS EQUAL TO WIREMOLD. RUN SURFACE RACEWAYS IN CORNER OF WALL AND CEILING. ALL RACEWAYS THAT ARE EXPOSED SHALL BE APPROVED BY ARCHITECT PRIOR TO ROUGH-IN.
12. TERMINATING AND SPLICING: MAKE ALL JOINTS AND SPLICES IN BRANCH CIRCUIT WIRING WITH APPROVED SOLDERLESS TOOL APPLIED OR TWIST-ON CONNECTORS, IN THE VARIOUS BOXES, GUTTERS, AND SIMILAR LOCATIONS, BUT NOT IN RACEWAYS. LEAVE SUFFICIENT SLACK TO PERMIT TWO (2) OR MORE SPLICES OR JOINTS TO BE REMADE IN CASE OF FAULT.
13. ELECTRICAL CONTRACTOR SHALL RECEIVE, FROM SYSTEM SUPPLIERS, ALL WIRING DIAGRAMS FOR ALL EQUIPMENT, PRIOR TO ANY ROUGH-IN, TO ASSURE PROPER ELECTRICAL CHARACTERISTICS ARE PROVIDED. ELECTRICAL CONTRACTOR SHALL PROVIDE ARCHITECT WRITTEN NOTIFICATION PRIOR TO ROUGH-IN, THAT ALL WIRING DIAGRAMS HAVE BEEN RECEIVED AND REVIEWED FOR CORRECTNESS. ANY INCORRECT WIRING OR DEVICES INSTALLED BY ELECTRICAL CONTRACTOR WITHOUT WIRING DIAGRAMS SHALL BE CORRECTED AT ELECTRICAL CONTRACTOR'S EXPENSE.
14. ELECTRICAL CONTRACTOR SHALL RECEIVE, FROM MECHANICAL CONTRACTOR, ALL WIRING DIAGRAMS AND SHOP DRAWINGS FOR ALL MECHANICAL EQUIPMENT, PRIOR TO ANY ROUGH-IN, TO ASSURE PROPER ELECTRICAL CHARACTERISTICS, VOLTAGE, PHASE, HORSEPOWER, AMPERE, KILOWATTS AND ETC. ARE PROVIDED. ELECTRICAL CONTRACTOR SHALL PROVIDE ARCHITECT WRITTEN NOTIFICATION PRIOR TO ANY ROUGH-IN, THAT ALL WIRING DIAGRAMS AND SHOP DRAWINGS HAVE BEEN RECEIVED AND REVIEWED FOR CORRECTNESS. ANY INCORRECT WIRING OR DEVICES INSTALLED BY ELECTRICALCONTRACTOR WITHOUT WIRING DIAGRAMS SHALL BE CORRECTED AT ELECTRICAL CONTRACTOR'S EXPENSE.
15. ALL EXISTING AND NEW SMOKE DETECTORS IN OR NEAR AREAS BEING REMODELED SHALL BE BAGGED OR REMOVED. IF REMOVED, STORE IN A SEALED BAG UNTIL ALL REMODELING WORK IS COMPLETE. IF SMOKE DETECTORS ARE NOT BAGGED OR REMOVED THEY SHALL BE REPLACED WITH NEW DETECTORS AT CONTRACTOR'S EXPENSE WHEN THE PROJECT IS COMPLETED.
16. PRIOR TO ROUGH-IN, THE ELECTRICAL CONTRACTOR SHALL VERIFY AND COORDINATE ALL ELECTRICAL DEVICE LOCATIONS WITH THE ARCHITECT OR OWNER.
17. ALL NEW ELECTRICAL ITEMS SHOWN ON EXISTING WALLS AND CEILINGS SHALL BE FLUSH MOUNTED UNLESS NOTED OTHERWISE. CUT AND PATCH EXISTING WALLS AND CEILINGS TO CONCEAL ALL MOUNTING BOXES AND CONDUITS.
18. RELOCATIONS: OWNER RESERVES THE RIGHT TO RELOCATE ANY ELECTRICAL DEVICE, UP TO A DISTANCE OF 12'-0", BEFORE INSTALLATION WITHOUT EXTRA CHARGE FROM ELECTRICAL CONTRACTOR.
19. CALL UTILITY COMPANIES (POWER, GAS, WATER, SEWER, TELEPHONE, CABLE TV, ETC.) IN ADVANCE BEFORE TRENCHING FOR THE MARKING OF THEIR UNDERGROUND UTILITIES. ALSO CONTRACTOR SHALL LOCATE ALL ON-SITE UTILITIES SUCH AS SECONDARY SERVICE FEEDERS, UNDERGROUND ELECTRICAL BRANCH CIRCUITS, SPRINKLER LINES, ETC. PRIOR TO TRENCHING. ANY CUT OR DAMAGED UNDERGROUND UTILITIES SHALL BE REPAIRED OR REPLACED AT CONTRACTOR'S EXPENSE.
20. EMT CONDUIT FITTINGS: IN DRY LOCATIONS ALL EMT COUPLERS AND CONNECTORS SHALL BE STEEL SET SCREW TYPE. DIE CAST FITTINGS SHALL NOT BE USED ON THIS PROJECT. IN DAMP/WET LOCATIONS, USE STEEL COMPRESSION GLAND TYPE COUPLERS AND CONNECTORS.
21. ACCESS PANELS REQUIRED BY THE ELECTRICAL CONTRACTOR SHALL BE PROVIDED BY THE ELECTRICAL BID CONTRACTOR, THEN TURNED OVER TO THE APPROPRIATE TRADE FOR INSTALLATION.
22. ELECTRICAL CONTRACTOR IS RESPONSIBLE TO COORDINATE WITH THE GENERAL CONTRACTOR TO OBTAIN ACTUAL ROOM NAMES AND NUMBERS, DESIGNATED BY THE OWNER/ARCHITECT AT THE COMPLETION OF THE PROJECT. ACTUAL ROOM NAMES AND NUMBERS SHALL BE USED ON ALL PANEL SCHEDULES, COMPUTER PROGRAMMING, GRAPHIC PLAQUES, SOUND SYSTEMS, TELEPHONE SYSTEMS, INTERCOMS, FIRE ALARMS, SECURITY SYSTEMS, CATV SYSTEMS AND SIMILAR.
23. CONTRACTOR SHALL NOT FASTEN, ATTACH OR HANG ANY MATERIAL FROM THE ROOF DECK. ALL CONDUITS, JUNCTION BOXES, FIXTURES, DEVICES AND EQUIPMENT SHALL BE HUNG FROM THE STRUCTURAL STEEL FRAME AND SHALL BE PLACED WITH A MINIMUM OF 1" CLEARANCE BELOW THE ROOF DECK. WIRING AND CONDUITS SHALL NOT BE PLACED WITHIN THE RIBS OF THE ROOF DECK. CONTRACTOR SHALL NOT LOOSEN, REMOVE OR CUT ANY ROOFING SYSTEM FASTENERS PROTRUDING THROUGH THE ROOF DECK.
24. SUPPORT CONDUIT AND EQUIPMENT FROM THE STRUCTURE TO PREVENT SAGGING, POCKETING, AND VIBRATION.
25. PROVIDE GALVANIZED STEEL JUNCTION AND OUTLET BOXES, EXCEPT AS INDICATED OTHERWISE. FOR WET LOCATIONS, PROVIDE A WEATHER-PROOF TYPE CAST BOX WITH GASKET AND CAST COVERPLATE. THROUGH THE WALL BOXES ARE NOT PERMITTED.
26. POWER CONDUCTORS SHALL BE COPPER, (STRANDED FOR NO. 8 AWG AND LARGER), WITH THE FOLLOWING INSULATION STANDARDS: THHN, THWN, XHHW (90C). THE CONDUCTORS SHALL BE APPLIED USING THE 75C RATING. ALUMINUM CONDUCTORS MAY BE SUBSTITUTED USING THE THE SAME CAPACITY OF THE COPPER CONDUCTORS SPECIFIED.
27. PROVIDE SPECIFICATION GRADE, IVORY COLORED DEVICES THROUGHOUT, UNLESS NOTED OTHERWISE ON THE PLANS. DEVICES SHALL BE HUBBELL. PLATES SHALL BE IVORY PLASTIC, WITH MATCHING SCREWS, UNLESS NOTED OTHERWISE. PROVIDE BLANK COVERPLATES FOR UNUSED OUTLETS. COVERPLATES FOR MULTI-GANG BOXES SHALL BE SIZED FOR THE BOX COVERED.
28. BRANCH CIRCUITS SHALL USE MINIMUM NO. 12 AWG WIRING. FOR DISTANCES EXCEEDING 75' FROM THE PANEL, PROVIDE MIN. 10 AWG WIRING. CONTROL WIRING SHALL USE MINIMUM NO. 14 AWG WIRING.
29. DO NOT INSTALL EXPOSED CONDUIT UNLESS APPROVED BY THE ARCHITECT.
30. RUN ALL CONDUIT PARALLEL AND PERPENDICULAR TO BUILDING LINES.
31. USE FLEXIBLE METALLIC CONDUIT FOR CONNECTIONS TO MOTORS, FIXTURES, OR OTHER EQUIPMENT WHERE VIBRATION IS PRESENT. PROVIDE SEALTITE FMC IN WET AREAS.
32. PROVIDE GROUND WIRE IN NON-METALLIC CONDUIT AND FLEXIBLE CONDUIT. GROUND WIRES SHALL BE INCREASED IN SIZE WHERE CIRCUIT WIRING IS INCREASED FOR VOLTAGE DROP.
33. PROVIDE A TYPED PANEL SCHEDULE FOR EACH PANEL, INSERTED IN A PLASTIC SLEEVE.

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a Bowman company

COLORADO REGISTERED PETER C. D'ANTONIO PROFESSIONAL ENGINEER
33293
11/19/21

SOUTHEAST COUNTY SERVICE HUB
1755 S. PUBLIC RD
LAFAYETTE, CO 80026

PROJECT:
PROJECT NO: 2007

#	ISSUE DATE	PHASE / REV NAME
	11/19/21	CONSTRUCTION DOCUMENTS

ELECTRICAL LEGEND AND NOTES

E-001

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FAULT CURRENT CALCULATIONS

MAXIMUM AVAILABLE FAULT CURRENT (Iaic)
Isc = (Iaic x M) ; M = 1 / (1 + F)
F (3Ø) = (1.73 x L x Iaic) / (C x N x Vp)
F (1Ø) = (2 x L x Iaic) / (C x N x Vp)

FAULT POINT	FAULT LOCATION	DISTANCE IN FEET (L)	PHASE	AL / CU	SIZE	# OF RUNS (N)	CONDUIT: MAG=1 NON-MAG=2	PRIMARY VOLT. (Vp)	SECONDARY VOLT. (Vs)	WIRE FACTOR (C)	XFMR SIZE (kVA)	XFMR IMPEDANCE (%Z)	UPSTREAM FAULT (Iaic)	FAULT VALUE (Isc)
1	UTILITY TRANSFORMER 750 kVA													**16900**
2	800A MAIN	15	3	AL	500	3	2	480		64173			16900	**16662**
3	70A ATS-1	20	3	CU	4	1	1	480		3806			16662	**12662**
4	PANEL 'HEM'	30	3	CU	4	1	1	480		3806			12662	**9309**
5	800A ATS-2	20	3	AL	500	3	1	480		56268			16662	**16314**
6	PANEL 'MDP'	20	3	AL	500	3	1	480		56268			16314	**15979**
7	PANEL 'H1'	20	3	AL	250	1	1	480		12122			15979	**14591**
8	150 kVA XFMR 'T1' - PRIMARY	15	3	AL	250	1	1	480		12122			14591	**13699**
9	150 kVA XFMR 'T1' - SECONDARY		3					480	208		150	3.00	13699	**9644**
10	PANEL 'L1A'	20	3	AL	250	1	1	208		12122			9644	**8516**
11	PANEL 'L1B'	20	3	AL	250	1	1	208		12122			9644	**8516**
12	PANEL 'H2'	25	3	AL	250	1	1	480		12122			15979	**14281**
13	150 kVA XFMR - PRIMARY	15	3	AL	250	1	1	480		12122			14281	**13425**
14	150 kVA XFMR - SECONDARY		3					480	208		150	3.00	13425	**9585**
15	PANEL 'L2A'	10	3	AL	250	1	1	208		12122			9585	**8993**
16	PANEL 'L2B'	10	3	AL	250	1	1	208		12122			9585	**8993**
17	DISC. FOR PV SYSTEM	40	3	AL	250	1	1	208		12122			15979	**11104**
18	RTU-1	160	3	CU	250	1	1	480		16483			15979	**10245**
19	ACC-1	80	3	CU	1/0	1	1	480		8925			15979	**10535**
20	(E)PANEL 'HH1'	20	3	AL	500	2	1	480		37512			15979	**15503**
21	(E)PANEL 'HH2'	20	3	AL	250	1	1	480		12122			15503	**14193**
22	(E)75 kVA XFMR - PRIMARY	10	3	CU	1	1	1	480		7293			15503	**14398**
23	(E)75 kVA XFMR - SECONDARY		3					480	208		75	3.00	14398	**5740**
24	(E)PANEL 'LH1'	10	3	AL	250	1	1	208		12122			5740	**5523**
25	(E)ELEVATOR	100	3	CU	1	1	1	480		7293			15503	**8773**

ELECTRICAL DEMAND LOAD SUMMARY
SOUTHEAST COUNTY SERVICES HUB - MDC
800A: 480/277V, 3-PHASE, 4-WIRE

LOAD DESCRIPTION	DEMAND LOAD PHASE A (VA)	DEMAND LOAD PHASE B (VA)	DEMAND LOAD PHASE C (VA)	TOTAL DEMAND PHASES (A,B,C) (VA)
PANEL 'H1'	16966	14466	12894	44326
PANEL 'L1A'	11191	13848	10911	35950
PANEL 'L1B'	8431	7424	7564	23418
PANEL 'H2'	15637	14289	14489	44414
PANEL 'L2A'	9235	7870	10678	27782
PANEL 'L2B'	13106	13606	12542	39254
PANEL 'HEM'	1250	1250	0	2500
RTU-1	62602	62602	62602	187806
ACC-1	40165	40165	40165	120495
(E)PANEL 'HH1'	37154	37912	28816	103882
TOTAL (VA)	215736	213431	200659	629826
			TOTAL AMPS @ 480V/3PH	757.91

FEEDER SCHEDULE

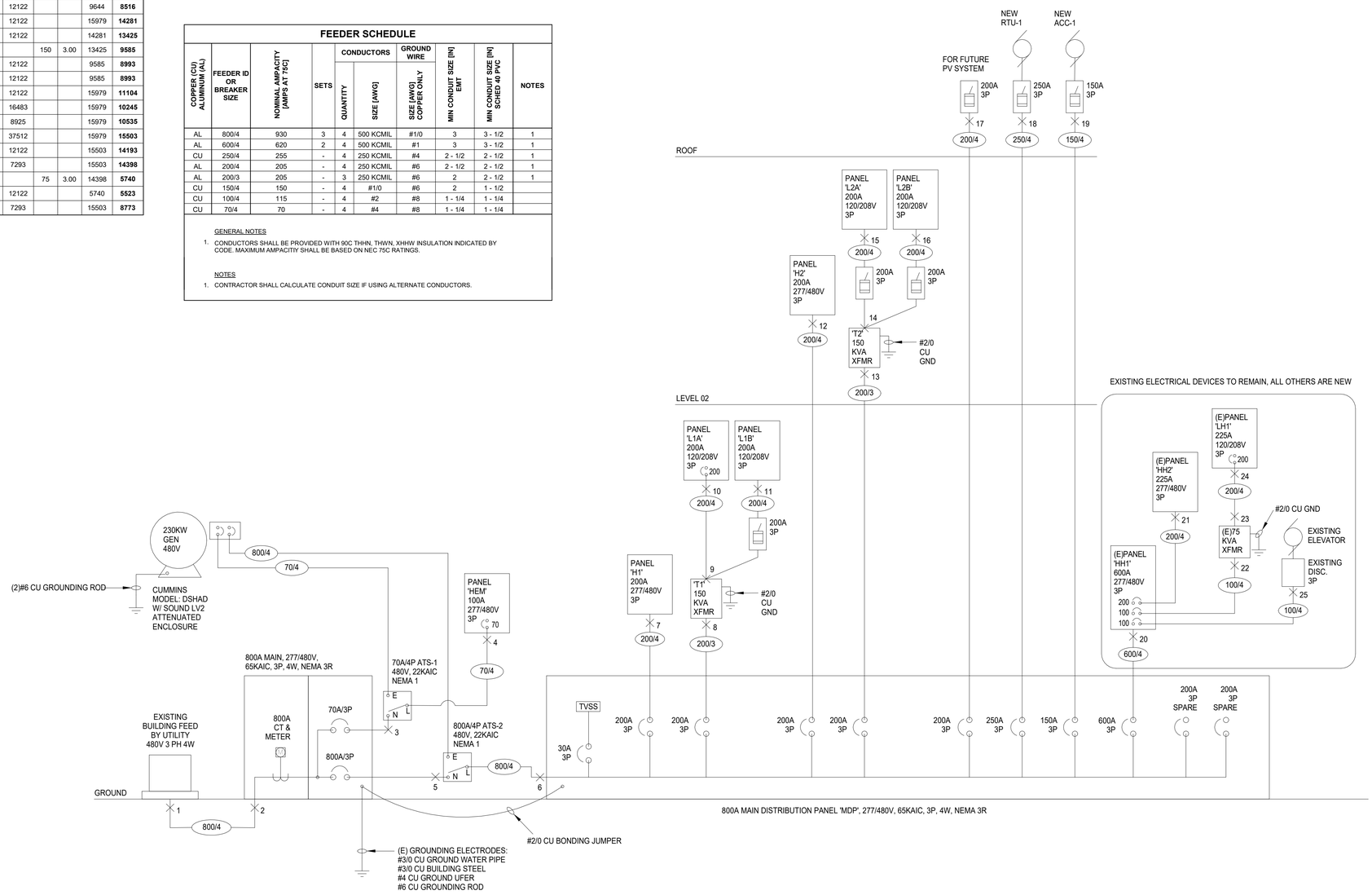
COPPER (CU) ALUMINUM (AL)	FEEDER ID OR BREAKER SIZE	NOMINAL AMPACITY [AMPS AT 75C]	SETS	CONDUCTORS		GROUND WIRE	MIN CONDUIT SIZE [IN] EMT	MIN CONDUIT SIZE [IN] SCHED 40 PVC	NOTES
				QUANTITY	SIZE [AWG]	SIZE [AWG] COPPER ONLY			
AL	800/4	930	3	4	500 KCMIL	#1/0	3	3 - 1/2	1
AL	600/4	620	2	4	500 KCMIL	#1	3	3 - 1/2	1
CU	250/4	255	-	4	250 KCMIL	#4	2 - 1/2	2 - 1/2	1
AL	200/4	205	-	4	250 KCMIL	#6	2 - 1/2	2 - 1/2	1
AL	200/3	205	-	3	250 KCMIL	#6	2	2 - 1/2	1
CU	150/4	150	-	4	#1/0	#6	2	1 - 1/2	
CU	100/4	115	-	4	#2	#8	1 - 1/4	1 - 1/4	
CU	70/4	70	-	4	#4	#8	1 - 1/4	1 - 1/4	

GENERAL NOTES

1. CONDUCTORS SHALL BE PROVIDED WITH 90C THHN, THWN, XHHW INSULATION INDICATED BY CODE. MAXIMUM AMPACITY SHALL BE BASED ON NEC 75C RATINGS.

NOTES

1. CONTRACTOR SHALL CALCULATE CONDUIT SIZE IF USING ALTERNATE CONDUCTORS.



ELECTRICAL ONE-LINE DIAGRAM
SCALE: NONE

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a Bowman company

COLORADO REGISTERED PETER C. D'ANTONIO PROFESSIONAL ENGINEER 33293 11/19/21

PROJECT:
SOUTHEAST COUNTY SERVICE HUB
1755 S. PUBLIC RD
LAFAYETTE, CO 80026

PROJECT NO: 2007

#	ISSUE DATE	PHASE / REV NAME
	11/19/21	CONSTRUCTION DOCUMENTS

ELECTRICAL ONE-LINE DIAGRAM

E-002

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PANEL HEM

Location : ELEC. CL 120
Supply From : 100A ATS
Mounting : SURFACE
Voltage Line-Line : 480
Voltage Line-Ground : 277
A.I.C Rating (A) : 14,000
Main Type : MLO

NEMA: 1
Phase: 3
Wires: 4
Main Rating (A): 100
MCB Rating (A): -

NOTES:
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Notes	LOAD DESCRIPTION	SIZE (A)	POLES	CKT No	VOLT-AMPS PER PHASE A	B	C	CKT No	SIZE (A)	POLES	LOAD DESCRIPTION	Notes
	SPARE	20	1	1	0	1000		2	20	1	EMERGENCY LIGHTING	
	SPARE	20	1	3		0	1000	4	20	1	EMERGENCY LIGHTING	
	SPARE	20	1	5			0 0	6			SPACE	
	SPARE	20	1	7	0 0			8			SPACE	
	SPARE	20	1	9		0	0	10			SPACE	
	SPARE	20	1	11			0 0	12			SPACE	
	SPARE	20	1	13	0 0			14			SPACE	
	SPARE	20	1	15		0	0	16			SPACE	
	SPARE	20	1	17			0 0	18			SPACE	
	SPARE	20	1	19	0 0			20			SPACE	
	SPARE	20	1	21		0	0	22			SPACE	
	SPARE	20	1	23			0 0	24			SPACE	
	SPARE	20	1	25	0 0			26			SPACE	
	SPARE	20	1	27		0	0	28			SPACE	
	SPARE	20	1	29			0 0	30			SPACE	
	SPARE	20	1	31	0 0			32			SPACE	
	SPARE	20	1	33		0	0	34			SPACE	
	SPARE	20	1	35			0 0	36			SPACE	
	SPARE	20	1	37	0 0			38			SPACE	
	SPARE	20	1	39		0	0	40			SPACE	
	SPARE	20	1	41			0 0	42			SPACE	
	Connected load per phase				1,000	1,000	0					

LOAD TYPE	FACTOR	CONNECTED (kVA) A	B	C	DEMAND (kVA) A	B	C	PANEL LEM A	B	C	TOTAL DEMAND (kVA)
Lighting load	1.25	1.0	1.0	0.0	1.3	1.3	0.0	0.0	0.0	0.0	2.5
Receptacle load (10 kVA or less)	1.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Receptacle load over 10 kVA	0.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Largest motor	1.25	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other motors	1.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Miscellaneous	1.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Kitchen Equipment	1.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	TOTAL KVA	1.0	1.0	0.0	1.3	1.3	0.0	0.0	0.0	0.0	2.5
	Total kVA per phase (kVA)				1.3	1.3	0.0				
	Total amps per phase (A)				5	5	0				

Minimum Panel Ampacity: 5 Amps

PANEL H2

Location : (E)ELEC. ROOM 223
Supply From : (E)MDC
Mounting : SURFACE
Voltage Line-Line : 480
Voltage Line-Ground : 277
A.I.C Rating (A) : 14,000
Main Type : MLO

NEMA: 1
Phase: 3
Wires: 4
Main Rating (A): 200
MCB Rating (A): -

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Notes	LOAD DESCRIPTION	SIZE (A)	POLES	CKT No	VOLT-AMPS PER PHASE A	B	C	CKT No	SIZE (A)	POLES	LOAD DESCRIPTION	Notes
	VAV 2-1	20	1	1	1773 2000			2	20	1	GENERAL LIGHTING	
	VAV 2-2	20	1	3		1773 2000		4	20	1	GENERAL LIGHTING	
	VAV 2-3	20	1	5			1773 2000	6	20	1	GENERAL LIGHTING	
	VAV 2-4	20	1	7	1773 2000			8	20	1	GENERAL LIGHTING	
	VAV 2-5	20	1	9		1773 0		10	20	1	SPARE	
	VAV 2-6	20	1	11			1773 200	12	20	1	LIGHTING CONTROL	
	VAV 2-7	20	1	13	1773 0			14	20	1	SPARE	
	VAV 2-8	20	1	15		1773 0		16	20	1	SPARE	
	VAV 2-9	20	1	17			1773 0	18	20	1	SPARE	
	VAV 2-10	20	1	19	1773 0			20	20	1	SPARE	
	VAV 2-11	20	1	21		1773 0		22	20	1	SPARE	
	VAV 2-12	20	1	23			1773 0	24	20	1	SPARE	
	VAV 2-13	20	1	25	1773 0			26			SPACE	
	VAV 2-14	20	1	27		1773 0		28			SPACE	
	VAV 2-15	20	1	29			1773 0	30			SPACE	
	VAV 2-16	20	1	31	1773 0			32			SPACE	
	VAV 2-17	20	1	33		1773 0		34			SPACE	
	VAV 2-18	20	1	35			1773 0	36			SPACE	
	SPARE	20	1	37	0 0			38			SPACE	
	HP-3-O	20	2	39		1152 0		40			SPACE	
	--	--	--	41			1152 0	42			SPACE	
	Connected load per phase				14,637	13,789	13,989					

LOAD TYPE	FACTOR	CONNECTED (kVA) A	B	C	DEMAND (kVA) A	B	C	ADD'L DEMAND A	B	C	TOTAL DEMAND (kVA)
Lighting load	1.25	4.0	2.0	2.0	5.0	2.5	2.5				10.0
Receptacle load (10 kVA or less)	1.00	0.0	0.0	0.2	0.0	0.0	0.2				0.2
Receptacle load over 10 kVA	0.50	0.0	0.0	0.0	0.0	0.0	0.0				0.0
Largest motor	1.25	0.0	0.0	0.0	0.0	0.0	0.0				0.0
Other motors	1.00	10.6	11.8	11.8	10.6	11.8	11.8				34.2
Miscellaneous	1.00	0.0	0.0	0.0	0.0	0.0	0.0				0.0
Kitchen Equipment	1.00	0.0	0.0	0.0	0.0	0.0	0.0				0.0
	TOTAL KVA	14.6	13.8	14.0	15.6	14.3	14.5				44.4
	Total kVA per phase (kVA)				15.6	14.3	14.5				
	Total amps per phase (A)				56	52	52				

Minimum Panel Ampacity: 57 Amps

PANEL H1

Location : (E)ELEC ROOM 119
Supply From : (E)MDC
Mounting : SURFACE
Voltage Line-Line : 480
Voltage Line-Ground : 277
A.I.C Rating (A) : 14,000
Main Type : MLO

NEMA: 1
Phase: 3
Wires: 4
Main Rating (A): 200
MCB Rating (A): -

NOTES:
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Notes	LOAD DESCRIPTION	SIZE (A)	POLES	CKT No	VOLT-AMPS PER PHASE A	B	C	CKT No	SIZE (A)	POLES	LOAD DESCRIPTION	Notes
	VAV 1-1	20	1	1	1773 2000			2	20	1	GENERAL LIGHTING	
	VAV 1-2	20	1	3		1773 2000		4	20	1	GENERAL LIGHTING	
	VAV 1-3	20	1	5			1773 2000	6	20	1	GENERAL LIGHTING	
	VAV 1-4	20	1	7	1773 2000			8	20	1	GENERAL LIGHTING	
	VAV 1-5	20	1	9		1773 0		10	20	1	SPARE	
	VAV 1-6	20	1	11			1773 200	12	20	1	LIGHTING CONTROL	
	VAV 1-7	20	1	13	1773 0			14	20	1	SPARE	
	VAV 1-8	20	1	15		1773 0		16	20	1	SPARE	
	VAV 1-9	20	1	17			1773 0	18	20	1	SPARE	
	VAV 1-10	20	1	19	1773 0			20	20	1	SPARE	
	VAV 1-11	20	1	21		1773 0		22	20	1	SPARE	
	VAV 1-12	20	1	23			1773 0	24	20	1	SPARE	
	VAV 1-13	20	1	25	1773 0			26			SPACE	
	VAV 1-14	20	1	27		1773 0		28			SPACE	
	VAV 1-15	20	1	29			1773 0	30			SPACE	
	VAV 1-16	20	1	31	1773 0			32			SPACE	
	VAV 1-17	20	1	33		1773 0		34			SPACE	
	SPARE	20	1	35			0 0	36			SPACE	
	P-3	20	3	37	1330 0			38			SPACE	
	--	--	--	39		1330 0		40			SPACE	
	--	--	--	41			1330 0	42			SPACE	
	Connected load per phase				15,966	13,966	12,394					

LOAD TYPE	FACTOR	CONNECTED (kVA) A	B	C	DEMAND (kVA) A	B	C	ADD'L DEMAND A	B	C	TOTAL DEMAND (kVA)
Lighting load	1.25	4.0	2.0	2.0	5.0	2.5	2.5				10.0
Receptacle load (10 kVA or less)	1.00	0.0	0.0	0.2	0.0	0.0	0.2				0.2
Receptacle load over 10 kVA	0.50	0.0	0.0	0.0	0.0	0.0	0.0				0.0
Largest motor	1.25	0.0	0.0	0.0	0.0	0.0	0.0				0.0
Other motors	1.00	12.0	12.0	10.2	12.0	12.0	10.2				34.1
Miscellaneous	1.00	0.0	0.0	0.0	0.0	0.0	0.0				0.0
Kitchen Equipment	1.00	0.0	0.0	0.0	0.0	0.0	0.0				0.0
	TOTAL KVA	16.0	14.0	12.4	17.0	14.5	12.9				44.3
	Total kVA per phase (kVA)				17.0	14.5	12.9				
	Total amps per phase (A)				61	52	47				

Minimum Panel Ampacity: 62 Amps

PANEL L2A

Location : (E)ELEC. ROOM 223
Supply From : 400A DISCONNECT
Mounting : SURFACE
Voltage Line-Line : 208
Voltage Line-Ground : 120
A.I.C Rating (A) : 10,000
Main Type : MLO

NEMA: 1
Phase: 3
Wires: 4
Main Rating (A): 200
MCB Rating (A): -

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Notes	LOAD DESCRIPTION	SIZE (A)	POLES	CKT No	VOLT-AMPS PER PHASE A	B	C	CKT No	SIZE (A)	POLES	LOAD DESCRIPTION	Notes
	P-6	20	2	1	750 900			2	20	1	OPEN OFFICE 222	
	--	--	--	3		750 900		4	20	1	OPEN OFFICE 206	
	HP-1-O	15	2	5			728 1300	6	20	1	PRINTER	
	--	--	--	7	728 900			8	20	1	FOCUS 220/221	
	HP-2-O	15	2	9		728 900		10	20	1	HALLWAY	
	--	--	--	11			728 900	12	20	1	FOCUS 224/225	
	SERVICE RECEPTS	20	1	13	540 900			14	20	1	OPEN OFFICE 226	
	SPARE	20	1	15		0 0		16	20	1	SPARE	
	HP-4-O	15	2	17			728 900	18	20	1	MEETING 227	
	--	--	--	19	728 900			20	20	1	BREAK AREA GFI	
	HP-5-O	15	2	21		728 1200		22	20	1	DISHWASHER	
	--	--	--	23			728 1127	24	20	1	GARBAGE DISPOSAL	
	CUBICAL POWER	20	1	25	1200 800			26	20	1	REFRIGERATOR	
	CUBICAL POWER	20	1	27		1200 800		28	20	1	REFRIGERATOR	
	CUBICAL POWER	20	1	29			1200 1500	30	20	1	MICROWAVE	
	CUBICAL POWER	20	1	31	1200 1500			32	20	1	MICROWAVE	
	CUBICAL POWER	20	1	33		1200 0		34	20	1	SPARE	
	CUBICAL POWER	20	1	35			1200 0	36	20	1	SPARE	
	CUBICAL POWER	20	1	37	1200 0			38	20	1	SPARE	
	CUBICAL POWER	20	1	39		1200 0		40	20	1	SPARE	
	CUBICAL POWER	20	1	41			1200 0	42	20	1	SPARE	
	SPARE	20	1	43	0 0			44	20	1	SPARE	
	SPARE	20	1	45		0 0		46	20	1	SPARE	
	SPARE	20	1	47			0 0	48	20	1	SPARE	
	SPARE	20	1	49	0 0			50	20	1	SPARE	
	SPARE	20	1	51		0 0		52	20	1	SPARE	
	SPARE	20	1	53			0 0	54	20	1	SPARE	
	SPARE	20	1	55	0 0			56	20	1	SPARE	
	SPARE	20	1	57		0 0		58	20	1	SPARE	
	SPARE	20	1	59			0 0	60	20	1	SPARE	
	Connected load per phase				12,246	9,606	12,239					

LOAD TYPE	FACTOR	CONNECTED (kVA) A	B	C	DEMAND (kVA) A	B	C	ADD'L DEMAND A	B	C	TOTAL DEMAND (kVA)
Lighting load	1.25	0.0	0.0	0.0	0.0	0.0	0.0				0.0
Receptacle load (10 kVA or less)	1.00	3.3	3.3	3.3	3.3	3.3	3.3				10.0
Receptacle load over 10 kVA	0.50	4.4	2.1	2.1	2.2	1.0	1.0				4.3
Largest motor	1.25	0.0	0.0	0.0	0.0	0.0	0.0				0.0
Other motors	1.00	2.2	2.2	4.0	2.2	2.2	4.0				8.5
Miscellaneous	1.00	0.0	0.0	1.3	0.0	0.0	1.3				1.3
Kitchen Equipment	0.65	2.3	2.0	1.5	1.5	1.3	1.0				3.8
	TOTAL KVA	12.2	9.6	12.2	9.2	7.9	10.7				27.8
	Total kVA per phase (kVA)				9.2	7.9	10.7				
	Total amps per phase (A)				77	66	89				

Minimum Panel Ampacity: 89 Amps

PANEL L1B

Location : ELEC STORAGE 144
Supply From : XFMR 'T1' VIA (E)MDC
Mounting : SURFACE
Voltage Line-Line : 208
Voltage Line-Ground : 120
A.I.C Rating (A) : 10,000
Main Type : MLO

NEMA: 1
Phase: 3
Wires: 4
Main Rating (A): 200
MCB Rating (A): -

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Notes	LOAD DESCRIPTION	SIZE (A)	POLES	CKT No	VOLT-AMPS PER PHASE A	B	C	CKT No	SIZE (A)	POLES	LOAD DESCRIPTION	Notes
	TRAINING ROOM 131	20	1	1	900 900			2	20	1	FACE 115	
	TRAINING ROOM 131	20	1	3		900 900		4	20	1	DESK AREA	
	TRAINING ROOM 132	20	1	5			900 900	6	20	1	DESK AREA	
	TRAINING ROOM 132	20	1	7	900 900			8	20	1	RESTROOM GFI	
	LARGE MEETING 133	20	1	9		900 720		10	20	1	PHONE	
	LARGE MEETING 133	20	1	11			900 900	12	20	1	CUBICAL POWER	
	HALL 145	20	1	13	900 900			14	20	1	CUBICAL POWER	
	JAN/REST GFI	20	1	15		900 900		16	20	1	CUBICAL POWER	
	AV CL IG	20	1	17			900 900	18	20	1	OFFICE 104/105	
	ELEC/FOCUS/WELLNESS	20	1	19	900 1200			20	20	1	COPIER	
	LAN RM	20	1	21		900 900		22	20	1	MAIN LOBBY	
	LAN RM	20	1	23			900 900	24	20	1	HALLWAY RECEPTS	
	FRONT DESK	20	1	25	900 1080			26	20	1	STORAGE 107	
	FRONT DESK	20	1	27		900 900		28	20	1	MAIN LOBBY	
	OPEN LOUNGE	20	1	29			900 0	30	20	1	SPARE	
	OPEN LOUNGE GFI	20	1	31	900 0			32	20	1	SPARE	
	HSS VISITATION 147	20	1	33		900 0		34	20	1	SPARE	
	HSS OBSERVATION 146	20	1	35			900 0	36	20	1	SPARE	
	RESTROOMS GFI	20	1	37	900 0			38	20	1	SPARE	
	FACILITIES OFFICE 149	20	1	39		900 0		40	20	1	SPARE	
	EWC-1	20	1	41			700 0	42	20	1	SPARE	
	GARBAGE DISPOSAL	20	1	43	1127 0			44	20	1	SPARE	
	DROPBOX/VESIBULE	20	1	45		900 0		46	20	1	SPARE	
	EWC-1	20	1	47			700 0	48	20	1	SPARE	
	SPARE	20	1	49	0 0			50	20	1	SPARE	
	SPARE	20	1	51		0 0		52	20	1	SPARE	
	SPARE	20	1	53			0 0	54	20	1	SPARE	
	SPARE	20	1	55	0 0			56	20	1	SPARE	
	SPARE	20	1	57		0 0		58	20	1	SPARE	
	SPARE	20	1	59			0 0	60	20	1	SPARE	
	Connected load per phase				12,407	11,520	10,400					

LOAD TYPE	FACTOR	CONNECTED (kVA) A	B	C	DEMAND (kVA) A	B	C	ADD'L DEMAND A	B	C	TOTAL DEMAND (kVA)
Lighting load	1.25	0.0	0.0	0.0	0.0	0.0	0.0				0.0
Receptacle load (10 kVA or less)	1.00	3.3	3.3	3.3	3.3	3.3	3.3				10.0
Receptacle load over 10 kVA	0.50	7.9	8.2	5.7	4.0	4.1	2.8				10.9
Largest motor	1.25	0.0	0.0	0.0	0.0	0.0	0.0				0.0
Other motors	1.00	0.0	0.0	0.0	0.0	0.0	0.0				0.0
Miscellaneous	1.00	0.0	0.0	1.4	0.0	0.0	1.4				1.4
Kitchen Equipment	1.00	1.1	0.0	0.0	1.1	0.0	0.0				1.1
	TOTAL KVA	12.4	11.5	10.4	8.4	7.4	7.6				23.4
	Total kVA per phase (kVA)				8.4	7.4	7.6				
	Total amps per phase (A)				70	62	63				

Minimum Panel Ampacity: 71 Amps

PANEL L1A

Location : (E)ELEC ROOM 119
Supply From : XFMR 'T1' VIA (E)MDC
Mounting : SURFACE
Voltage Line-Line : 208
Voltage Line-Ground : 120
A.I.C Rating (A) : 10,000
Main Type : MCB

NEMA: 1
Phase: 3
Wires: 4
Main Rating (A): 200
MCB Rating (A): 200

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Notes	LOAD DESCRIPTION	SIZE (A)	POLES	CKT No	VOLT-AMPS PER PHASE A	B	C	CKT No	SIZE (A)	POLES	LOAD DESCRIPTION	Notes
	P-1/P-2	20	1	1	394 900			2	20	1	OPEN OFFICE	
	P-4/P-5	20	2	3		1072 900		4	20	1	HSS OBSER. 128	
	--	--	--	5			1072 900	6	20	1	HSS VISITATION 126	
	B-1	20	1	7	1200 900			8	20	1	STORAGE 124	
	B-2	20	1	9		1200 900		10	20	1	BIKE/ELEC. CL	
	UH-1	20	2	11			998 900	12	20	1	FACE 117	
	--	--	--	13	998 900			14	20	1	OFFICE 116	
	UH-2	20	2	15		1498 900		16	20	1	FACE 111	
	--	--	--	17			1498 900	18	20	1	FLEX AREA 110	
	FIRE DAMPERS	20	1	19	400 900			20	20	1	TREASURER 112	
	RP-1	20	1	21		528 900		22	20	1	BENEFITS 113	
	WASHER	20	1	23			1500 900	24	20	1	ISSUANCE 114	
	DRYER	30	2	25	2500 360			26	20	1	HHS LAUNDRY 130	
				27		2500 1440		28	20	1	EXT. GFI RECEPTS	
	LAUNDRY/STORE	20	1	29			360 900	30	20	1	VISIT 125	
	HALL 129/MAIN LOBBY	20	1	31	900 900			32	20	1	FACE TO FACE 121	
	OPEN OFFICE BREAK	20	1	33		900 900		34	20	1	FACE 118	
	DISHWASHER	20	1	35			1200 900	36	20	1	FACE 115	
	MICROWAVE	20	1	37	1500 0			38	20	1	SPARE	
	GARBAGE DISPOSAL	20	1	39		1127 0		40	20	1	SPARE	
	REFRIGERATOR	20	1	41			800 0	42	20	1	SPARE	
	BREAK RM RECEPTS	20	1	43	360 0			44	20	1	SPARE	
	DWH-1	20	1	45		840 0		46	20	1	SPARE	
	SPARE	20	1	47			0 0	48	20	1	SPARE	
	SPARE	20	1	49	0 0			50	20	1	SPARE	
	SPARE	20	1	51		0 0		52	20	1	SPARE	
	SPARE	20	1	53			0 0	54	20	1	SPARE	
	SPARE	20	1	55	0 0			56	20	1	SPARE	
	SPARE	20	1	57		0 0		58	20	1	SPARE	
	SPARE	20	1	59			0 0	60	20	1	SPARE	
	Connected load per phase				13,112	15,604	12,828					

LOAD TYPE	FACTOR	CONNECTED (kVA) A	B	C	DEMAND (kVA) A	B	C	ADD'L DEMAND A	B	C	TOTAL DEMAND (kVA)
Lighting load	1.25	0.0	0.0	0.0	0.0	0.0	0.0				0.0
Receptacle load (10 kVA or less)	1.00	3.3	3.3	3.3	3.3	3.3	3.3				10.0
Receptacle load over 10 kVA	0.50	2.8	3.5	2.4	1.4	1.8	1.2				4.4
Largest motor	1.25	0.0	0.0	0.0	0.0	0.0	0.0				0.0
Other motors	1.00	0.4	2.7	2.6	0.4	2.7	2.6				5.7
Miscellaneous	1.00	5.1	6.0	2.5	5.1	6.0	2.5				13.6
Kitchen Equipment	0.65	1.5	0.0	2.0	1.0	0.0	1.3				2.3
	TOTAL KVA	13.1	15.6	12.8	11.2	13.8	10.9				35.9
	Total kVA per phase (kVA)				11.2	13.8	10.9				
	Total amps per phase (A)				93	115	91				

Minimum Panel Ampacity: 116 Amps

studiotrope
design collective
2942 Welton Street - Denver, CO 80205 - 303.308.1144 - www.studiotrope.com

pcd ENGINEERING
a Bowman company

COLORADO REGISTERED PETER C. D'ANTONIO 33293 11/19/21 PROFESSIONAL ENGINEER

PROJECT:
SOUTHEAST COUNTY SERVICE HUB
1755 S. PUBLIC RD
LAFAYETTE, CO 80026

PROJECT NO: 2007

ISSUE DATE	PHASE / REV NAME
11/19/21	CONSTRUCTION DOCUMENTS

ELECTRICAL PANEL SCHEDULES

E-003

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MECHANICAL/PLUMBING EQUIPMENT SCHEDULE

ITEM	DESCRIPTION	AREA/ EQUIPMENT SERVED	QTY	AMPS	VOLTS	PHASE	WATTS OR VA	MOP	DISC.	FEEDER	NOTES
ACC-1	AIR COOLED CHILLER	BUILDING	1	145.0	460	3	-	150	FRS-R-150	#1/0	
B-1	BOILER	MECH. ROOM	1	10.0	120	1	-	20	JJN-20	#12	
B-2	BOILER	MECH. ROOM	1	10.0	120	1	-	20	JJN-20	#12	
EF-1	EXHAUST FAN	STORAGE 124	1	-	120	1	62	20	TO SWITCH	#12	
HP-1-O	HEAT PUMP OUTDOOR UNIT	HP-1-I	1	7.0	208	1	-	15	FRN-R-15	#12	
HP-1-I	HEAT PUMP INDOOR UNIT	LAN RM 141	1	N/A	N/A	1	N/A	N/A	N/A	N/A	1
HP-2-O	HEAT PUMP OUTDOOR UNIT	HP-2-I	1	7.0	208	1	-	15	FRN-R-15	#12	
HP-2-I	HEAT PUMP INDOOR UNIT	LAN RM 236	1	N/A	N/A	1	N/A	N/A	N/A	N/A	1
HP-3-O	HEAT PUMP OUTDOOR UNIT	HP-3-I	1	7.0	208	1	-	15	FRN-R-15	#12	
HP-3-I	HEAT PUMP INDOOR UNIT	ELEV MECH RM	1	N/A	N/A	1	N/A	N/A	N/A	N/A	1
HP-4-O	HEAT PUMP OUTDOOR UNIT	HP-3-I	1	7.0	208	1	-	15	FRN-R-15	#12	
HP-4-I	HEAT PUMP INDOOR UNIT	ELEC RM 119	1	N/A	N/A	1	N/A	N/A	N/A	N/A	1
HP-5-O	HEAT PUMP OUTDOOR UNIT	HP-3-I	1	7.0	208	1	-	15	FRN-R-15	#12	
HP-5-I	HEAT PUMP INDOOR UNIT	ELEC RM 223	1	N/A	N/A	1	N/A	N/A	N/A	N/A	1
P-1	PUMP	BOILER (B-1)	1	-	120	1	197.0	20	TO SWITCH	#12	
P-2	PUMP	BOILER (B-2)	1	-	120	1	197.0	20	TO SWITCH	#12	
P-3	PUMP	HOT WATER (DWH-1)	1	4.8	460	1	-	20	FRS-R-20	#12	
P-4	PUMP	ROOF TOP UNIT (RTU-1)	1	-	208-230	1	1385.0	20	FRN-R-20	#12	
P-5	PUMP	VAV BOXES	1	-	208-230	1	758.0	20	FRN-R-20	#12	
P-6	PUMP	ACC-1	1	-	208-230	1	1500.0	20.0	FRN-R-20	#12	
RTU-1	ROOF TOP UNIT	ENTIRE BUILDING	1	227.0	460	3	-	250	FRS-R-250	250 MCM CU	
VAV 1-1	VARIABLE AIR VOLUME UNIT	SEE PLANS	1	6.4	277	1	-	15	TO SWITCH	#12	
VAV 1-2	VARIABLE AIR VOLUME UNIT	SEE PLANS	1	6.4	277	1	-	15	TO SWITCH	#12	
VAV 1-3	VARIABLE AIR VOLUME UNIT	SEE PLANS	1	6.4	277	1	-	15	TO SWITCH	#12	
VAV 1-4	VARIABLE AIR VOLUME UNIT	SEE PLANS	1	6.4	277	1	-	15	TO SWITCH	#12	
VAV 1-5	VARIABLE AIR VOLUME UNIT	SEE PLANS	1	6.4	277	1	-	15	TO SWITCH	#12	
VAV 1-6	VARIABLE AIR VOLUME UNIT	SEE PLANS	1	6.4	277	1	-	15	TO SWITCH	#12	
VAV 1-7	VARIABLE AIR VOLUME UNIT	SEE PLANS	1	6.4	277	1	-	15	TO SWITCH	#12	
VAV 1-8	VARIABLE AIR VOLUME UNIT	SEE PLANS	1	6.4	277	1	-	15	TO SWITCH	#12	
VAV 1-9	VARIABLE AIR VOLUME UNIT	SEE PLANS	1	6.4	277	1	-	15	TO SWITCH	#12	
VAV 1-10	VARIABLE AIR VOLUME UNIT	SEE PLANS	1	6.4	277	1	-	15	TO SWITCH	#12	
VAV 1-11	VARIABLE AIR VOLUME UNIT	SEE PLANS	1	6.4	277	1	-	15	TO SWITCH	#12	
VAV 1-12	VARIABLE AIR VOLUME UNIT	SEE PLANS	1	6.4	277	1	-	15	TO SWITCH	#12	
VAV 1-13	VARIABLE AIR VOLUME UNIT	SEE PLANS	1	6.4	277	1	-	15	TO SWITCH	#12	
VAV 1-14	VARIABLE AIR VOLUME UNIT	SEE PLANS	1	6.4	277	1	-	15	TO SWITCH	#12	
VAV 1-15	VARIABLE AIR VOLUME UNIT	SEE PLANS	1	6.4	277	1	-	15	TO SWITCH	#12	
VAV 1-16	VARIABLE AIR VOLUME UNIT	SEE PLANS	1	6.4	277	1	-	15	TO SWITCH	#12	
VAV 1-17	VARIABLE AIR VOLUME UNIT	SEE PLANS	1	6.4	277	1	-	15	TO SWITCH	#12	
VAV 2-1	VARIABLE AIR VOLUME UNIT	SEE PLANS	1	6.4	277	1	-	15	TO SWITCH	#12	
VAV 2-2	VARIABLE AIR VOLUME UNIT	SEE PLANS	1	6.4	277	1	-	15	TO SWITCH	#12	
VAV 2-3	VARIABLE AIR VOLUME UNIT	SEE PLANS	1	6.4	277	1	-	15	TO SWITCH	#12	
VAV 2-4	VARIABLE AIR VOLUME UNIT	SEE PLANS	1	6.4	277	1	-	15	TO SWITCH	#12	
VAV 2-5	VARIABLE AIR VOLUME UNIT	SEE PLANS	1	6.4	277	1	-	15	TO SWITCH	#12	
VAV 2-6	VARIABLE AIR VOLUME UNIT	SEE PLANS	1	6.4	277	1	-	15	TO SWITCH	#12	
VAV 2-7	VARIABLE AIR VOLUME UNIT	SEE PLANS	1	6.4	277	1	-	15	TO SWITCH	#12	
VAV 2-8	VARIABLE AIR VOLUME UNIT	SEE PLANS	1	6.4	277	1	-	15	TO SWITCH	#12	
VAV 2-9	VARIABLE AIR VOLUME UNIT	SEE PLANS	1	6.4	277	1	-	15	TO SWITCH	#12	
VAV 2-10	VARIABLE AIR VOLUME UNIT	SEE PLANS	1	6.4	277	1	-	15	TO SWITCH	#12	
VAV 2-11	VARIABLE AIR VOLUME UNIT	SEE PLANS	1	6.4	277	1	-	15	TO SWITCH	#12	
VAV 2-12	VARIABLE AIR VOLUME UNIT	SEE PLANS	1	6.4	277	1	-	15	TO SWITCH	#12	
VAV 2-13	VARIABLE AIR VOLUME UNIT	SEE PLANS	1	6.4	277	1	-	15	TO SWITCH	#12	
VAV 2-14	VARIABLE AIR VOLUME UNIT	SEE PLANS	1	6.4	277	1	-	15	TO SWITCH	#12	
VAV 2-15	VARIABLE AIR VOLUME UNIT	SEE PLANS	1	6.4	277	1	-	15	TO SWITCH	#12	
VAV 2-16	VARIABLE AIR VOLUME UNIT	SEE PLANS	1	6.4	277	1	-	15	TO SWITCH	#12	
VAV 2-17	VARIABLE AIR VOLUME UNIT	SEE PLANS	1	6.4	277	1	-	15	TO SWITCH	#12	
VAV 2-18	VARIABLE AIR VOLUME UNIT	SEE PLANS	1	6.4	277	1	-	15	TO SWITCH	#12	
UH-1	UNIT HEATER	VESTIBULE	1	9.7	208	1	-	20	JJN-20	#12	
UH-2	UNIT HEATER	STORAGE 124	1	12.5	120	1	-	20	JJN-20	#12	
UH-3	UNIT HEATER	STORAGE 123	1	12.5	120	1	-	20	JJN-20	#12	
EWC-1	ELEC. WATER COOLER	SEE PLANS	-	6.0	120	1	-	20	NEMA 5-20P	#12	2
LAV-1/2	LAVATORY	SEE PLANS	-	-	120	1	-	-	-	-	2
S-1	2-COMP SINK	SEE PLANS	-	-	120	1	-	-	-	-	2
UR-1	URINAL	SEE PLANS	-	-	120	1	-	-	-	-	2
WC-1/2/3	WATER CLOSET	SEE PLANS	-	-	120	1	-	-	-	-	2
DWH-1	DOMESTIC WATER HEATER	MECH 150	1	7.0	120	1	-	20	NEMA 5-20P	#12	2
RP-1	RECIRCULATING PUMP	DWH-1	1	4.4	120	1	-	20	NEMA 5-20P	#12	2

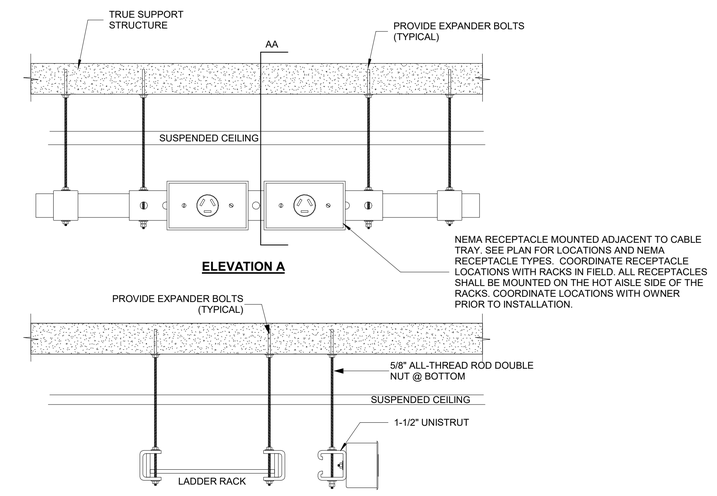
GENERAL NOTES

A. REFER TO VENDOR SHOP DRAWINGS FOR MORE DETAILS, CONFIRM FINAL POWER REQUIREMENTS AND LAYOUT PRIOR TO ANY NEW WORK.

B. MOUNTING HEIGHT IS CURRENTLY TBD.

DETAIL NOTES

1. INDOOR UNIT POWERED BY OUTDOOR UNIT. COORDINATE WITH VENDOR FOR EXACT POWER REQUIREMENTS AND LOCATION.
2. COORDINATE WITH PC FOR EXACT POWER REQUIREMENTS.



ELEVATION A

SECTION AA

1 SERVER ROOM RECEPTACLE MOUNTING DETAIL
N.T.S.

EXISTING PANEL HH1

Location : (E)ELECTRICAL 110
Supply From : (E)MDC
Mounting : SURFACE
Voltage Line-Line : 480
Voltage Line-Ground : 277
A.I.C Rating (A) : 22,000
Main Type : MLO
Main Rating (A): 600
MCB Rating (A): -

NOTES:
1. NEW WORK.
2.
3.
NEMA: 1
Phase: 3
Wires: 4
4.
5.
6.

Notes	LOAD DESCRIPTION	SIZE (A)	POLES	CKT No	VOLT-AMPS PER PHASE A	B	C	CKT No	SIZE (A)	POLES	LOAD DESCRIPTION	Notes
1	SPARE	30	3	1	0 2991			2	20	1	EWH-1	
1	--	--	--	3		0 2991		4	20	1	EWH-2	
1	--	--	--	5			0 2991	6	20	1	EWH-5	
1	SPARE	30	3	7	0 2991			8	20	1	EWH-6	
1	--	--	--	9		0 2991		10	20	1	EWH-4	
1	--	--	--	11			0 200	12	20	1	LIGHTING FOR GEN.	
1	SPARE	30	3	13	0 0			14			SPACE	
1	--	--	--	15		0 0		16			SPACE	
1	--	--	--	17			0 0	18			SPACE	
1	SPARE	30	3	19	0 0			20			SPACE	
1	--	--	--	21		0 0		22			SPACE	
1	--	--	--	23			0 0	24			SPACE	
1	SPARE	30	3	25	0 2991			26	3	200	PANEL HH2	
1	--	--	--	27		0 2991		28	--	--	--	
1	--	--	--	29			0 0	30	--	--	--	
1	SPARE	30	3	31	0 5528			32	3	100	75KVA XFMR	
1	--	--	--	33		0 5900		34	--	--	--	
1	--	--	--	35			0 3140	36	--	--	--	
	SPACE			37	0 22160			38	3	100	ELV DISCONNECT	
	SPACE			39		0 22160		40	--	--	--	
	SPACE			41			0 22160	42	--	--	--	
	Connected load per phase				36,661	37,033	28,491					

LOAD TYPE	FACTOR	CONNECTED (kVA) A	B	C	DEMAND (kVA) A	B	C	LH1 + HH2 A	B	C	TOTAL DEMAND (kVA)
Lighting load	1.25	0.0	0.0	0.2	0.0	0.0	0.3	2.5	4.4	1.4	8.5
Receptacle load (10 kVA or less)	1.00	0.0	0.0	0.0	0.0	0.0	0.0	2.6	2.4	1.5	6.5
Receptacle load over 10 kVA	0.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Largest motor	1.25	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other motors	1.00	22.2	22.2	22.2	22.2	22.2	22.2	0.0	0.0	0.0	66.5
Miscellaneous	1.00	6.0	6.0	3.0	6.0	6.0	3.0	4.0	3.0	0.5	22.4
Kitchen Equipment	1.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	TOTAL KVA	28.1	28.1	25.4	28.1	28.1	25.4	9.0	9.8	3.4	103.9
	Total kVA per phase (kVA)				37.2	37.9	28.8				
	Total amps per phase (A)				134	137	104				

Minimum Panel Ampacity: 137 Amps

EXISTING PANEL LH1

Location : (E)ELECTRICAL 110
Supply From : XFMR VIA (E)HH1
Mounting : SURFACE
Voltage Line-Line : 208
Voltage Line-Ground : 120
A.I.C Rating (A) : 10,000
Main Type : MCB
Main Rating (A): 225
MCB Rating (A): 200

NOTES:
1. NEW WORK.
2.
3.
NEMA: 1
Phase: 3
Wires: 4
4.
5.
6.

Notes	LOAD DESCRIPTION	SIZE (A)	POLES	CKT No	VOLT-AMPS PER PHASE A	B	C	CKT No	SIZE (A)	POLES	LOAD DESCRIPTION	Notes
	LTG - CORR. NITE LT/EM	20	1	1	533 1000			2	20	1	FACP	
	LTG - CORR.	20	1	3		640 1125		4	20	1	RCPTS - 1ST FLR CORR.	
	LTG - BOH STAIR	20	1	5			160 460	6	20	1	RCPTS - 1ST FLR BTRM	
	EXT. LTG - POLES	20	1	7	1000 360			8	20	1	RCPTS - DMARC	
	EXT. LTG - FACADE	20	1	9		625 180		10	20	1	RCPT - IRR. CTRL	
	LTG - TI 1ST FLR	20	1	11			440 720	12	20	1	RCPTS - TI 1ST FLR	
	LTG - TI 1ST FLR	20	1	13	400 720			14	20	1	RCPTS - TI 1ST FLR	
	LTG - TI 2ND FLR	20	1	15		1000 1080		16	20	1	RCPTS - TI 2ND FLR	
	SP-1	20	1	17			500 180	18	20	1	RCPT - MECH CTRLS	
	ELV RM - LTG & POWER	20	1	19	40 475			20	20	1	ELV. - PIT/SHAFT	
1	MONUMENT SIGN	20	1	21		1200 0		22	20	1	ELV. - LTG DISC.	
1	GEN. BATTERY	20	1	23			500 180	24	20	1	RCPTS - ROOF	
1	GEN. HEATER	20	1	25	1000 0			26			SPACE	
1	FLAG POLE LIGHT	20	1	27		50 0		28			SPACE	
	SPACE			29			0 0	30			SPACE	
	SPACE			31	0 0			32			SPACE	
	SPACE			33		0 0		34			SPACE	
	SPACE			35			0 0	36			SPACE	
	SPACE			37	0 0			38			SPACE	
	SPACE			39		0 0		40			SPACE	
	SPACE			41			0 0	42			SPACE	
	Connected load per phase				5,528	5,900	3,140					

LOAD TYPE	FACTOR	CONNECTED (kVA) A	B	C	DEMAND (kVA) A	B	C	ADD'L DEMAND A	B	C	TOTAL DEMAND (kVA)
Lighting load	1.25	2.0	3.5	1.1	2.5	4.4	1.4				8.2
Receptacle load (10 kVA or less)	1.00	2.6	2.4	1.5	2.6	2.4	1.5				6.5
Receptacle load over 10 kVA	0.50	0.0	0.0	0.0	0.0	0.0	0.0				0.0
Largest motor	1.25	0.0	0.0	0.0	0.0	0.0	0.0				0.0
Other motors	1.00	0.0	0.0	0.0	0.0	0.0	0.0				0.0
Miscellaneous	1.00	1.0	0.0	0.5	1.0	0.0	0.5				1.5
Kitchen Equipment	1.00	0.0	0.0	0.0	0.0	0.0	0.0				0.0
	TOTAL KVA	5.5	5.9	3.1	6.0	6.8	3.4				16.2
	Total kVA per phase (kVA)				6.0	6.8	3.4				
	Total amps per phase (A)				50	56	28				

Minimum Panel Ampacity: 57 Amps

PANEL L2B

Location : (E)ELEV MECH ROOM 212
Supply From : 400A DISCONNECT
Mounting : SURFACE
Voltage Line-Line : 208
Voltage Line-Ground : 120
A.I.C Rating (A) : 10,000
Main Type : MLO
Main Rating (A): 200
MCB Rating (A): -

NOTES:
1.
2.
NEMA: 1
Phase: 3
Wires: 4
3.
4.
5.
6.

Notes	LOAD DESCRIPTION	SIZE (A)	POLES	CKT No	VOLT-AMPS PER PHASE A	B	C	CKT No	SIZE (A)	POLES	LOAD DESCRIPTION	Notes
	P-4	20	2	1	693 900			2	20	1	HALL 233	
	--	--	--	3		693 900		4	20	1	COPY/STOR/WELLNESS	
	EF-1	20	1	5			528 900	6	20	1	COPIER	
	CUBICAL POWER	20	1	7	1200 900			8	20	1	OFFICE 230-231	
	CUBICAL POWER	20	1	9		1200 900		10	20	1	OFFICE/CONF	
	MEDIUM MEETING 205	20	1	11			900 900	12	20	1	STORAGE/SMALL	
	CUBICAL POWER	20	1	13	900 900			14	20	1	FACE 243	
	CUBICAL POWER	20	1	15		1200 900		16	20	1	MEDIUM MEETING 249	
	CUBICAL POWER	20	1	17			1200 900	18	20	1	LARGE MEETING 242	
	CUBICAL POWER	20	1	19	1200 900			20	20	1	LARGE MEETING 242	
	CARDIO RM	20	1	21		1200 900		22	20	1	STORAGE/FOCUS/ETC	
	WORKOUT RM	20	1	23			900 900	24	20	1	BREAK AREA	
	CSAP OFFICE	20	1	25	900 900			26	20	1	BREAK AREA	
	FACE 208-209	20	1	27		900 1200		28	20	1	CUBICAL POWER	
	HALL 210	20	1	29			900 1200	30	20	1	CUBICAL POWER	
	FOCUS 202-203	20	1	31	900 1200			32	20	1	CUBICAL POWER	
	MEDIUM MEETING 201	20	1	33		900 1200		34	20	1	CUBICAL POWER	
	RESTROOMS GFI	20	1	35			900 900	36	20	1	LOCKERS NEARBY	
	STOR/MEETING	20	1	37	900 700			38	20	1	EWC-1	
	LAN RM	20	1	39		900 900		40	20	1	ELEV MECH RM 212	
	LAN RM	20	1	41			900 1200	42	20	1	PRINTER	
	CARDIO RM	20	1	43	1500 1200			44	20	1	PRINTER	
	CARDIO RM	20	1	45		1500 1200		46	20	1	PRINTER	
	FITNESS RM	20	1	47			1500 0	48	20	1	SPARE	
	FITNESS RM	20	1	49	1500 0			50	20	1	SPARE	
	FITNESS RM	20	1	51		1500 900		52	20	1	BUSINESS CENTER 247	
	CARDIO RM	20	1	53			1500 900	54	20	1	FOCUSED HOTELING 204	
	SPARE	20	1	55	0 0			56	20	1	SPARE	
	SPARE	20	1	57		0 0		58	20	1	SPARE	
	SPARE	20	1	59			0 0	60	20	1	SPARE	
	Connected load per phase				17,293	18,993	17,028					

LOAD TYPE	FACTOR	CONNECTED (kVA) A	B	C	DEMAND (kVA) A	B	C	ADD'L DEMAND A	B	C	TOTAL DEMAND (kVA)
Lighting load	1.25	0.0	0.0	0.0	0.0	0.0	0.0				0.0
Receptacle load (10 kVA or less)	1.00	3.3	3.3	3.3	3.3	3.3	3.3				10.0
Receptacle load over 10 kVA	0.50	8.4	10.8	9.0	4.2	5.4	4.5				14.1
Largest motor	1.25	0.0	0.0	0.0	0.0	0.0	0.0				0.0
Other motors	1.00	0.7	0.7	0.5	0.7	0.7	0.5				1.9
Miscellaneous	1.00	4.9	4.2	4.2	4.9	4.2	4.2				13.3
Kitchen Equipment	1.00	0.0	0.0	0.0	0.0	0.0	0.0				0.0
	TOTAL KVA	17.3	19.0	17.0	13.1	13.6	12.5				39.3
	Total kVA per phase (kVA)				13.1	13.6	12.5				
	Total amps per phase (A)				109	113	105				

Minimum Panel Ampacity: 114 Amps

EXISTING PANEL HH2

Location : (E)ELECTRICAL 210
Supply From : (E)MDC
Mounting : SURFACE
Voltage Line-Line : 480
Voltage Line-Ground : 277
A.I.C Rating (A) : 22,000
Main Type : MLO
Main Rating (A): 225
MCB Rating (A): -

GENERAL NOTES:
1. CONFIRM AIC RATING OF EXISTING PANEL.

NOTES:
1. NEW WORK.
2.
3.
NEMA: 1
Phase: 3
Wires: 4
4.

Notes	LOAD DESCRIPTION	SIZE (A)	POLES	CKT No	VOLT-AMPS PER PHASE A	B	C	CKT No	SIZE (A)	POLES	LOAD DESCRIPTION	Notes
1	SPARE	30	3	1	0 2991			2	20	1	EWH-7	
1	--	--		3		0 2991		4	20	1	EWH-3	
1	--	--		5			0 0	6			SPACE	
1	SPARE	30	3	7	0 0			8			SPACE	
1	--	--		9		0 0		10			SPACE	
1	--	--		11			0 0	12			SPACE	
1	SPARE	30	3	13	0 0			14			SPACE	
1	--	--		15		0 0		16			SPACE	
1	--	--		17			0 0	18			SPACE	
1	SPARE	30	3	19	0 0			20			SPACE	
1	--	--		21		0 0		22			SPACE	
1	--	--		23			0 0	24			SPACE	
1	SPARE	30	3	25	0 0			26			SPACE	
1	--	--		27		0 0		28			SPACE	
1	--	--		29			0 0	30			SPACE	
1	SPARE	30	3	31	0 0			32			SPACE	
1	--	--		33		0 0		34			SPACE	
1	--	--		35			0 0	36			SPACE	
	SPACE			37	0 0			38			SPACE	
	SPACE			39		0 0		40			SPACE	
	SPACE			41			0 0	42			SPACE	
	Connected load per phase				2,991	2,991	0					

LOAD TYPE	FACTOR	CONNECTED (kVA) A	B	C	DEMAND (kVA) A	B	C	ADD'L DEMAND A	B	C	TOTAL DEMAND (kVA)
Lighting load	1.25	0.0	0.0	0.0	0.0	0.0	0.0				0.0
Receptacle load (10 kVA or less)	1.00	0.0	0.0	0.0	0.0	0.0	0.0				0.0
Receptacle load over 10 kVA	0.50	0.0	0.0	0.0	0.0	0.0	0.0				0.0
Largest motor	1.25	0.0	0.0	0.0	0.0	0.0	0.0				0.0
Other motors	1.00	0.0	0.0	0.0	0.0	0.0	0.0				0.0
Miscellaneous	1.00	3.0	3.0	0.0	3.0	3.0	0.0				6.0
Kitchen Equipment	1.00	0.0	0.0	0.0	0.0	0.0	0.0				0.0
	TOTAL KVA	3.0	3.0	0.0	3.0	3.0	0.0				6.0
	Total kVA per phase (kVA)				3.0	3.0	0.0				
	Total amps per phase (A)				11	11	0				

Minimum Panel Ampacity: 11 Amps

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pcd ENGINEERING a Bowman company

COLORADO REGISTERED PETER C. DANTON 33293 11/19/21 PROFESSIONAL ENGINEER

PROJECT: SOUTHEAST COUNTY SERVICE HUB
1755 S. PUBLIC RD
LAFAYETTE, CO 80026

PROJECT NO: 2007

#	ISSUE DATE	PHASE / REV NAME
	11/19/21	CONSTRUCTION DOCUMENTS

ELECTRICAL PANEL SCHEDULES

E-004

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11/19/2021 10:23:27 AM

LIGHTING CONTROL SCHEDULE

APPLICABLE ENERGY CODE = 2015 IECC

TYPE	SPACE DESCRIPTION	ON	OFF	SENSOR	TIMING	DIMMING	DAYLIGHT	DAYLIGHT SETTINGS	EM	INTERFACE	NOTES
		M = MANUAL(SWITCH) A = AUTOMATIC (SENSOR) T = TIME SCHEDULE P = PHOTOCELL		C = CEILING W = WALL CR = CORNER SI = SENSOR INTEGRAL TO WALL SWITCH SL = SENSOR INTEGRAL TO LUMINAIRE PIR = PIR SENSOR DT = DUAL TECH SENSOR US = ULTRASONIC SENSOR		0-10V, ELV, MLV, DALI, DMX	INT = INTERIOR DIMMING PHOTOSENSOR EXT = EXTERIOR PHOTOCELL INPUT LUM = PHOTOSENSOR INEGRAL TO LUMINAIRE(S)		ALCR = AUTOMATIC LOAD CONTROL RELAYS FOR LUMINAIRES ON EMERGENCY CIRCUIT (NOTE: TEST SWITCH IF NOT INTEGRAL TO RELAY	N = TIE TO CENTRAL NETWORK BAS = TIE TO BAS AV = EMABLE SCENE CONTROL VIA AV SYSTEM	
LC0b	EXTERIOR - BUILDING MOUNTS	P	T		ON = DUSK OFF = DAWN		EXT		ALCR	N	1
LC1a	CORRIDOR	T	T		ON = 6:00 AM OFF = 8:00 PM	0-10V			ALCR	N	3
LC1b	STAIR - ENCLOSED (EXISTING LTG)	A	A	LI	5 MIN	0-10V					4
LC2a	LOBBY	T	T		ON=6:00AM OFF=8:00PM	0-10v	INT		ALCR	N	3
LC2b	RESTROOM - MULTI	A	A	C DT	20 MIN				ALCR		
LC2c	RESTROOM - SINGLE	A	A	SI	5 MIN						
LC3a	MECHANICAL, ELECTRICAL, IT SPACES	M	M								
LC3b	STORAGE - LARGE	M	A	C PIR	5 MIN						
LC3c	STORAGE - SMALL, JANITOR, ETC	M	A	SI	5 MIN						
LC4a	OFFICE - PRIVATE HHS VISITATION, HHS OBSERVATION, FRONT DESK	M	A	SI OR C DT	10 MIN	0-10V					
LC4b	OFFICE - OPEN OFFICE	T	T		ON=6:00AM OFF=8:00PM	0-10V			ALCR	N	3
LC4c	OFFICE - OPEN AREA W/ DAYLIGHTING OPEN OFFICE 226, FOCUS HOTELING 204	T	T		ON=6:00AM OFF=8:00PM	0-10V	INT	ON AT 30FC OFF AT 40FC	ALCR	N	3
LC4d	WORKSPACE, CARDIO, WORKOUT	M	A	C DT	15 MIN	0-10V					
LC5a	CONFERENCE, MEETING	M	A	C DT	10 MIN	0-10V					
LC5b	BREAK AREA	M	A	C DT	10 MIN	0-10V			ALCR		
LC5c	TRAINING ROOMS	M	A	C DT	10 MIN	0-10V			ALCR	AV	2
LC5d	LARGE MEETING ROOM W/ DAYLIGHTING	M	A	C DT	10 MIN	0-10V	INT	ON AT 30FC OFF AT 40FC		AV	2
LC5e	OPEN LOUNGE 134 W/ DAYLIGHTING	M	A	C DT	10 MIN	0-10V	INT	ON AT 30FC OFF AT 40FC			

GENERAL NOTES:

A. LIGHTING CONTROL SYSTEM SHALL BE WATTSTOPPER, NO SUBSTITUTIONS. PROVIDE ALL REQUIRED COMPONENTS, ACCESSORIES, AND CONNECTIONS TO ACCOMPLISH DESIGN INTENT, AND PROVIDE A COMPLETE AND OPERATIONAL LIGHTING CONTROL SYSTEM.

B. SUBMITTALS SHALL INCLUDE FLOOR PLANS SHOWING ALL DEVICE LAYOUTS, AS WELL AS WIRING DIAGRAMS, CUT SHEETS, ETC.. INDICATE DAYLIGHT ZONES AND OVERRIDE SWITCH ZONES ON SHOP DRAWINGS. SHOP DRAWINGS SUBMITTED WITHOUT FLOOR PLAN LAYOUTS WILL BE RETURNED WITHOUT REVIEW.

C. PROVIDE ALL DEVICES AND ACCESSORIES FROM A SINGLE MANUFACTURER WHENEVER POSSIBLE.

D. NOT ALL SPACE NAMES MAY BE LISTED FOR EACH LIGHTING CONTROL TYPE. REFER TO PLANS FOR ALL SPACES TO BE CONTROLLED.

E. SPACES MAY CONTAIN MULTIPLE ZONES OF CONTROL. REFER TO PLANS FOR ADDITIONAL INFORMATION.

F. LOCATIONS OF OCCUPANCY AND DAYLIGHT SENSORS ON PLANS ARE DIAGRAMMATIC. FINAL LOCATION OF SENSORS SHALL BE PER MANUFACTURER'S SHOP DRAWINGS. MANUFACTURER SHALL REVIEW AND REVISE LOCATIONS AS REQUIRED FOR PROPOSED PRODUCTS. CONTRACTOR AND MANUFACTURER SHALL BE RESPONSIBLE TO RECONFIGURE AND ADJUST COMPONENTS IN FIELD WHERE CONTROL SYSTEM DESIGN INTENT IS NOT MET.

G. CONTRACTOR SHALL COORDINATE AND VERIFY DIMMING COMPATIBILITY OF THE PROPOSED CONTROLS AND LUMINAIRES TO ENSURE THAT LUMINAIRES CAN MEET THE SPECIFIED DIMMING RANGE. ALL LUMINAIRES SHALL BE CAPABLE OF DIMMING TO OFF.

H. PROVIDE CONTROL SYSTEM WITH 20% SPARE CAPACITY, RELAYS, ETC.

NOTES:

1. BOTH EXISTING AND NEW BUILDING MOUNT EXTERIOR LIGHTING SHALL BE CONTROLLED BY LIGHTING CONTROL PANEL. EXTERIOR BUILDING MOUNT LIGHTING PROVIDES EGRESS LIGHTING.
2. PROVIDE INTEGRATED DIMMING CONTROL SYSTEM IN TRAINING ROOMS AND LARGE MEETING ROOM WITH TOUCHSCREEEN CONTROL STATIONS IN EACH PARTITIONED SPACE AS INDICATED. SYSTEM SHALL BE CAPABLE OF AUTOMATIC COORDINATION OF LIGHTING CONTROL BASED UPON PARTITION SENSOR INPUT, AND AV INTEGRATION. EXTENT OF AV INTEGRATION TO BE DETERMINED.
3. PROVIDE QUANTITY OF OVERRIDE SWITCHES SUCH THAT AREA CONTROLLED IS NO MORE THAN 5000 SF.
4. EXISTING LIGHTING AND INTEGRAL OCCUPANCY SENSOR CONTROL TO REMAIN IN EXISTING STAIR.

INTERIOR LUMINAIRE SCHEDULE

ALL LED LAMPS TO BE 3500K COLOR TEMPERATURE AND MINIMUM 80CRI, UNLESS NOTED OTHERWISE.

TYPE	LAMP	LAMP LUMENS	DIMMING	VOLT	FINISH	MOUNTING	DESCRIPTION	MFR	MODEL	VA	NOTES
A (E)	LED			UNV		SURFACE OR CHAIN	EXISTING (E) 4' LED STRIP LIGHT TO REMAIN			53	
A (RL)	LED			UNV		SURFACE OR CHAIN	RELOCATED 4' LED STRIP LIGHT			53	
B/EM (E)	LED			UNV		WALL	EXISTING (E) 4' LED LINEAR WALL MOUNT LIGHT TO REMAIN IN STAIRS, INTEGRAL OCCUPANCY SENSOR			50	
D4	LED	764	1% 0-10V	UNV	SOFTGLOW CLEAR, WHITE FLANGE	RECESS	4" SQUARE LED DOWNLIGHT,80 CRI, MEDIUM DISTRIBUTION	PRESCOLITE LITEISTRY (NO SUBSTITUTION)	LTR-4SQD-H-SL-06L-DM1 / LTR-4SQD-T-SL-35K-8-MD-VS-WT	8	
D4A	LED	764	1% 0-10V	UNV	SOFTGLOW CLEAR, FLANGE COLOR TBD	RECESS	4" SQUARE LED SURFACE DOWNLIGHT,80 CRI, WIDE DISTRIBUTION	PRESCOLITE LITEISTRY (NO SUBSTITUTION)	LTR-4SQD-H-SL-06L-DM1 / LTR-4SQD-T-SL-35K-8-WD-VS-TBD	8	
D4W	LED	764	1% 0-10V	UNV	SOFTGLOW CLEAR, WHITE FLANGE	RECESS	4" SQUARE LED DOWNLIGHT,80 CRI, MEDIUM DISTRIBUTION, WET LOCATION, SHOWER TRIM	PRESCOLITE LITEISTRY (NO SUBSTITUTION)	LTR-4SQD-H-SL-06L-DM1 / LTR-4SQD-T-SL-35K-8-MD-VS-WT	8	
D/EM (E)	LED			UNV	WHITE TRIM	RECESS	EXISTING (E) 4" SQUARE LED DOWNLIGHT TO REMAIN, 3000K, (AT STAIR & VESTIBULE)			20	
DS1	LED	2000	1% 0-10V	UNV	SURFACE FINISH TBD REFLECTOR FINISH TBD	SURFACE	2' 3" DIA x 3 11/32" H LED SURFACE DECORATIVE LIGHT, SATIN ACRYLIC GLASS DIFFUSER, DIRECT /INDIRECT LIGHT DISTRIBUTION PROVIDE COLOR SAMPLE CHIPS TO ARCHITECT.	LIGHTART BEAM ME UP JR.	1M-X3-O-TBD-D-835-M-D700-TBD	29	
DW4	LED	764	1% 0-10V	UNV	SOFTGLOW CLEAR, WHITE FLANGE	RECESS	4' SQUARE LED WALL WASH, LENSED	PRESCOLITE LITEISTRY (NO SUBSTITUTION)	LTR-4SQD-H-SL-6L-DM1 / LTR-4SQW-T-SL-35K-9-LWW-VS-WT	8	
G (E)	LED			UNV	EXISTING	PENDANT, CORD	EXISTING (E) DECORATIVE PENDANT IN LOBBY				
LP44	LED	350L/FT UP, 350L/FT DOWN	1% 0-10V	UNV	WHITE	PENDANT, AC CABLES	4' x 4' SQUARE "RING" LED PENDANT, DIRECT AND INDIRECT OUTPUT, SPOTLESS LENS, ALUMINUM HOUSING	AXIS BEAM 2 PINNACLE EDGE (NO SUBSTITUTION)	TB2DILEDPAT-S(4)-350-350-80-35-SO-SO-W-UNV- DP-1-AC CABLE FROM STRUCTURE	96	
LP64	LED	350L/FT UP, 350L/FT DOWN	1% 0-10V	UNV	WHITE	PENDANT, AC CABLES	4' x 6' RECTALINEAR "RING" LED PENDANT, DIRECT AND INDIRECT OUPUT, SPOTLESS LENS, ALUMINUM HOUSING	AXIS BEAM 2 PINNACLE EDGE (NO SUBSTITUTION)	TB2DILEDPAT-R(4X6)-350-350-80-35-SO-SO-W-UNV- DP-1-AC CABLE FROM STRUCTURE	120	
LR3	LED	500L/FT DOWN	1% 0-10V	UNV	WHITE	RECESS	3' LED RECESS LED LINEAR LIGHT, SPOTLESS LENS,	AXIS BEAM 2 PINNACLE EDGE (NO SUBSTITUTION)	BRLED-500-90-35-XXX-SO-3-W-UNV-DP-1-AS REQUIRED	15	
LR4	LED	500L/FT DOWN	1% 0-10V	UNV	WHITE	RECESS	SIMILAR TO LR3, WITH 4' L	AXIS BEAM 2 PINNACLE EDGE (NO SUBSTITUTION)	BRLED-500-90-35-XXX-SO-4-W-UNV-DP-1-AS REQUIRED	20	
LR5	LED	500L/FT DOWN	1% 0-10V	UNV	WHITE	RECESS	SIMILAR TO LR3, WITH 5' L	AXIS BEAM 2 PINNACLE EDGE (NO SUBSTITUTION)	BRLED-500-90-35-XXX-SO-5-W-UNV-DP-1-AS REQUIRED	25	
LR6	LED	500L/FT DOWN	1% 0-10V	UNV	WHITE	RECESS	SIMILAR TO LR3, WITH 6' L	AXIS BEAM 2 PINNACLE EDGE (NO SUBSTITUTION)	BRLED-500-90-35-XXX-SO-6-W-UNV-DP-1-AS REQUIRED	30	
LR8	LED	500L/FT DOWN	1% 0-10V	UNV	WHITE	RECESS	SIMILAR TO LR3, WITH 8' L	AXIS BEAM 2 PINNACLE EDGE (NO SUBSTITUTION)	BRLED-500-90-35-XXX-SO-8-W-UNV-DP-1-AS REQUIRED	40	
LR9	LED	500L/FT DOWN	1% 0-10V	UNV	WHITE	RECESS	SIMILAR TO LR3, WITH 9' L	AXIS BEAM 2 PINNACLE EDGE (NO SUBSTITUTION)	BRLED-500-90-35-XXX-SO-9-W-UNV-DP-1-AS REQUIRED	45	
LR10	LED	500L/FT DOWN	1% 0-10V	UNV	WHITE	RECESS	SIMILAR TO LR3, WITH 10' L	AXIS BEAM 2 PINNACLE EDGE (NO SUBSTITUTION)	BRLED-500-90-35-XXX-SO-10-W-UNV-DP-1-AS REQUIRED	50	
LR11	LED	500L/FT DOWN	1% 0-10V	UNV	WHITE	RECESS	SIMILAR TO LR3, WITH 11' L	AXIS BEAM 2 PINNACLE EDGE (NO SUBSTITUTION)	BRLED-500-90-35-XXX-SO-11-W-UNV-DP-1-AS REQUIRED	55	
LR12	LED	500L/FT DOWN	1% 0-10V	UNV	WHITE	RECESS	SIMILAR TO LR3, WITH 12' L	AXIS BEAM 2 PINNACLE EDGE (NO SUBSTITUTION)	BRLED-500-90-35-XXX-SO-12-W-UNV-DP-1-AS REQUIRED	60	
LR13	LED	500L/FT DOWN	1% 0-10V	UNV	WHITE	RECESS	SIMILAR TO LR3, WITH 13' L	AXIS BEAM 2 PINNACLE EDGE (NO SUBSTITUTION)	BRLED-500-90-35-XXX-SO-13-W-UNV-DP-1-AS REQUIRED	65	
LR14	LED	500L/FT DOWN	1% 0-10V	UNV	WHITE	RECESS	SIMILAR TO LR3, WITH 14' L	AXIS BEAM 2 PINNACLE EDGE (NO SUBSTITUTION)	BRLED-500-90-35-XXX-SO-14-W-UNV-DP-1-AS REQUIRED	70	
LR22	LED	3800L	1% 0-10V	UNV	WHITE	RECESS	2' x 2' RECESSED LED SQUARE "RING" SHAPE, EXTRUDED ALUMINUM HOUSING, CRYSTAL GLASS OPTICS	AXIS SKYEPOOL	SKPO-22-3800-80-35-FL-W-UNV-DP-1-AS REQUIRED	39	
P2	LED	1044	1% 0-10V	120	TBD	PENDANT, AC CABLE	22" DIA x 11" H LED DECORATIVE PENDANT, 65% RECYCLED RESIN, INTEGRAL LED, FLOOD OPTICS (NOOKS)	3FORM LIGHTART COIL PENDANT D1	COL-COIL-PEND-D1-TBD-835CK-1000LM-FL-PCE-LV01-STD-TBD-TBD	9.5	
P8	LED	700L UP / 1300L DN	1% 0-10V	UNV	WHITE	PENDANT, AC CABLES	6" DIA. UP/DOWN PENDANT MOUNT DECORATIVE CYLINDER, WHITE CORD	ALW INZA METEOR	I6RT-D-1-Z1-078335W-13833583DF-SW-WH	18	
P2	LED	1044	1% 0-10V	120	TBD	PENDANT, AC CABLE	22" DIA x 11" H LED DECORATIVE PENDANT, 65% RECYCLED RESIN, INTEGRAL LED, FLOOD OPTICS (BREAK ROOM ISLAND)	3FORM LIGHTART COIL PENDANT D1	COL-COIL-PEND-D1-TBD-835CK-1000LM-FL-PCE-LV01-STD-TBD-TBD	9.5	
R22	LED	~3500	1% 0-10V	UNV	WHITE	RECESS	2' x 2' LED, CENTER LENS, FROSTED POLYCARBONATE, INTEGRAL REFLECTOR, RECESS ARCHITECTURAL LIGHT, 0-10V DIMMABLE, FIELD ADJUSTABLE LIGHT OUTPUT - SET AT 29W, FIELD SELECTABLE COLOR TEMP, 83CRI	RAB SWISH (NO SUBSTITUTION)	SWISHFA-2X2-D10	29	
T22	LED	2420	1% 0-10V	UNV	WHITE	RECESS	2' x 2' LED FLAT PANEL,	METALUX FPS	22FPSL2SCT3	21.6	
TH1	LED	1000	FORWARD OR REVERSE PHASE	120	WHITE	SURFACE, MONO-POINT	SMALL SCALE DECORATIVE LED TRACK HEAD ON EXTENDED WAND AND MONOPOINT MOUNTING, 2 SDCM BINNING	INTENSE IQ CONTECH LTG	IQ-L0-35-DIM-W-FL & -WF-MONO-LH56-PFL56 & PFL56-1-IP-B047NF	11	
UC3	LED	195L/FT	0-10V	UNV	ANODIZED CHANNEL	SURFACE	3' LED UNDERCABINET LIGHT, SQUARE CHANNEL, FROSTED LENS	LEDI INSPIRE V5 SPEC 1.5	V5-SPEC-15-35-CONNECTORS & DRIVERS AS REQUIRED-CH1-SQ-CH1-LENS-STFR	4.5	
UCE	LED	195L/FT	0-10V	UNV	ANODIZED CHANNEL	SURFACE	SIMILAR TO UC3, WITH 4' LENGTH	LEDI INSPIRE V5 SPEC 1.6	V5-SPEC-15-35-CONNECTORS & DRIVERS AS REQUIRED-CH1-SQ-CH1-LENS-STFR	6	

GENERAL NOTES:

A. ALL CRITERIA LISTED IN THE DESCRIPTION SHALL BE PROVIDED. MODEL NUMBER MAY NOT REPRESENT THE COMPLETE MODEL NUMBER.

B. MODEL NUMBER REPRESENTS THE PRODUCT FROM THE FIRST MANUFACTURER LISTED. ALTERNATE MANUFACTURERS ARE LISTED AS BEING ABLE TO PROVIDE EQUIVALENT PRODUCTS. EQUIVALENT PRODUCTS MUST MUST MEET THE CRITERIA LISTED IN THE DESCRIPTION AND THE MODEL NUMBER.

C. PROVIDE ALL COMPONENTS (INTEGRAL/REMOTE DRIVER, MOUNTING HARDWARE, LENSES, END CAPS, CABLES, ETC) NECESSARY FOR A COMPLETE AND OPERABLE SYSTEM.

D. CONFRIM CEILING TYPES AND VERIFY TRIM COMPATABILITY PRIOR TO SUBMITTALS.

E. VERIFY FINAL LUMINAIRE FINISH SELECTIONS WITH ARCHITECT PRIOR TO ORDERING. FINISH SHALL BE SELECTED FROM MANURACTURER'S STANDARD FINISHES UNLESS NOTED OTHERWISE.

F. VERIFY FINAL LUMINAIRE MOUNTING HEIGHTS WITH ARCHITECT PRIOR TO ORDERING.

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pcd ENGINEERING
a Bowman company

COLORADO REGISTERED PROFESSIONAL ENGINEER
PETER C. D'ANTONIO
33293
11/19/21

PROJECT: SOUTHEAST COUNTY SERVICE HUB
1755 S. PUBLIC RD
LAFAYETTE, CO 80026

PROJECT NO: 2007

#	ISSUE DATE	PHASE / REV NAME
	11/19/21	CONSTRUCTION DOCUMENTS

LUMINAIRE SCHEDULES

E-005

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EXTERIOR LUMINAIRE SCHEDULE

ALL LED LAMPS TO BE 4000K COLOR TEMPERATURE AND MINIMUM 80CRI, UNLESS NOTED OTHERWISE.

TYPE	LAMP	LUMENS	DIMMING	VOLT	FINISH	MOUNTING	DESCRIPTION	MFR	MODEL	VA	NOTES
BB	LED			277V	DARK BRONZE	WALL 12' 0" AFG	EXISTING (E) EXTERIOR LED BUILDING MOUNT, 4000K	LITHONIA	EXISTING - DSXW2-LED-30C-530-40K-T3M-MVOLT-DDBXD	54	
BB1	LED			277V	DARK BRONZE	WALL 12' 0" AFG	EXISTING (E) EXTERIOR LED BUILDING MOUNT, 4000K	LITHONIA	EXISTING - DSXW2-LED-30C-530-40K-T3M-MVOLT-DDBXD	54	
BB1/EM	LED			277V	DARK BRONZE	WALL 12' 0" AFG	EXISTING (E) EXTERIOR LED BUILDING MOUNT, 4000K, REMOTE EMERGENCY DRIVER	LITHONIA	EXISTING - DSXW2-LED-30C-530-40K-T3M-MVOLT-DDBXD W/ PHILLIPS #BSL17C	54	
EW1	LED	1458		277V	DARK BRONZE	WALL 9' 0" AFG	EXTERIOR LED BUILDING MOUNT, SIMILAR TO EXISTING TYPE BB WITH SMALLER SCALE, 14" W x 6.6" H x 10" D, 4000K, 10 LEDS, 350MA, TYPE IV DISTRIBUTION	LITHONIA	DSXW1-10C-350-40K-T4M-MVOLT-XXX-DDBXD	13	

GENERAL NOTES:

A. ALL CRITERIA LISTED IN THE DESCRIPTION SHALL BE PROVIDED. MODEL NUMBER MAY NOT REPRESENT THE COMPLETE MODEL NUMBER.
B. MODEL NUMBER REPRESENTS THE PRODUCT FROM THE FIRST MANUFACTURER LISTED. ALTERNATE MANUFACTURERS ARE LISTED AS BEING ABLE TO PROVIDE EQUIVALENT PRODUCTS. EQUIVALENT PRODUCTS MUST MUST MEET THE CRITERIA LISTED IN THE DESCRIPTION AND THE MODEL NUMBER.
C. PROVIDE ALL COMPONENTS (INTEGRAL/REMOTE DRIVER, MOUNTING HARDWARE, LENSES, END CAPS, CABLES, ETC) NECESSARY FOR A COMPLETE AND OPERABLE SYSTEM.
D. CONFRIM CEILING TYPES AND VERIFY TRIM COMPATABILITY PRIOR TO SUBMITTALS.
E. VERIFY FINAL LUMINAIRE FINISH SELECTIONS WITH ARCHITECT PRIOR TO ORDERING. FINISH SHALL BE SELECTED FROM MANURACTURER'S STANDARD FINISHES UNLESS NOTED OTHERWISE.
F. VERIFY FINAL LUMINAIRE MOUNTING HEIGHTS WITH ARCHITECT PRIOR TO ORDERING.

NOTES:

EMERGENCY LUMINAIRE SCHEDULE

TAG	DESCRIPTION	INSTALLATION METHOD	LUMENS	COLOR TEMP	VOLTAGE	INPUT WATTS	REFERENCED PRODUCTS	NOTES
EX	EXIT SIGN, GREEN LETTERS, 90 MIN AC ONLY	UNIV	-	-	120	1	EATON SURE-LITES APX	
EM1	EXTERIOR LED EM LIGHT, WET LISTED	WALL MOUNT	-	-	120	2	EATON SURE-LITES SRP, SRPD	

GENERAL NOTES

A. EQUIVALENT PRODUCTS BY OTHER MANUFACTURERS MAY BE CONSIDERED PRIOR TO BID.
B. DETERMINE SPECIFIC PRODUCT NUMBERS BASED ON REFERENCED PRODUCT SERIES, WRITTEN DESCRIPTIONS, AND PROJECT MANUAL SPECIFICATIONS WHERE APPLICABLE.
C. COORDINATE FINAL FINISH, REFLECTOR COLORS, MOUNTING TYPE AND ACCESSORIES WITH ARCHITECT PRIOR TO PLACING ORDER.
D. LISTED SIZES, LAMPING, AND TYPES OF LUMINAIRES MAY NOT BE AVAILABLE FROM ANY GIVEN MANFUACTURER OR SERIES.
E. ALERT ARCHITECT AND ELECTRICAL ENGINEER OF DISCREPANCIES PRIOR TO BID.

DETAIL NOTES

1.
2.
3.

COMcheck Software Version 4.1.5.3

Interior Lighting Compliance Certificate

Project Information

Energy Code: 2015 IECC
Project Title: SOUTHEAST COUNTY SERVICES HUB
Project Type: Alteration

Construction Site:
1755 S. PUBLIC RD
LAFAYETTE, CO 80026

Owner/Agent:

Designer/Contractor:
Peter D'Antonio
PCD Engineering
323-3rd Ave.
Suite 100
Longmont, CO 80501
303-678-1108
peter@pcdengineering.com

Allowed Interior Lighting Power

A Area Category	B Floor Area (ft2)	C Allowed Watts / ft2	D Allowed Watts (B X C)
1-Office	38883	0.82	31884
		Total Allowed Watts =	31884

Proposed Interior Lighting Power

A Fixture ID : Description / Lamp / Wattage Per Lamp / Ballast	B Lamps/ Fixture	C # of Fixtures	D Fixture Watt.	E (C X D)
Office (38883 sq ft)				
LED 1: A/E)/A/RL): Other:	1	38	53	1908
LED 1 copy 1: B/EM: Other:	1	4	50	200
LED 1 copy 1: D4/D4A/D4W/D4V4: Other:	1	36	8	288
LED 1 copy 2: D/EM: Other:	1	8	20	160
LED 1 copy 2: LP44: Other:	1	5	190	950
LED 1 copy 2: LR3: Other:	1	14	15	210
LED 1 copy 2: LR4: Other:	1	14	20	280
LED 1 copy 3: LR5: Other:	1	1	25	25
LED 1 copy 3: LR6: Other:	1	15	30	450
LED 1 copy 3: LR8: Other:	1	5	40	200
LED 1 copy 4: LR9: Other:	1	2	45	90
LED 1 copy 4: LR11: Other:	1	2	55	110
LED 1 copy 4: LR12: Other:	1	1	60	60
LED 1 copy 5: LR13: Other:	1	1	65	65
LED 1 copy 5: LR14: Other:	1	1	70	70
LED 24: LR22: Other:	1	24	39	936
LED 25: LR44: Other:	1	10	80	800
LED 26: LR84: Other:	1	14	100	1400
LED 1 copy 6: P2: Other:	1	3	20	60
LED 1 copy 6: P8: Other:	1	88	30	2640

A Fixture ID : Description / Lamp / Wattage Per Lamp / Ballast	B Lamps/ Fixture	C # of Fixtures	D Fixture Watt.	E (C X D)
LED 1 copy 6: R22: Other:	1	370	29	10730
LED 1 copy 6: T22: Other:	1	8	22	173
LED 1 copy 7: PH1: Other:	1	5	10	50
		Total Proposed Watts =		21855

Interior Lighting PASSES

Interior Lighting Compliance Statement

Compliance Statement: The proposed interior lighting alteration project represented in this document is consistent with the building plans, specifications, and other calculations submitted with this permit application. The proposed interior lighting systems have been designed to meet the 2015 IECC requirements in COMcheck Version 4.1.5.3 and to comply with any applicable mandatory requirements listed in the Inspection Checklist.

MIKE NG - PCD ENGINEERING — Name - Title
MIKE NG - PCD ENGINEERING — Signature
11/18/2021 — Date

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pcd ENGINEERING
a Bowman company
PETER C. D'ANTONIO 33293 PROFESSIONAL ENGINEER
COLORADO REGISTERED
11/19/21

PROJECT:
SOUTHEAST COUNTY SERVICE HUB
1755 S. PUBLIC RD
LAFAYETTE, CO 80026

PROJECT NO: 2007

ISSUE DATE	PHASE / REV NAME
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LUMINAIRE SCHEDULES & COMCHECKS

E-006

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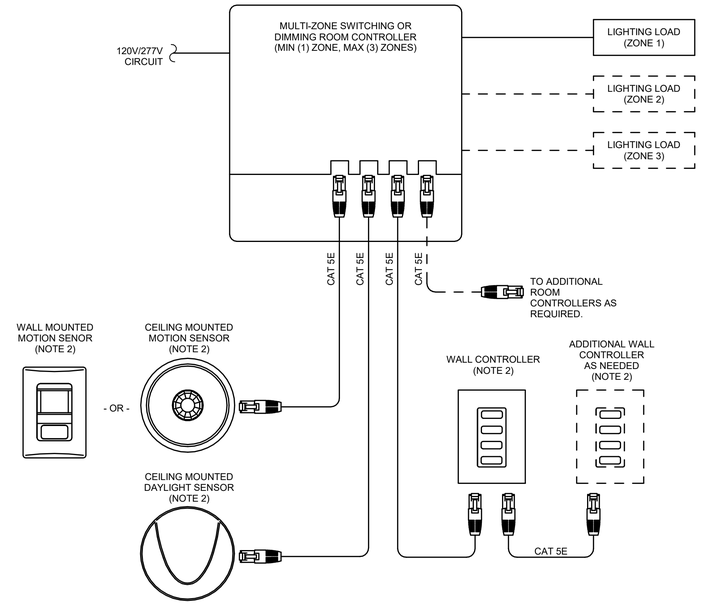
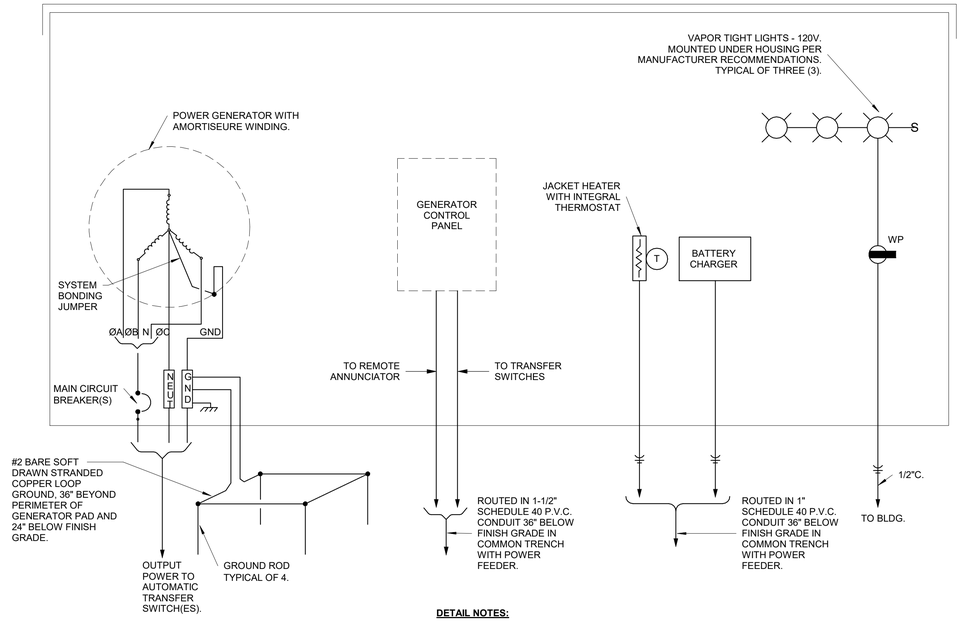
DETAIL NOTES

1. REFER TO SPECIFICATIONS FOR APPROVED MANUFACTURERS FOR DIGITAL LIGHTING CONTROLS.
2. REFER TO LIGHTING CONTROL SEQUENCE OF OPERATIONS FOR INFORMATION ON SENSORS AND WALL CONTROLLERS SCENES AND ENGRAVINGS.
3. REFER TO LIGHTING PLANS FOR NUMBER OF ZONES PER SPACE/ROOM TYPE.
4. ELECTRICAL CONTRACTOR SHALL REFER TO MANUFACTURER WIRING DIAGRAMS FOR INSTALLATION INFORMATION.
5. FOR EACH SPACE / ROOM TYPE, PROVIDE QUANTITIES OF ROOM CONTROLLERS, WIRING, AND ACCESSORIES AS REQUIRED TO FULFILL REQUIREMENTS OF SWITCHING AND DIMMING ZONES SHOWN ON THE LIGHTING PLANS AND SEQUENCE OF OPERATIONS.
6. FOR ALL CAT5E CABLES, PROVIDE 24-INCH SLACK BETWEEN TERMINATION POINT TO ALLOW FOR REPOSITIONING OF SENSORS AND/OR SWITCHES AFTER INITIAL INSTALL.
7. ELECTRICAL CONTRACTOR SHALL INCLUDE IN SCOPE OF WORK PROGRAMMING OF ALL ROOM CONTROLLERS AND SET POINT ADJUSTMENT OF ROOM SCENES BASED ON OWNER FEEDBACK AT SUBSTANTIAL COMPLETION.
8. ALL CONTROLLERS AND DEVICES LOCATED IN PLENUM SPACES SHALL BE UL-2043 LISTED.
9. CONSULT WITH OWNER FOR FINAL COLOR OF ALL CAT5E CABLES USED FOR LIGHTING CONTROLS.



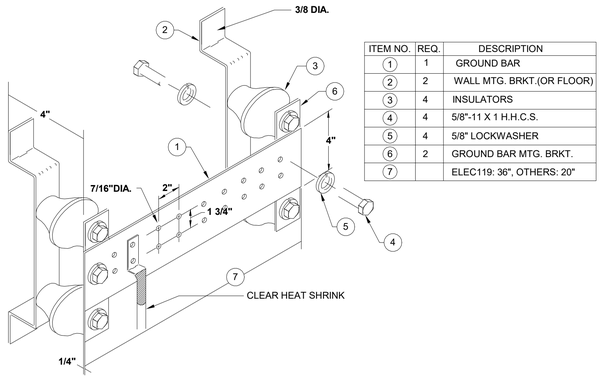
1 DIGITAL LIGHTING CONTROL DETAIL
N.T.S.



DETAIL NOTES:

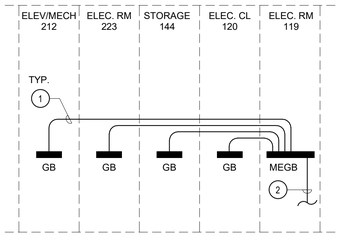
1. CONFIRM ALL REQUIREMENTS, INCLUDING POWER REQUIREMENTS FOR HEATER AND BATTERY CHARGER, WITH GENERATOR MANUFACTURER PRIOR TO INSTALLATION.
2. REFER TO PANEL SCHEDULES FOR CIRCUIT INFORMATION.
3. GENERATOR MANUFACTURER SHALL PROVIDE WALKWAY PLATFORM. REFER TO DIV 26 SPECIFICATIONS, ARCHITECTURAL DRAWINGS, AND STRUCTURAL DRAWINGS FOR ADDITIONAL INFORMATION.

2 EXTERIOR GENERATOR DETAIL
N.T.S.



ITEM NO.	REQ.	DESCRIPTION
1	1	GROUND BAR
2	2	WALL MTG. BRKT.(OR FLOOR)
3	4	INSULATORS
4	4	5/8"-11 X 1 H.H.C.S.
5	4	5/8" LOCKWASHER
6	2	GROUND BAR MTG. BRKT.
7		ELEC119: 36", OTHERS: 20"

3 GROUND BAR (COPPER) DETAIL
N.T.S.



DETAIL NOTES:

1. #4/0 GREEN INSULATED COPPER CONDUCTOR.
2. TIE TO EXISTING BUILDING GROUNDING SYSTEM OR BUILDING STEEL USING #4/0 GREEN INSULATED COPPER CONDUCTOR.

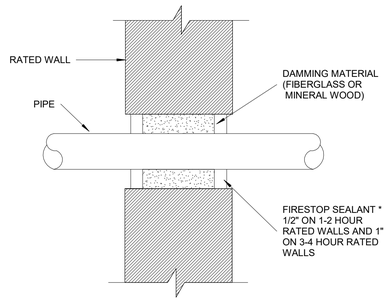
4 GROUNDING DETAIL
N.T.S.

PANELBOARD (TYP.)			
CIR	LOAD DESCRIPTION	LOAD DESCRIPTION	CIR
1	RECEPTACLE - ROOMS 102,103	RECEPTACLE - ROOMS 104,105	2
3	LIGHTING - ROOMS 102,103,104	LIGHTING - ROOMS 105,106,107	4
5	LIGHTING - ROOMS 108,109		

NOTES:

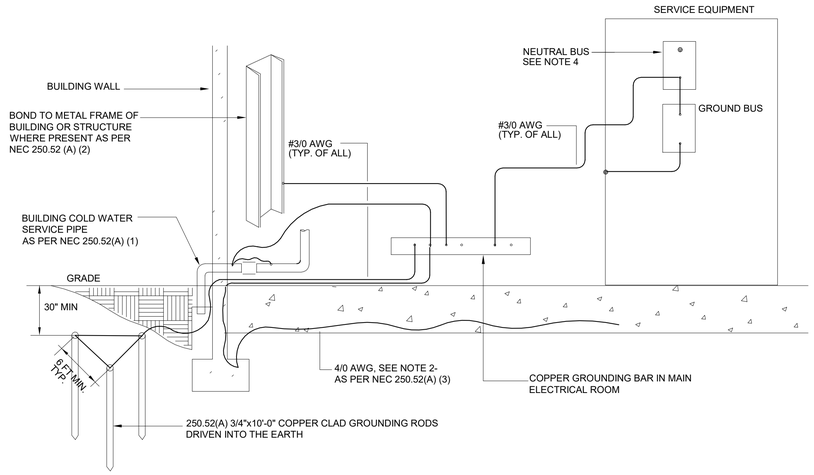
1. UPDATE PANELBOARD IDENTIFICATION CARD AT COMPLETION OF WORK.
2. LOAD DESCRIPTION PER NEC 408.4 SHALL INCLUDE:
   a. ITEM SERVED (EX. RECEPTACLE)
   b. ITEM LOCATION (EX. ROOM 102).
3. ROOM NUMBERS SHALL BE VERIFIED WITH ARCHITECT.
4. PANEL IDENTIFICATION CARD SHALL BE TYPEWRITTEN.

5 PANELBOARD IDENTIFICATION DETAIL
N.T.S.



* SEALANT SHALL BE SIMILAR TO DOW CORNING FIRESTOP 2000.

6 PENETRATION DETAIL
N.T.S.



DETAIL NOTES:

1. PROVIDE EXOTHERMIC WELDED CONNECTIONS BELOW GROUND.
2. A CONCRETE ENCASED ELECTRODE "UFER" TO BE USED AS THE PRINCIPLE GROUNDING ELEMENT. A CONCRETE ENCASED ELECTRODE IS AN ELECTRODE ENCASED BY AS LEAST 2 INCHES OF CONCRETE LOCATED WITHIN AND NEAR THE BOTTOM OF A CONCRETE FOUNDATION OF FOOTING THAT IS IN DIRECT CONTACT WITH THE EARTH. CONSISTING OF AT LEAST 20 FEET OF ONE MORE STEEL REINFORCING BARS OF RODS OF NOT LESS THAN 1/2 INCH DIAMETER OR CONSISTING OF AT LEAST 20 FEET OF BARE SOLID COPPER CONDUCTOR NOT SMALLER THAN NO. 3/0 AWG. 250.52 (A)(3). STEEL REINFORCING RODS AND/OR COPPER CONDUCTORS UTILIZED IN THE INSTALLATION REQUIRE A MINIMUM OF 2 FEET OF ACCESSIBLE LENGTH AFTER INSTALLATION 250.50 UNDERGROUND CONNECTION SHALL BE WELDED TYPE.
3. FURNISH AND INSTALL ADDITIONAL GROUND RODS AS REQUIRED TO ACHIEVE 5 OHMS OR LESS RESISTANCE. RODS SHALL BE LOCATED IN UNPAVED AREAS.
4. SERVICE SWITCH NEUTRAL BUS SHALL BE BONDED TO THE GROUND BUS.

7 GROUNDING SYSTEM DETAIL
N.T.S.

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ELECTRICAL DETAILS

E-007

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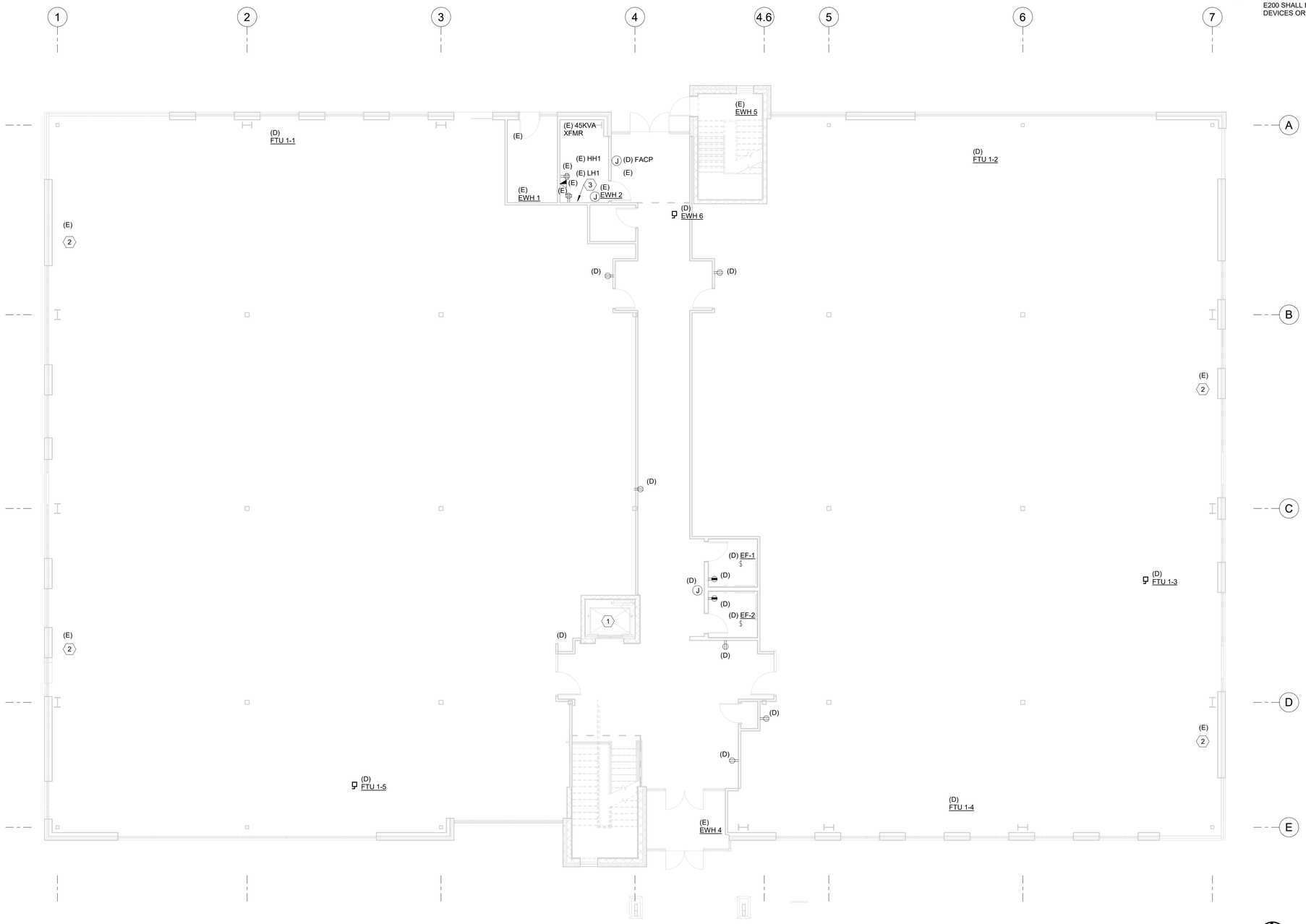
WORK NOTES:

1. ALL EXISTING DEVICES WITHIN ELEVATOR SHAFT SHALL REMAIN.
2. EXISTING RECEPTACLE AND CONDUCTORS SHALL BE TERMINATED AT THE NEAREST J-BOX TO BE REUSED FOR TENANT FINISH. DEMOLISH REMAINING CONDUCTORS FROM J-BOX TO ELECTRICAL PANEL.
3. DEMO. EXISTING TRANE CONTROL BOX, METER HOUSING, AND RELOCATE (E)EUH-2 AND QUADPLEX ON THIS WALL. REFER TO NEW LAYOUT OF ELECTRICAL DEVICES PRIOR TO DETERMINING NEW RELOCATIONS OF (E)EUH-2 AND QUADPLEX.

GENERAL NOTES:

1. CONTRACTOR SHALL BE RESPONSIBLE TO VERIFY CONDITION AND PROPER FUNCTIONALITY OF ALL SYSTEMS AND DEVICES WHICH ARE INVOLVED OR AFFECTED BY THE SCOPE OF THIS PROJECT PRIOR TO BEGINNING WORK. ALL DAMAGE OR IMPROPER FUNCTIONALITY SHALL BE REPORTED TO OWNER IN WRITING. UNDOCUMENTED DAMAGE OR IMPROPER FUNCTIONALITY DISCOVERED FOLLOWING THE START OF WORK SHALL BE CORRECTED AT CONTRACTORS EXPENSE TO APPROVAL OF OWNER.
2. CONTRACTOR SHALL TRACE AND VERIFY ALL CIRCUITING PRIOR TO BEGINNING WORK. PANEL SCHEDULES FOR EXISTING PANELS SHOWN SHALL BE UPDATED TO REFLECT REVISED CONDITIONS.
3. DEVICES TAGGED 'EX' OR PREFIXED WITH (E) ARE EXISTING TO REMAIN AND SHOWN FOR REFERENCE ONLY. DEVICES AND THEIR CONDUITS WITH PREFIXED WITH (D) SHALL BE DEMOLISHED FROM DEVICE TO THE ELECTRICAL PANEL.
4. ALL EXISTING FIRE ALARM DEVICES PER ARCHITECT DRAWING SHEET E200 SHALL REMAIN. COORDINATE WITH FIRE ALARM VENDOR IF DEVICES OR EMPTY J-BOX NEEDS TO BE DEMOLISHED OR REUSED.



1 LEVEL 01 - DEMO POWER FLOOR PLAN
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COLORADO REGISTERED PETER C. D'ANTONIO 33293 PROFESSIONAL ENGINEER
11/19/21

PROJECT:
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LEVEL 01 - DEMO POWER FLOOR PLAN

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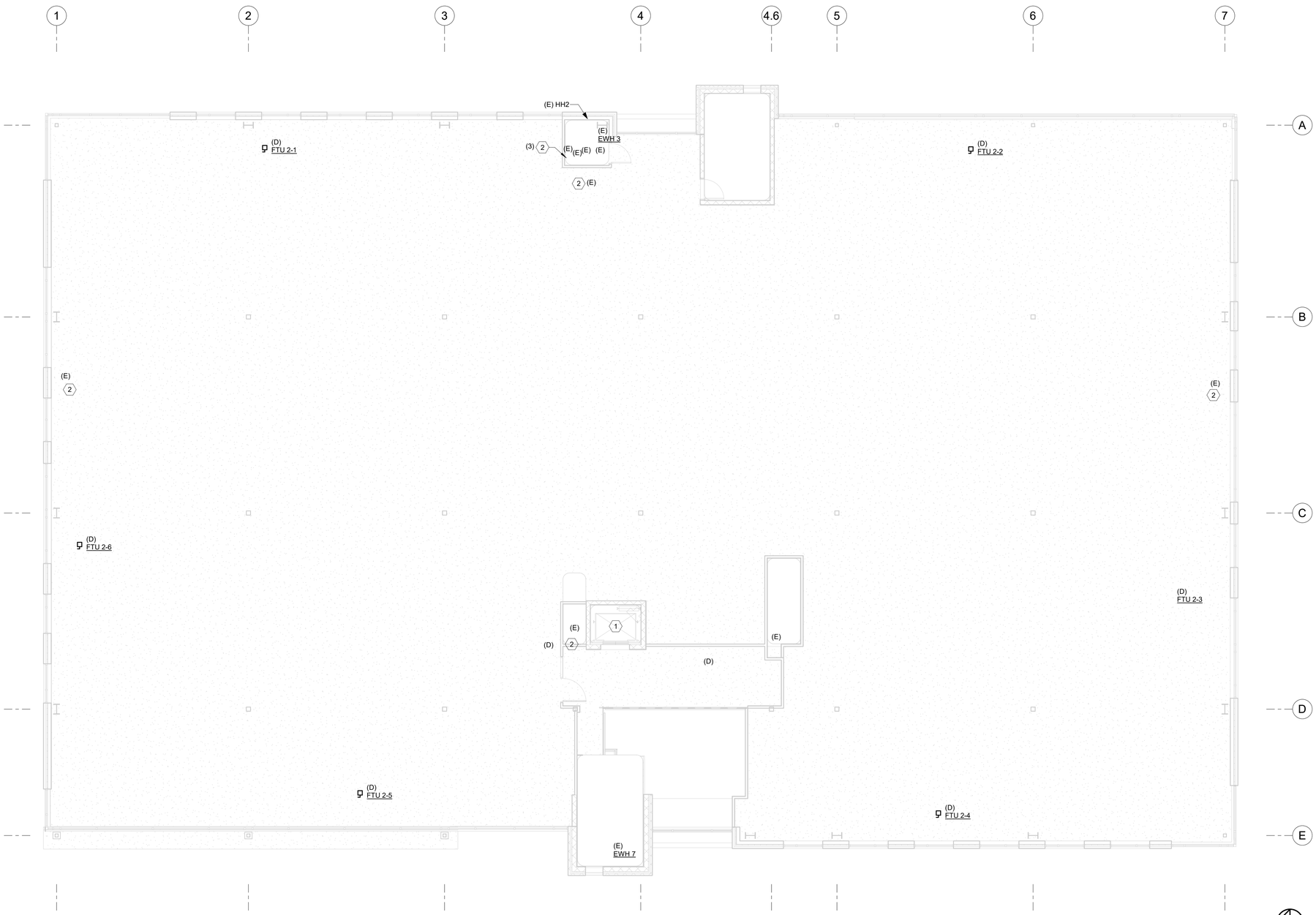
WORK NOTES:

1. ALL EXISTING DEVICES WITHIN ELEVATOR SHAFT SHALL REMAIN.
2. EXISTING RECEPTACLE AND CONDUCTORS SHALL BE TERMINATED AT THE NEAREST J-BOX TO BE REUSED FOR TENANT FINISH. REMAINING CONDUCTORS FROM J-BOX TO ELECTRICAL PANEL SHALL BE DEMOLISHED.

GENERAL NOTES:

1. CONTRACTOR SHALL BE RESPONSIBLE TO VERIFY CONDITION AND PROPER FUNCTIONALITY OF ALL SYSTEMS AND DEVICES WHICH ARE INVOLVED OR AFFECTED BY THE SCOPE OF THIS PROJECT PRIOR TO BEGINNING WORK. ALL DAMAGE OR IMPROPER FUNCTIONALITY SHALL BE REPORTED TO OWNER IN WRITING. UNDOCUMENTED DAMAGE OR IMPROPER FUNCTIONALITY DISCOVERED FOLLOWING THE START OF WORK SHALL BE CORRECTED AT CONTRACTORS EXPENSE TO APPROVAL OF OWNER.
2. CONTRACTOR SHALL TRACE AND VERIFY ALL CIRCUITING PRIOR TO BEGINNING WORK. PANEL SCHEDULES FOR EXISTING PANELS SHOWN SHALL BE UPDATED TO REFLECT REVISED CONDITIONS.
3. DEVICES TAGGED 'EX' OR PREFIXED WITH (E) ARE EXISTING TO REMAIN AND SHOWN FOR REFERENCE ONLY. DEVICES AND THEIR CONDUITS WITH PREFIXED WITH (D) SHALL BE DEMOLISHED FROM DEVICE TO THE ELECTRICAL PANEL.
4. ALL EXISTING FIRE ALARM DEVICES PER ARCHITECT DRAWING SHEET E200 SHALL REMAIN. COORDINATE WITH FIRE ALARM VENDOR IF DEVICES OR EMPTY J-BOX NEEDS TO BE DEMOLISHED OR REUSED.



1 LEVEL 02 - DEMO POWER FLOOR PLAN
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11/19/21

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LEVEL 02 - DEMO POWER FLOOR PLAN

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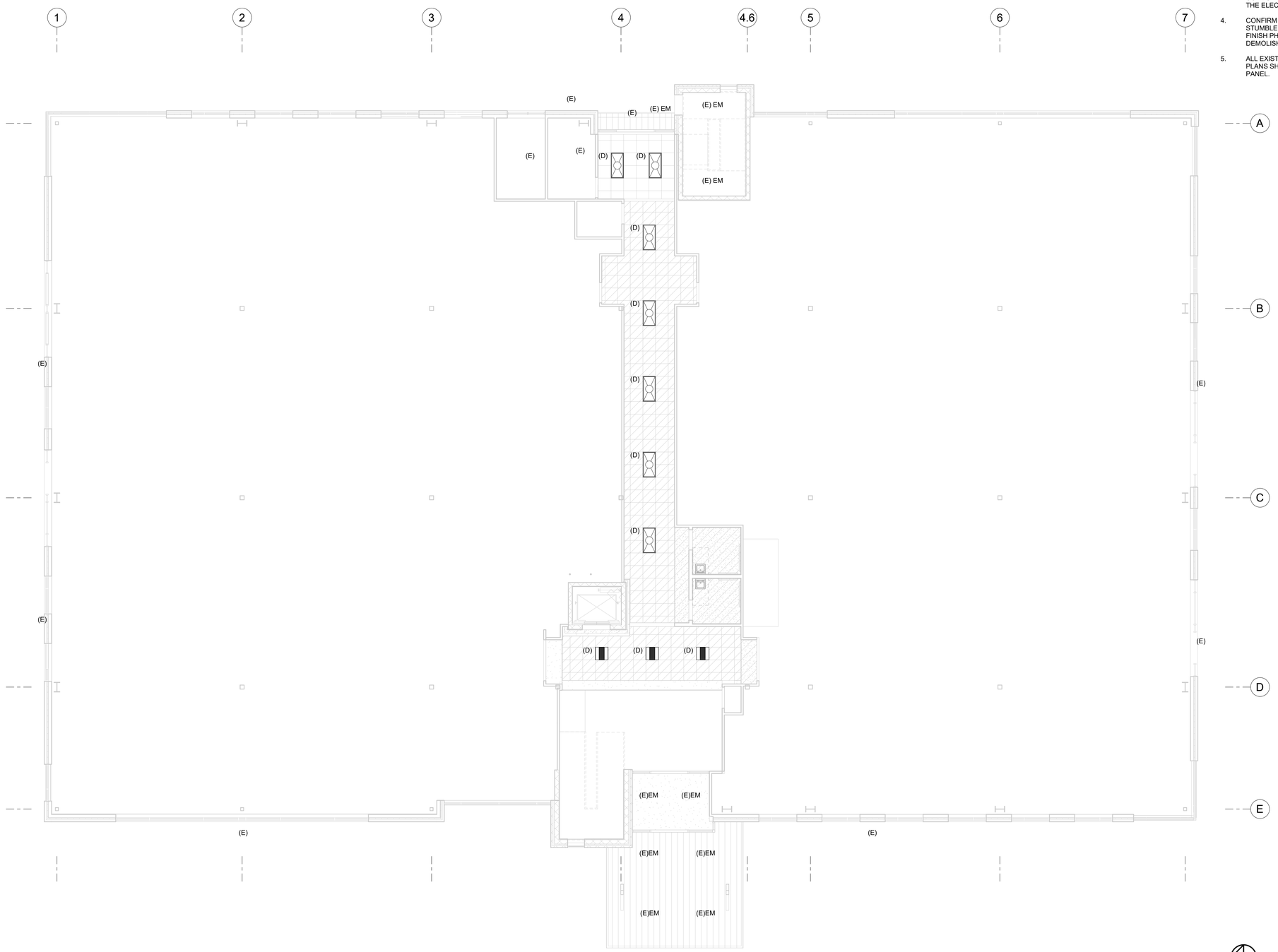
GENERAL NOTES:

1. CONTRACTOR SHALL BE RESPONSIBLE TO VERIFY CONDITION AND PROPER FUNCTIONALITY OF ALL SYSTEMS AND DEVICES WHICH ARE INVOLVED OR AFFECTED BY THE SCOPE OF THIS PROJECT PRIOR TO BEGINNING WORK. ALL DAMAGE OR IMPROPER FUNCTIONALITY SHALL BE REPORTED TO OWNER IN WRITING. UNDOCUMENTED DAMAGE OR IMPROPER FUNCTIONALITY DISCOVERED FOLLOWING THE START OF WORK SHALL BE CORRECTED AT CONTRACTORS EXPENSE TO APPROVAL OF OWNER.
2. CONTRACTOR SHALL TRACE AND VERIFY ALL CIRCUITING PRIOR TO BEGINNING WORK. PANEL SCHEDULES FOR EXISTING PANELS SHOWN SHALL BE UPDATED TO REFLECT REVISED CONDITIONS.
3. DEVICES TAGGED 'EX' OR PREFIXED WITH (E) ARE EXISTING TO REMAIN AND SHOWN FOR REFERENCE ONLY. DEVICES AND THEIR CONDUITS WITH PREFIXED WITH (D) SHALL BE DEMOLISHED BACK TO THE ELECTRICAL PANEL FED FROM.
4. CONFIRM OPERATION AND CAREFULLY REMOVE ALL EXISTING STUMBLE LIGHTING AND EXIT SIGNS TO BE REUSED DURING TENANT FINISH PHASE IF POSSIBLE. ALL EMERGENCY FROG EYES SHALL BE DEMOLISHED.
5. ALL EXISTING LIGHTING NOT MENTIONED ABOVE OR SHOWN ON PLANS SHALL BE DEMOLISHED FROM FIXTURE TO THE ELECTRICAL PANEL.



1 LEVEL 01 - DEMO LIGHTING FLOOR PLAN
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11/19/21

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LEVEL 01 - DEMO LIGHTING FLOOR PLAN

ED-111

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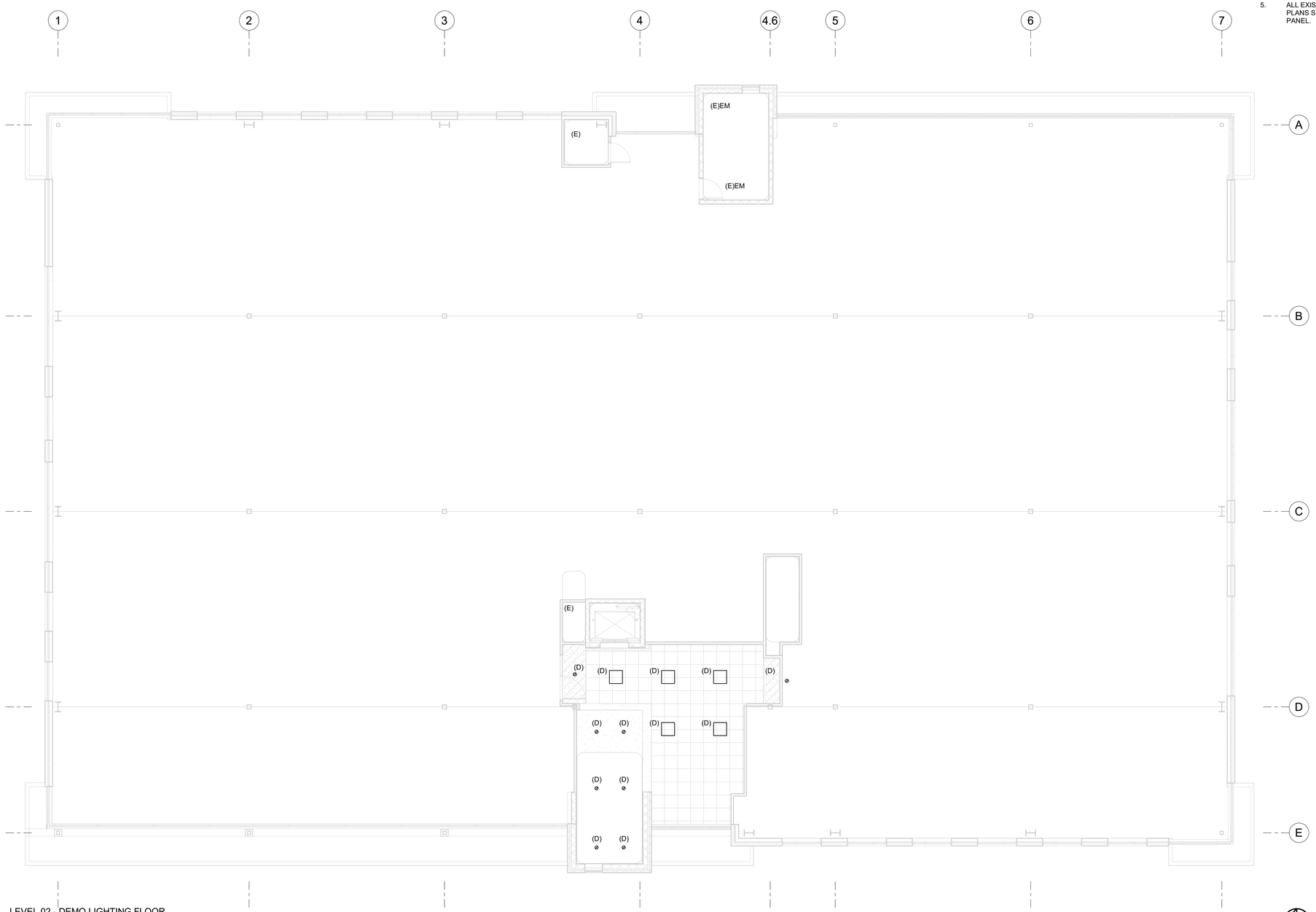
GENERAL NOTES:

1. CONTRACTOR SHALL BE RESPONSIBLE TO VERIFY CONDITION AND PROPER FUNCTIONALITY OF ALL SYSTEMS AND DEVICES WHICH ARE INVOLVED OR AFFECTED BY THE SCOPE OF THIS PROJECT PRIOR TO BEGINNING WORK. ALL DAMAGE OR IMPROPER FUNCTIONALITY SHALL BE REPORTED TO OWNER IN WRITING. UNDOCUMENTED DAMAGE OR IMPROPER FUNCTIONALITY DISCOVERED FOLLOWING THE START OF WORK SHALL BE CORRECTED AT CONTRACTORS EXPENSE TO APPROVAL OF OWNER.
2. CONTRACTOR SHALL TRACE AND VERIFY ALL CIRCUITING PRIOR TO BEGINNING WORK. PANEL SCHEDULES FOR EXISTING PANELS SHOWN SHALL BE UPDATED TO REFLECT REVISED CONDITIONS.
3. DEVICES TAGGED 'EX' OR PREFIXED WITH (E) ARE EXISTING TO REMAIN AND SHOWN FOR REFERENCE ONLY. DEVICES AND THEIR CONDUITS WITH PREFIXED WITH (D) SHALL BE DEMOLISHED BACK TO THE ELECTRICAL PANEL FED FROM.
4. CONFIRM OPERATION AND CAREFULLY REMOVE ALL EXISTING STUMBLE LIGHTING AND EXIT SIGNS TO BE REUSED DURING TENANT FINISH PHASE IF POSSIBLE. ALL EMERGENCY FROG EYES SHALL BE DEMOLISHED.
5. ALL EXISTING LIGHTING NOT MENTIONED ABOVE OR SHOWN ON PLANS SHALL BE DEMOLISHED FROM FIXTURE TO THE ELECTRICAL PANEL.



1 LEVEL 02 - DEMO LIGHTING FLOOR PLAN
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LEVEL 02 - DEMO LIGHTING FLOOR PLAN

ED-112

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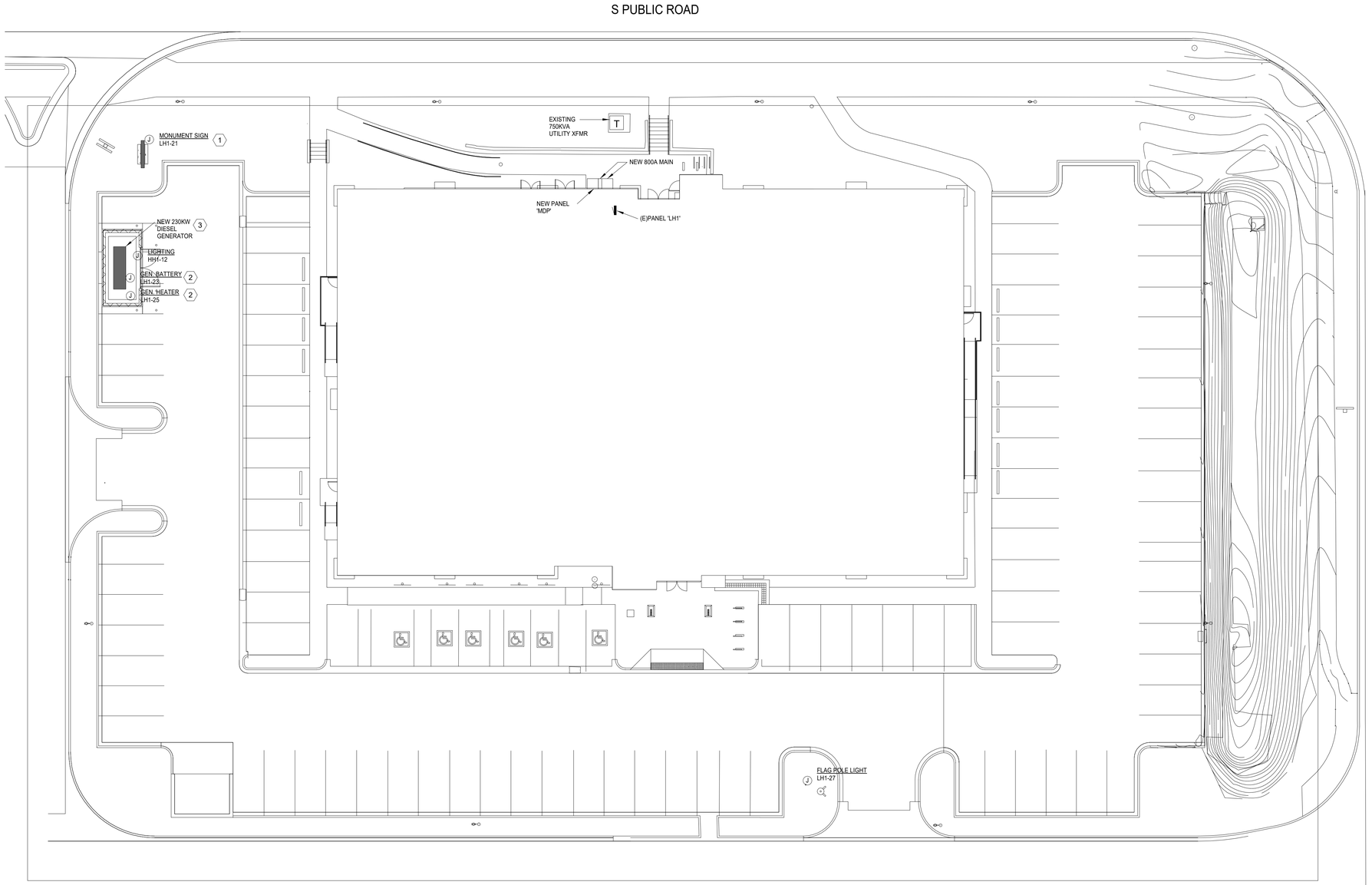
GENERAL NOTES:

1. ALL EXISTING SITE LIGHTING SHALL REMAIN.

WORK NOTES: (#)

1. COORDINATE WITH MONUMENT SIGN VENDOR FOR EXACT POWER REQUIREMENTS AND FINAL LOCATION.
2. COORDINATE WITH GENERATOR VENDOR FOR EXACT POWER REQUIREMENTS AND LOCATION OF GENERATOR BATTERY AND HEATER.
3. FURNISH A MINIMUM OF SOUND ATTENTUATED LEVEL 2 ENCLOSURE FOR GENERATOR AND PROVIDE A MINIMUM OF 18" CLEARANCE. COORDINATE WITH CUMMINS VENDOR FOR MORE DETAILS. GENERATOR SHALL OPERATE A MINIMUM OF 24 HOURS. COORDINATE FOR FINAL LOCATION OF GENERATOR REMOTE ANNUNCIATOR PANEL.



1 ELECTRICAL SITE PLAN
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ELECTRICAL SITE PLAN

E-100

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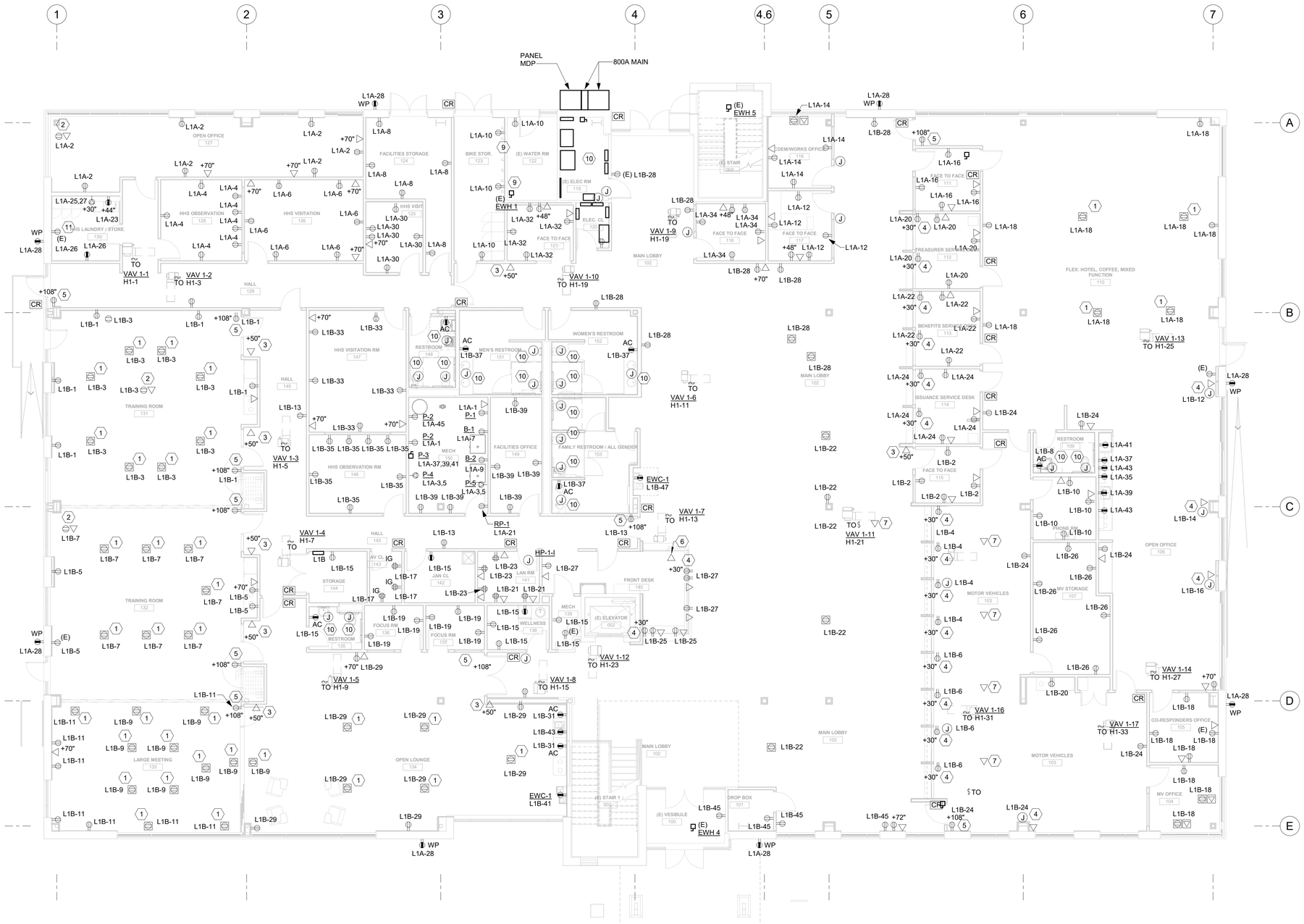
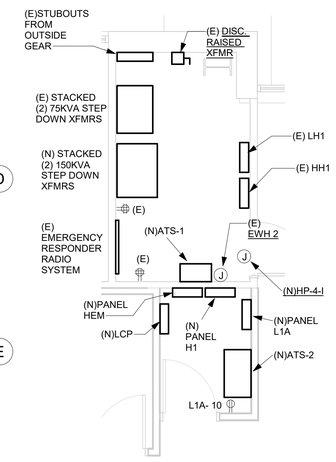
GENERAL NOTES:

1. CONFIRM ALL WALL AND CEILING MOUNTED TELEVISION LOCATIONS. OUTLETS FOR WALL MOUNTED TV TO BE FURNISHED AT 78" AFF.
2. COORDINATE ALL FLOOR BOXES WITH FURNITURE VENDOR.
3. COORDINATE KITCHEN APPLIANCES WITH VENDOR AND ACTUAL NUMBER OF RECEPTACLES AND THEIR MOUNTING HEIGHT.

WORK NOTES: (#)

1. WALKER DUCT PREFERRED FOR FLOOR BOX, DEDUCT ALTERNATE: FLOOR BOXES.
2. RECEPTACLE AND DATA MOUNTED ON CEILING. FURNISH CEILING POLE FOR PROJECTOR/TV.
3. FURNISH CAT5E CABLE FOR ROOM WIZARD DEVICE, COORDINATE WITH LOW VOLTAGE CONSULTANT FOR EXACT REQUIREMENTS.
4. POWER FOR MICROPHONE SPEAK THROUGH GLASS SYSTEM, COORDINATE WITH VENDOR FOR FINAL LOCATION.
5. COORDINATE WITH SECURITY VENDOR FOR DOOR PANIC/LATCH FINAL LOCATION AND POWER REQUIREMENTS.
6. DOOR RELEASE DEVICE, COORDINATE WITH SECURITY VENDOR FOR FINAL LOCATION.
7. DATA J-BOX MOUNTED ON CEILING FOR DOME CAMERA, COORDINATE FINAL LOCATION WITH SECURITY VENDOR.
8. COORDINATE WITH FIRE ALARM VENDOR FOR EXACT LOCATION AND POWER REQUIREMENTS FOR FIRE DAMPER.
9. DOUBLE STACKED TRANSFORMERS. COMPLY WITH ALL WORKING CLEARANCE REQUIREMENTS AND ACCESSIBILITY PER NEC 110.26 AND 450.13.
10. COORDINATE WITH PC FOR EXACT POWER REQUIREMENTS OF URINAL, TOLIET, OR FAUCET SENSOR.
11. FURNISH A GFI RECEPTACLE IF EXISTING IS NOT GFI.
12. REFER TO "ENLARGEMENT OF ELECTRICAL ROOMS" ON THIS SHEET FOR MORE DETAILS.





1 LEVEL 01 - POWER FLOOR PLAN
N.T.S.

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2 ENLARGEMENT - ELECTRICAL ROOMS
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LEVEL 01 - POWER FLOOR PLAN

E-101

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GENERAL NOTES:

1. CONFIRM ALL WALL AND CEILING MOUNTED TELEVISION LOCATIONS. OUTLETS FOR WALL MOUNTED TV TO BE FURNISHED AT 78" AFF.
2. COORDINATE ALL FLOOR BOXES WITH FURNITURE VENDOR.
3. COORDINATE KITCHEN APPLIANCES WITH VENDOR AND ACTUAL NUMBER OF RECEPTACLES AND THEIR MOUNTING HEIGHT.

WORK NOTES: (#)

1. COORDINATE WITH SECURITY VENDOR FOR DOOR PANIC/LATCH FINAL LOCATION AND POWER REQUIREMENTS.
2. RECEPTACLE AND DATA MOUNTED ON CEILING. FURNISH CEILING POLE FOR PROJECTOR/TV.
3. FURNISH CAT5E CABLE FOR ROOM WIZARD DEVICE, COORDINATE WITH LOW VOLTAGE CONSULTANT FOR EXACT REQUIREMENTS.
4. COORDINATE WITH CUBICAL VENDOR FOR EXACT POWER REQUIREMENTS.
5. COORDINATE WITH FIRE ALARM VENDOR FOR EXACT LOCATION AND POWER REQUIREMENTS FOR FIRE DAMPER.
6. COORDINATE WITH PC FOR EXACT POWER REQUIREMENTS OF URINAL, TOLIET, OR FAUCET SENSOR.

1 LEVEL 02 - POWER FLOOR PLAN
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LEVEL 02 - POWER FLOOR PLAN

E-102

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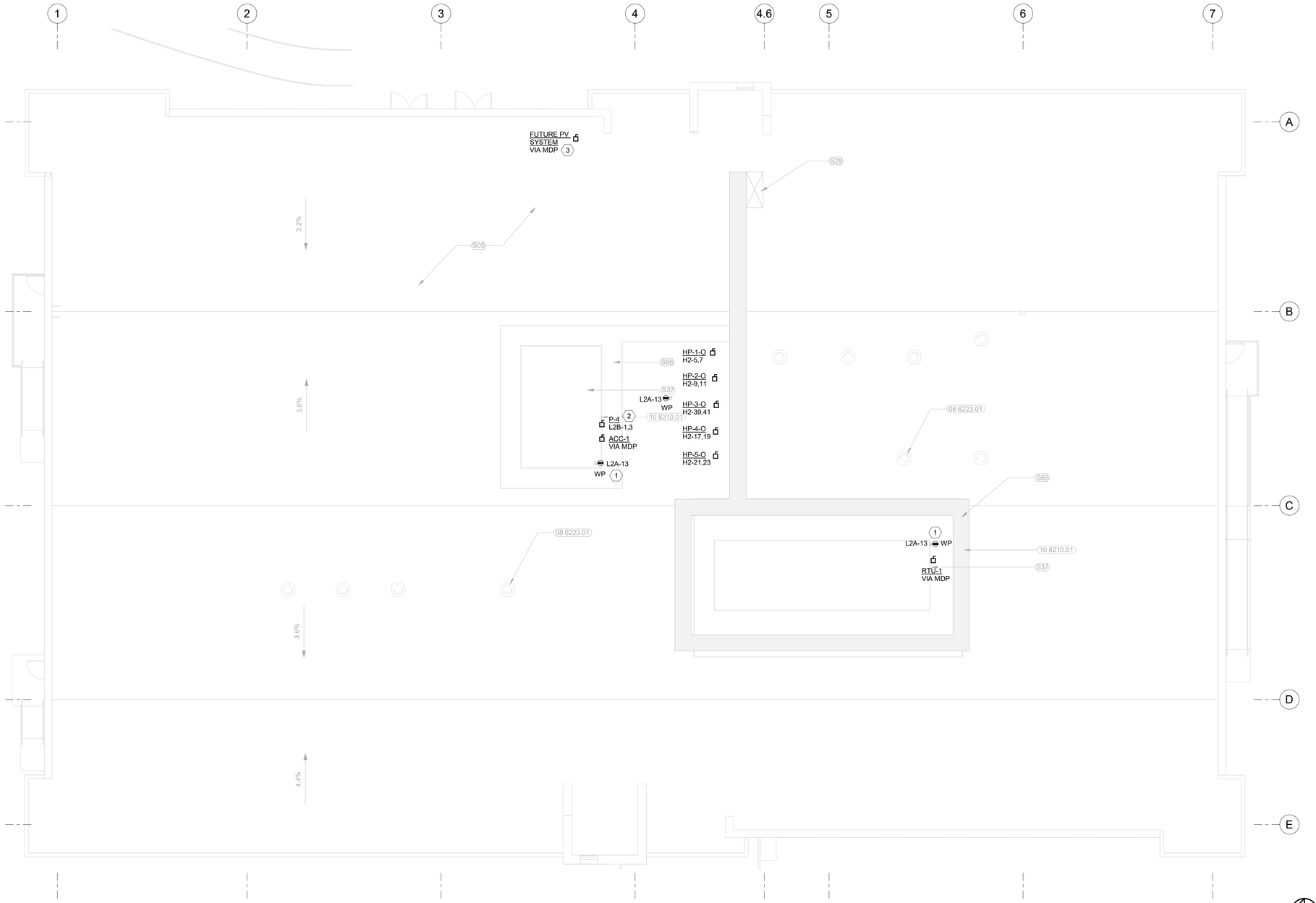
GENERAL NOTES:

1. DEMOLISH ALL EXISTING ELECTRICAL DEVICES AND CONDUITS TO THEIR ELECTRICAL PANEL(S) PRIOR TO ANY NEW WORK.

WORK NOTES: (#)

1. COORDINATE WITH HVAC VENDOR TO CONFIRM IF RECEPTACLE COMES WITH THE ROOF TOP UNIT (RTU-1) OR AIR COOLED CHILLER (ACC-1).
2. COORDINATE WITH HVAC VENDOR FOR EXACT LOCATION AND POWER REQUIREMENTS OF PACKAGED PUMP (P-4).
3. COORDINATE WITH PV VENDOR (IF ANY) FOR FINAL LOCATION AND POWER REQUIREMENTS OF AC DISCONNECT ON ROOF.



1 Roof - Electrical
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33293
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ROOF - ELECTRICAL PLAN

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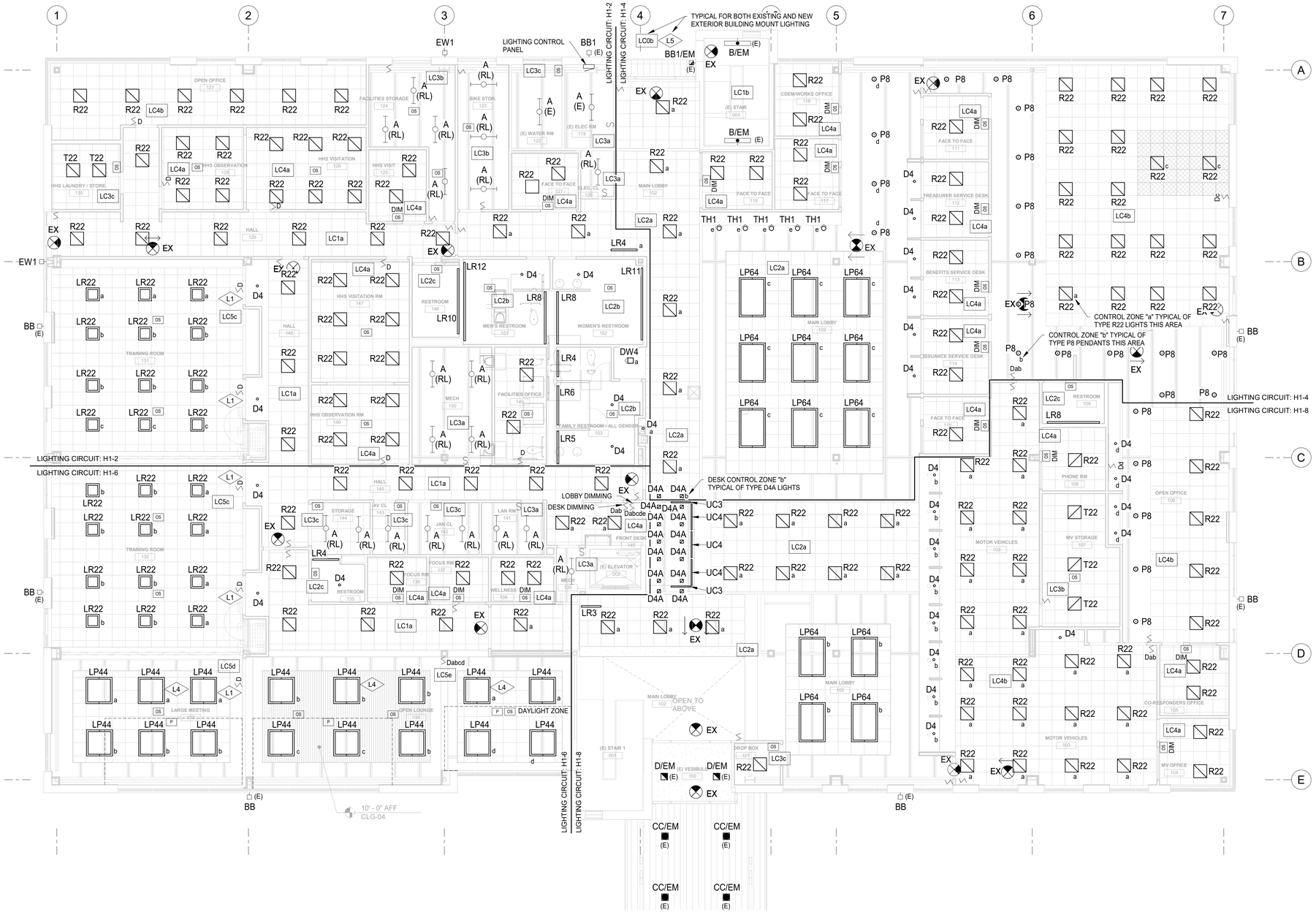
ABBREVIATIONS

+4'-6"	MOUNTING HEIGHT AFF	EPO	EMERGENCY POWER OFF	(R)	RELOCATED
A	AMPS	EWC	ELECTRIC WATER COOLER	(RR)	REMOVE & RELOCATE
AFCI	ARC FAULT CIRCUIT INTERRUPTER	F	FUSE OR FIRE	SPD	SURGE PROTECTIVE DEVICE
AFF	ABOVE FINISHED FLOOR	G	GROUND	ST	SHUNT TRIP
AFG	ABOVE FINISHED GRADE	GFCI	GROUND FAULT CIRCUIT INTERRUPTER	TR	TAMPER RESISTANT
AF	AMP FRAME	KV	KILOVOLT	TTB	TELEPHONE TERMINAL BOARD
AT	AMP TRIP	KVA	KILOVOLT-AMPERE	UC	UNDER CABINET
C	CONDUIT	KW	KILOWATT	UF	UNDER FLOOR
CT	CURRENT TRANSFORMER	MC	MECHANICAL CONTRACTOR	UG	UNDER GROUND
D	DEDICATED	N	NEUTRAL	UON	UNLESS OTHERWISE NOTED
(E)	EXISTING	(N)	NEW	V	VOLTS
EC	ELECTRICAL CONTRACTOR	NIC	NOT IN CONTRACT	WP	WEATHERPROOF
EM	EMERGENCY	ø OR PH	PHASE	WR	WEATHER RESISTANT

LIGHTING & LIGHTING CONTROL

(LETTER ADJACENT TO LUMINAIRE REFERS TO LUMINAIRE SCHEDULE; LOWER CASE LETTER INDICATES SWITCHING)

- SURFACE MOUNTED LUMINAIRE
- PENDANT MOUNTED LUMINAIRE
- RECESSED LUMINAIRE
- WALL MOUNTED LUMINAIRE
- PENDANT MOUNTED LINEAR LUMINAIRE
- SURFACE WALL WASH LUMINAIRE
- RECESSED WALL WASH LUMINAIRE
- STRIPLIGHT
- EXIT SIGN
- BATTERY PACK
- LUMINAIRE ON EMERGENCY CIRCUIT
- LIGHTING CONTROL PANEL
- P — PHOTOCELL/DAYLIGHT SENSOR
- TC — TIMECLOCK
- S — SWITCH (* INDICATES TYPE)
  - SINGLE POLE SWITCH
  - 3 — THREE-WAY SWITCH
  - 4 — FOUR-WAY SWITCH
  - D — DIMMER SWITCH
  - K — KEY OPERATED SWITCH
- LOW VOLTAGE SWITCH
- OS — OCCUPANCY/VACANCY SENSOR (ON/OFF)
- OS DIM — OCCUPANCY/VACANCY SENSOR (DIMMING)



1 LEVEL 01 - LIGHTING FLOOR PLAN
N.T.S.

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#	WORK NOTES
L1	PROVIDE TOUCHSCREEN CONTROL STATION FOR DIMMING CONTROL SYSTEM IN PARTITIONED TRAINING ROOMS AND LARGE MEETING ROOM. REFERENCE LIGHTING CONTROL MATRIX FOR ADDITIONAL INFORMATION.
L2	EXISTING ENTRY CHANDELIER SHALL BE CONTROL WITH THE FIRST FLOOR LOBBY LIGHTING CONTROL ZONE.
L3	MAKE ADJUSTMENT OR REPAIR EXISTING DOWNLIGHTS AT STAIR SO THAT TRIMS ARE INSTALLED FLUSH TO CEILING.
L4	MOUNT BOTTOM OF PENDANT LEVEL WITH BOTTOM OF CEILING IN THIS AREA.
L5	ALL EXISTING BUILDING MOUNT LIGHTING TYPE BB, BB1, BB1/EM, AND CC/EM, ALONG WITH NEW TYPE EW1 BUILDING MOUNT LIGHTING SHALL BE CONTROLLED AS ONE ZONE BY THE NEW LIGHTING CONTROL PANEL. EXISTING TIMECLOCK AND PHOTOCELL SHALL BE MAINTAIN FOR OTHER EXISTING EXTERIOR LIGHTING. UITLIZE EXISTING PHOTOCELL AS INPUT TO NEW LIGHTING CONTROL PANEL IF POSSIBLE, OR PROVIDE NEW.

GENERAL NOTES:

1. ALL FIXTURES ON FIRST LEVEL WITH LABEL "EM" SHALL BE FED BY PANEL 'HEM' CIRCUIT 2. ALL FIXTURES ON SECOND LEVEL WITH LABEL "EM" SHALL BE FED BY PANEL 'HEM' CIRCUIT 4.
2. ALL EXIT SIGNS SHALL BE FED BY PANEL 'HEM' CIRCUIT 6.

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LEVEL 01 - LIGHTING FLOOR PLAN

E-111

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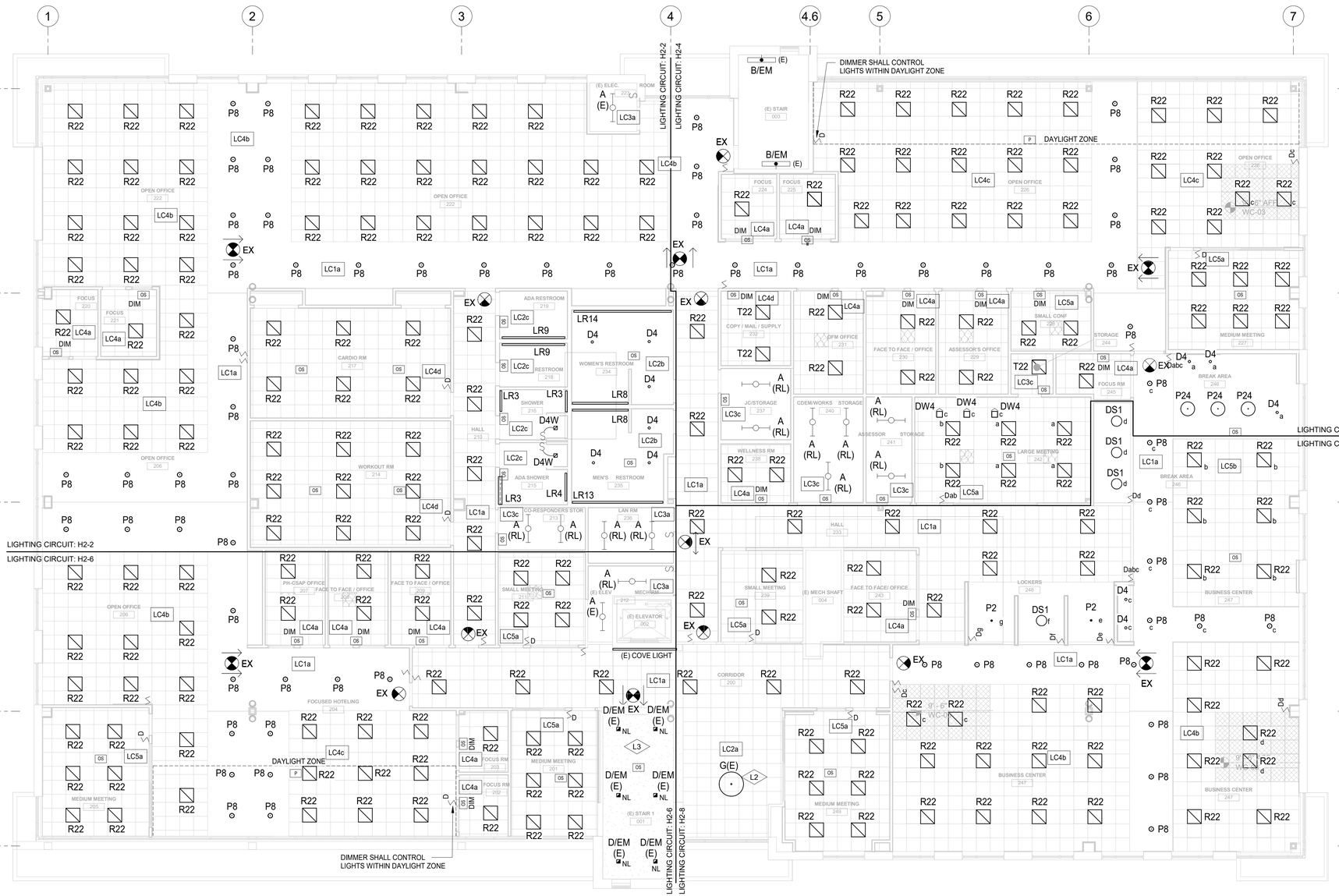
ABBREVIATIONS

+4'-6"	MOUNTING HEIGHT AFF	EPO	EMERGENCY POWER OFF	(R)	RELOCATED
A	AMPS	EWC	ELECTRIC WATER COOLER	(RR)	REMOVE & RELOCATE
AFCI	ARC FAULT CIRCUIT INTERRUPTER	F	FUSE OR FIRE	SPD	SURGE PROTECTIVE DEVICE
AFF	ABOVE FINISHED FLOOR	G	GROUND	ST	SHUNT TRIP
AFG	ABOVE FINISHED GRADE	GFCI	GROUND FAULT CIRCUIT INTERRUPTER	TR	TAMPER RESISTANT
AF	AMP FRAME	KV	KILOVOLT	TTB	TELEPHONE TERMINAL BOARD
AT	AMP TRIP	KVA	KILOVOLT-AMPERE	UC	UNDER CABINET
C	CONDUIT	KW	KILOWATT	UF	UNDER FLOOR
CT	CURRENT TRANSFORMER	MC	MECHANICAL CONTRACTOR	UG	UNDER GROUND
D	DEDICATED	N	NEUTRAL	UON	UNLESS OTHERWISE NOTED
(E)	EXISTING	(N)	NEW	V	VOLTS
EC	ELECTRICAL CONTRACTOR	NIC	NOT IN CONTRACT	WP	WEATHERPROOF
EM	EMERGENCY	ø OR PH	PHASE	WR	WEATHER RESISTANT

LIGHTING & LIGHTING CONTROL

(LETTER ADJACENT TO LUMINAIRE REFERS TO LUMINAIRE SCHEDULE; LOWER CASE LETTER INDICATES SWITCHING)

- SURFACE MOUNTED LUMINAIRE
- PENDANT MOUNTED LUMINAIRE
- RECESSED LUMINAIRE
- WALL MOUNTED LUMINAIRE
- PENDANT MOUNTED LINEAR LUMINAIRE
- SURFACE WALL WASH LUMINAIRE
- RECESSED WALL WASH LUMINAIRE
- STRIPLIGHT
- EXIT SIGN
- BATTERY PACK
- LUMINAIRE ON EMERGENCY CIRCUIT
- LIGHTING CONTROL PANEL
- P — PHOTOCELL/DAYLIGHT SENSOR
- TC — TIMECLOCK
- S — SWITCH (* INDICATES TYPE)
  - SINGLE POLE SWITCH
  - 3 — THREE-WAY SWITCH
  - 4 — FOUR-WAY SWITCH
  - D — DIMMER SWITCH
  - K — KEY OPERATED SWITCH
- LOW VOLTAGE SWITCH
- OS — OCCUPANCY/VACANCY SENSOR (ON/OFF)
- OS DIM — OCCUPANCY/VACANCY SENSOR (DIMMING)



1 LEVEL 02 - LIGHTING FLOOR PLAN
N.T.S.

#	WORK NOTES
L1	PROVIDE TOUCHSCREEN CONTROL STATION FOR DIMMING CONTROL SYSTEM IN PARTITIONED TRAINING ROOMS AND LARGE MEETING ROOM. REFERENCE LIGHTING CONTROL MATRIX FOR ADDITIONAL INFORMATION.
L2	EXISTING ENTRY CHANDELIER SHALL BE CONTROL WITH THE FIRST FLOOR LOBBY LIGHTING CONTROL ZONE.
L3	MAKE ADJUSTMENT OR REPAIR EXISTING DOWNLIGHTS AT STAIR SO THAT TRIMS ARE INSTALLED FLUSH TO CEILING.
L4	MOUNT BOTTOM OF PENDANT LEVEL WITH BOTTOM OF CEILING IN THIS AREA.
L5	ALL EXISTING BUILDING MOUNT LIGHTING TYPE BB, BB1, BB1/EM, AND CC/EM, ALONG WITH NEW TYPE EW1 BUILDING MOUNT LIGHTING SHALL BE CONTROLLED AS ONE ZONE BY THE NEW LIGHTING CONTROL PANEL. EXISTING TIMECLOCK AND PHOTOCELL SHALL BE MAINTAIN FOR OTHER EXISTING EXTERIOR LIGHTING. UITLIZE EXISTING PHOTOCELL AS INPUT TO NEW LIGHTING CONTROL PANEL IF POSSIBLE, OR PROVIDE NEW.

GENERAL NOTES:

1. ALL FIXTURES ON FIRST LEVEL WITH LABEL "EM" SHALL BE FED BY PANEL 'HEM' CIRCUIT 2. ALL FIXTURES ON SECOND LEVEL WITH LABEL "EM" SHALL BE FED BY PANEL 'HEM' CIRCUIT 4.
2. ALL EXIT SIGNS SHALL BE FED BY PANEL 'HEM' CIRCUIT 6.

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COLORADO REGISTERED
PETER C. DANTON
33293
11/19/21
PROFESSIONAL ENGINEER

PROJECT:
SOUTHEAST COUNTY SERVICE HUB
1755 S. PUBLIC RD
LAFAYETTE, CO 80026

PROJECT NO: 2007

ISSUE DATE	PHASE / REV NAME
11/19/21	CONSTRUCTION DOCUMENTS

LEVEL 02 - LIGHTING FLOOR PLAN

E-112

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