Lewis and Clark County, Montana
Invitation for Bids
Murray MAU Replacement

Notice is hereby given that the Board of County Commissioners of Lewis and Clark County, Montana is soliciting competitive bids from interested parties to replace the makeup air unit for a county-owned building that is operated as a health and medical facility.

The complete solicitation is available online at https://www.lccountymt.gov/Government/Grants-and-Purchasing/Bids-and-Proposals-Current. Questions related to this solicitation must be directed only to the designated point of contact for this solicitation: Jade Wills, Administrative Assistant II, jwills@lccountymt.gov. A cone of silence is established for this solicitation which prohibits any bidder, or entity with financial interest in the bid award, from communicating regarding the solicitation with any Lewis and Clark County elected official, employee, or agent other than the designated point of contact.

A pre-bid conference and tour will be held on Thursday, February 13, 2025 at 3:30 p.m. at the Michael A. Murray Building north entrance, 1930 9th Avenue, Helena, MT. Interested bidders are encouraged to attend.

The deadline for bids to be delivered to the Lewis and Clark County Commissioner's Office, located at the City-County Administrative Building, 316 North Park Avenue, Room 345, Helena, MT is on or before 4:00 PM local time on Monday, February 24, 2025. The sealed envelope containing the bid must be labeled, "Murray MAU Replacement Bid Enclosed." Bids received by this deadline will be unsealed publicly on Tuesday, February 25, 2024 beginning at 9:00 AM local time in Room 330 of the City-County Administrative Building. Late bids are not accepted.

All bids must be accompanied by a bid bond or other form of security as specified in Montana Code Annotated 18-1-203, payable to Lewis and Clark County, in an amount of no less than ten percent (10%) of the total bid. Bids received without the required bid security will be deemed nonresponsive.

The successful bidder shall furnish an approved performance bond and labor and materials payment bond each in the amount of one hundred percent (100%) of the contract amount.

Bids will be considered based on the most responsive and responsible bid submitted along with the following criteria: purchase price, product availability, delivery date, specifications, etc.

Insurances, permits, and licenses shall be obtained by the successful bidder and certificates of such shall be provided to Lewis and Clark County.

The contractor and any of the subcontractors bidding or doing work on this project will be required to be registered with the Montana Department of Labor and Industry. Forms and registration information are available from this agency. All workers employed by the contractor or subcontractors in performance of this contract shall be paid wages as required by the current Montana Prevailing Wage Rates. The contractor must ensure that employees and applicants for employment are not discriminated against because of their race, color, religion, sex or national origin.

Small business enterprises (SBE), minority business enterprises (MBE), women business enterprises (WBE), veteran businesses enterprises (VBE), and disadvantaged business enterprises (DBE) are encouraged to participate in this solicitation.

This Project is funded in whole or in part with a grant from the American Rescue Plan Act (ARPA). Award of the Project will be contingent upon the Contractor providing or establishing a Unique Entity Identification (UEI) and passing a suspension and debarment verification per the requirements of the Funding Agency Special Provisions in this bid package.

The County reserves the right to reject any or all bids received, to waive informalities, to postpone the solicitation for a period not to exceed 60 days, and to accept the bid that is in the best interest of the County. Bidders shall be bound to the terms and conditions listed in the solicitation.

This solicitation is being offered in accordance with federal and state statutes and county regulations governing procurement. Bids become the property of Lewis and Clark County. The County is not responsible for costs associated with preparing a bid.

Published in the Helena Independent Record on Saturday, February 1, 2025, and Saturday, February 8, 2025.

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Standard Terms and Conditions:

By submitting a bid to this Invitation for Bids, the Bidder agrees to acceptance of the following Standard Terms and Conditions and any other provisions that are specific to this solicitation.

1. Competition. Lewis and Clark County encourages free and open competition among bidders. Whenever possible, specifications, bid invitations, and conditions are designed to accomplish this objective, consistent with the necessity to satisfy the County's needs and accomplishment of a sound economical operation.

   The bidder's signature on this proposal guarantees that the prices quoted have been established without collusion with other eligible bidders and without effort to preclude Lewis and Clark County from obtaining the lowest possible competitive price.

   Prior to the Notice of Intent to Award, bids may be held by Lewis and Clark County for a period not to exceed 60 days from the date of the opening of bids for the purpose of reviewing bids and investigating the qualifications of the bidders.

2. Preparation of Bids. Bids will be written in ink and/or typewritten on the bid forms furnished herewith. Erasures and alterations must be initialed by the bidder in ink. No verbal bids shall be accepted. The bidder agrees that the bid shall be good and may not be withdrawn during the 60-day review period.

3. Bid Items. The bidder warrants articles offered to conform to the specifications herein requested, to be fit and sufficient for the purpose manufactured, of good material and workmanship, and free from defect.

4. Special Brands. Brand name items or descriptions used in this proposal are specified solely for the purpose of indicating standards of quality, performance, and/or use desired. Any bid offering goods or sources which deviate from the specifications must be clearly indicated by the bidder. Substitutions must be identified by the manufacturer and stock number and complete descriptive literature must be included with the bid. Goods delivered which do not conform to the contract terms, conditions, or specifications may be rejected and returned at the vendors' expense. Any bid for foreign produced products shall be so indicated and the source of supply noted for each item.

5. Packaging. Unless otherwise stipulated, no charges will be allowed for packing, wrapping, bags, containers, reels, etcetera. All items shall be packed in accordance with prevailing commercial practices and in such a manner as to ensure delivery in good condition and as specified herein.

6. Delivery/Shipping. Goods shall be prepaid, Free on Board (FOB) destination. In the event the contract terms specify FOB shipping point, shipping charges will be prepaid and itemized as a separate item on invoicing. Such shipments shall be via the least expensive common carrier unless otherwise stipulated. Lewis and Clark County reserves the right to reject Cash on Delivery (COD).

7. Warranty. Bidders agree to provide a warranty for product on offer and perform all warranty and maintenance services in a professional and timely manner and acknowledge that they will be liable for any breach of this warranty.

8. Cash Discount. Bidders may quote a cash discount, provided it is based on a period of 60 days or more. A shorter period will not be considered in determination of a low bid. Any cash discount as part of this contract will be computed from the date of receipt of a properly executed claim or the date of completion of delivery of all items in satisfactory condition, whichever is later.

9. Excise Taxes. Lewis and Clark County is exempt from federal excise taxes (FET). Exemption certificates will be furnished upon request.

10. Acceptance/Rejection of Bids. Lewis and Clark County reserves the right to accept or reject any or all bids, wholly or in part, and to make awards in any manner deemed in the best interest of the County.

11. All-or-None Proposals. Bidders may submit alternate proposals on an all-or-none basis but are required to submit a primary quotation on an item-by-item basis to be considered for either type of award.

12. Bid Determination. The basis of the award will be dependent on the most responsible bid submitted with consideration given to the following criteria:
    a. Purchase price;
    b. Warranty and/or maintenance agreement;
    c. Delivery date; and
    d. Analysis and comparison by the county with similar or related equipment.

13. Tabulation. In the event that a quotation is entered in which the unit price and extension do not agree, the unit price shall prevail.

14. Bid Proposal Worksheet. Bidders are required to complete all Bid Proposal Worksheets and must provide a detailed proposed specification packet with the bid. Any variance to specifications the bidder wishes to seek consideration for must be clearly stated in the section provided on the Bid Proposal Worksheet.

15. Nondiscrimination. In accordance with federal and state laws, the bidder agrees not to discriminate against any client, employee, or applicant for employment or for services because of race, creed, color, national origin, sex, or age with regard to, but not limited to, the following:
    a. Employment upgrading;
    b. Demotion or transfer;
    c. Recruitment or recruitment advertising;
    d. Lay-offs or terminations;
    i. Rates of pay or other forms of compensation;
    ii. Selection for training; or
    iii. Rendition of services.

    Bidders and the awardee shall comply with all federal, state, and local laws, rules and regulations. Bidders and the awardee and any of the Bidders' and the awardee's sub-grantees, contractors, subcontractors, successors, transferees, and assignees shall comply with Title VI of the Civil Rights Act of 1964, which prohibits recipients of federal financial assistance from excluding from a program or activity, denying benefits of, or otherwise

discriminating against a person on the basis of race, color, or national origin (42 U.S.C. § 2000d et seq.), as implemented by the Department of the Treasury's Title VI regulations, 31 CFR Part 22, which are herein incorporated by reference and made a part of this contract (or agreement). Title VI also includes protection to persons with "Limited English Proficiency" in any program or activity receiving federal financial assistance, 42 U.S.C. § 2000d et seq., as implemented by the Department of the Treasury's Title VI regulations, 31 CFR Part 22, which are herein incorporated by reference and made a part of this contract or agreement.

It is further understood that any vendor who is in violation of this clause shall be barred forthwith from receiving awards of any purchase from Lewis and Clark County unless a satisfactory showing is made that discriminatory practices have ceased, and the recurrence of such acts is unlikely.

16. OSHA and EPA Requirements. The equipment shall meet OSHA and EPA requirements and specifications on the date of the bid opening.

17. Bid Consideration. No bid will be considered unless accompanied by a bid bond, bank draft, money order, or certified check in the amount of not less than ten (10) percent of the total bid.

18. Public Inspection of Bids. Except as otherwise stated in these terms and conditions, all information received in response to this IFB is deemed public information and will be available for public viewing and copying after the Notice of Intent to Award is issued.

19. Trade Secrets. In order for a bidder to claim information is protected under Montana's Uniform Trade Secrets Act, a notarized Affidavit for Trade Secret Confidentiality shall be provided by the bidder's attorney acknowledging that material included in a bid is open to public inspection except for information that meets the provisions of Montana's Uniform Trade Secrets Act. Trade secrets contained in the bid must be clearly marked and separate from materials that are open for public inspection. Bidders must be prepared to pay all legal costs and fees associated with defending a claim for confidentiality in the event of a records request from another party.

20. Claims of Confidentiality and Personal Safety. In order for a Bidder to claim information is confidential and protected by law or a matter of personal safety, this information must be marked and separated from the materials that are open for public inspection. Clear reference to the laws that protect the information must be provided. No confidentiality material may be contained in the pricing or cost estimates. Contract provisions shall not be covered by claims of confidentiality or personal safety. Bidders will be solely responsible for all legal costs and fees associated with defending a claim for confidentiality and/or personal safety in the event of a records request from another party which the Bidder chooses to oppose. The Bidder will either totally assume all responsibility for the opposition of the request, and all liability and costs of any such defense, thereby defending, protecting, indemnifying, and saving harmless the County or the Bidder will immediately withdraw its opposition to the records request and permit the County to release the documents for examination. The County will inform the Bidder in writing of any open records request that is made, and the Bidder will have three working days from receipt of the notice to notify the County in writing whether the Bidder

opposes the request or not. Failure to provide that notice in writing will waive the claim of confidentiality and allow the County to treat the documents as a public record.

21. Cone of Silence. A cone of silence shall be established on all Lewis and Clark County formal solicitation processes. The cone of silence prohibits any communication regarding a formal solicitation between any bidder (or its agents or representatives) or other entity with the potential for a financial interest in the award (or their respective agents or representatives) and any Lewis and Clark County elected official, employee, or agent other than the designated point of contact for the solicitation.

    The cone of silence shall be in effect from the time of posting the formal solicitation on the County's website and until the County issues a Notice of Intent to Award, cancels the solicitation, or otherwise takes action to end the selection process.

    Violations of the cone of silence may be grounds for disqualification from the selection process. The cone of silence shall not apply to communications at any public proceeding or meeting.

22. Advanced Payments. Except as provided in law, provisions requiring payment by the County, fully or in part, for goods or services before receipt of such shall not be authorized.

23. Protest Procedure. A bidder aggrieved in connection with the solicitation or bid award may protest in accordance with the procedure outlined in the Lewis and Clark County procurement policy.

24. Nondiscrimination Against Firearm Entities/Trade Associations. Per Montana Code Annotated 30-20-301, a Bidder whose company has at least ten full-time employees and is awarded a contract with a value of at least $100,000 paid wholly or partly from public funds shall not have a practice, policy, guidance, or directive that discriminates against a firearm entity or firearm trade association, and the awarded Bidder shall not discriminate during the term of the contract against a firearm entity or firearm trade association.

Specific Terms and Conditions

1. Contractor Registration – Contractor shall be registered in order to bid on this Project. Registration shall be per Montana Code Annotated 39-9-201. All subcontractors whose portion of the work is over $2,500 will be required to submit proof of registration with the Department of Labor and Industry.

2. Permits – Contractor is responsible for obtaining all required permits for construction. Copies of permits must be provided to the Owner prior to demolition.

3. Montana Public Works Standard Specifications – All work shall be done in accordance with Montana Public Works Standard Specifications Seventh Edition (April 2021), and all subsequent addenda.

4. Contractor's Gross Receipts Tax – All contractors or subcontractors working on a public funded project are required to pay or have withheld from earnings one percent (1%) of the

gross contract price. This tax applies to public contracts of 80 thousand dollars ($80,000) and above.

5. Disposal – Contractor will be responsible for the safe disposal of all demolition materials including refrigeration unit.

Labor Requirements

All employees employed on the Project will be paid wages at rates as may be required by the laws of the State of Montana in accordance with Montana Prevailing Wage Rates for Building Construction 2025 established by the Montana Department of Labor and Industry.

Contractor must submit certified payrolls for all employees and employees of subcontractors within one week of issuing each respective payroll. Certified payrolls must be numbered sequentially and submitted on a weekly basis whether or not work was performed. If no work was performed, the Contractor should note this on the payroll.

Bond & Insurance Requirements

The successful Contractor shall furnish an approved Performance Bond and a Labor and Materials Payment Bond, each in the amount of one hundred percent (100%) of the contract amount.

Contractor agrees to maintain general liability insurance from an insurance carrier licensed to do business in the State of Montana in the amount of one million dollars ($1,000,000) for each occurrence (minimum) and two million dollars ($2,000,000.00) aggregate.

Contractor also agrees to maintain workers compensation insurance from an insurance carrier licensed to do business in the State of Montana. Proof of general liability and workers compensation insurance shall be provided prior to commencing Project. Lewis and Clark County must be listed as an additional insured on the general liability insurance certificate.

Examination of Specifications and Site of Work

Prospective Bidders shall make a careful examination of the site of the Project, improvements to be protected, disposal sites for surplus materials not designated to be salvaged materials, as to methods of providing ingress and egress to property and methods of handling traffic during construction of the entire Project.

Bidders, including both the General Contractor as well as Subcontractors are required, before submitting any proposal, to read all of the specifications, proposal, contract, and bond forms carefully, to visit the site of the work, to examine carefully the local conditions, to inform themselves of the difficulties to be encountered, and judge for themselves of the accessibility of the work, and all attending circumstances affecting the cost of the work, or time required to make an intelligent proposal.

No information given by the Owner or any officials thereof, other than that contained in the specifications, proposal, and other documents, shall be binding upon the Owner. Bidders shall rely upon their own estimates, investigations, tests, and other data which are necessary for full and complete information upon which the proposal may be based. It is mutually agreed that submission

of a proposal is evidence that the Bidder has made the examinations, he will enter into the usual contract with the Owner.

Pre-Bid Conference

A pre-bid conference will be held at the time and location stated in the invitation or advertisement to bid. Bidders are encouraged to attend and participate in the conference.

BID PROPOSAL WORKSHEET

Return To: Lewis and Clark County
Board of County Commissioners
316 N. Park Avenue, Room 345
Helena, MT 59623

Bids must be submitted no later than Monday, February 24, 2025 by 4:00 p.m. local time.

THE UNDERSIGNED BIDDER has become familiar with the Project solicited by Lewis and Clark County through the Specifications. The Bidder agrees to follow and abide by all laws required in the State of Montana and Lewis and Clark County. The Bidder, having satisfied himself of the Project, does submit the offer as follows:

THE BIDDER HEREBY PROPOSES AND AGREES, if this offer is accepted, to enter into a Contract and assumes all obligations, duties, and responsibilities specified herein for the following unit prices and lump sum.

BASE BID

ITEM #	ITEM DESCRIPTION	TOTAL
1	Project as shown in the drawings and specifications, less balancing the outlets from the unit within the building. Only the inlets and outlets of the unit shall be balanced.	$
BID PRICE WRITTEN IN WORDS:		

ADDITIVE ALTERNATE #1

ITEM #	ITEM DESCRIPTION	TOTAL
1	Unit shall be balanced the schedule values and all associated outlets within the building including both GRD's and duct connections to individual fan coils.	$
BID PRICE WRITTEN IN WORDS:		

Earliest Possible Start Date: _____

Number of Construction Days: _____

BID PROPOSAL WORKSHEET

THE UNDERSIGNED BIDDER HEREBY CERTIFIES THAT:

1. This offer is genuine and is not made in the interest of, or on the behalf of, any undisclosed person or firm, and is not submitted as a result of any agreement with any association, corporation, or group.

2. The Bidder has not directly or indirectly induced or solicited any other bidder to put in a false or sham offer.

3. The Bidder has not solicited or induced any person or firm to refrain from bidding.

4. The Bidder has not sought by collusion to obtain any advantage over any other bidder or over Lewis and Clark County.

5. The Bidder, their material suppliers, sub-contractors, etc. has visited the site of the work and has carefully examined the entire set of Contract documents pertaining to the work covered by the above bid.

Business Legal Name: _____ Phone: _____

Contact Person: _____ E-Mail: _____

Address: _____ Federal Tax ID#: _____

City, State, Zip: _____ Federal UEI #: _____

Contractor Reg. #: _____

Signature of authorized company official approving the bid as submitted:

Name: _____

Title: _____

Date: _____

_____

Authorized Company Official Signature

_____

Notary Signature

(Notary Seal)

LEWIS AND CLARK COUNTY
INDEPENDENT CONTRACTOR CONTRACT

This Contract is entered into by and between Lewis and Clark County, Montana, herein referred to as "COUNTY", and Company Name, herein referred to as "CONTRACTOR", whose address is Street, City, State, Zip Code; phone number is (XXX) XXX-XXXX; Montana Contractor Registration Number is XXXXXX; and Federal Employee Identification Number is XX-XXXXXX.

THE PARTIES AGREE AS FOLLOWS:

1. SCOPE OF SERVICES: CONTRACTOR agrees to complete and perform the work or services in accordance with the solicitation, plans, and specifications attached and hereby incorporated as **Exhibit X**.

2. INDEPENDENT CONTRACTOR: COUNTY hereby employs CONTRACTOR as an independent contractor to complete and perform the scope of services. It is understood by the parties hereto that CONTRACTOR is an independent CONTRACTOR and that neither its principals nor its employees, if any, are employees of COUNTY for purposes of tax, retirement system, or social security (FICA) withholding. It is further understood that pursuant to section 39-71-401, MCA, CONTRACTOR has obtained, and shall maintain at its expense for the duration of this Contract, coverage in a workers' compensation plan for its principals and employees for the services to be performed hereunder. COUNTY shall not have control over the performance of this Contract by CONTRACTOR or its employees, except to specify the time and place of performance. No changes to key personnel may be made by CONTRACTOR without consent of COUNTY. COUNTY shall not be responsible for security or protection of CONTRACTOR'S supplies or equipment.

3. WARRANTY: CONTRACTOR warrants that all services shall be performed in a professional manner. CONTRACTOR acknowledges that it shall be liable for any breach of this warranty for a period of one (1) year from the time services are completed.

4. LIAISON: COUNTY's designated liaison with CONTRACTOR is Officer's Name, Officer's Title or their designee. CONTRACTOR's designated liaison with COUNTY is Name of Individual in Company.

5. EFFECTIVE DATE AND TIME OF PERFORMANCE: CONTRACTOR shall commence work *[a]* by Month Day, Year *or [b]* upon approval of this Contract by both parties and shall complete the described work by Month Day, Year.

6. COMPENSATION: For the satisfactory completion of the scope services, COUNTY shall pay CONTRACTOR time and materials for a total sum not to exceed Amount of Dollars/Cents ($X,XXX.XX). CONTRACTOR shall submit *[a]* monthly *[b]* quarterly *or [c]* final invoices to COUNTY based on **Exhibit X**, Schedule of Billing Rates. COUNTY shall pay invoices within 30 days of invoice date. Additionally, COUNTY shall withhold at least one thousand dollars ($1,000.00) of the total Contract price pursuant to section 18-2-404 (2), MCA, until the

termination of this Contract, but may not withhold more than five percent (5%) of the total Contract price pursuant to section 18-2-316, MCA, if CONTRACTOR is performing by the terms of this Contract.

7. CONFLICT OF INTEREST: CONTRACTOR covenants that it presently has no interest and shall not acquire any interest, direct or indirect, in the project, which would conflict in any manner or degree with the performance of its services hereunder. CONTRACTOR further covenants that in performing this Contract it shall employ no person who has such interest.

8. MODIFICATION AND ASSIGNABILITY OF CONTRACT: This Contract contains the entire agreement between the parties, and no statements, promises, or inducements made by either party, or agents of either party, which are not contained in the written Contract, are valid or binding. This Contract may not be enlarged, modified or altered except upon written agreement signed by both parties hereto. CONTRACTOR may not subcontract or assign its rights, including the right to compensation, or duties arising hereunder without the prior written consent of COUNTY. Any subcontractor or assignee shall be bound by all of the terms and conditions of this Contract.

9. OWNERSHIP AND PUBLICATION OF MATERIALS: All reports, information, data, and other materials prepared by CONTRACTOR pursuant to this Contract are the property of COUNTY which has the exclusive and unrestricted authority to release, publish or otherwise use, in whole or part, information relating thereto. Any reuse without written verification or adaptation for the specific purpose intended shall be at the COUNTY 's sole risk and without liability or legal exposure to CONTRACTOR. No material produced in whole or in part under this Contract may be copyrighted or patented in the United States or in any other country without the prior written approval of COUNTY.

10. INDEMNIFICATION: CONTRACTOR waives all claims and recourse against COUNTY, including the right of contribution for loss and damage to persons or property arising from, growing out of, or in any way connected with or incidental to CONTRACTOR's performance of this Contract except for liability arising out of concurrent or sole negligence of COUNTY or its officers, agents or employees. Further, CONTRACTOR shall indemnify, hold harmless, and defend COUNTY against all claims, demands, damages, costs, expenses or liability arising out of CONTRACTOR's negligent performance of this Contract except for liability arising out of the concurrent or sole negligence of COUNTY or its officers, agents or employees.

11. INSURANCE: CONTRACTOR shall maintain general liability insurance from an insurance carrier licensed to do business in the State of Montana in the amount of one million dollars ($1,000,000.00) for each occurrence (minimum) and two million dollars ($2,000,000.00) aggregate. CONTRACTOR also agrees to maintain workers compensation insurance from an insurance carrier licensed to do business in the State of Montana. Proof of general liability and workers compensation insurance shall be provided to COUNTY prior to commencing work under this Contract. COUNTY must be listed as an additional insured on the general liability insurance certificate for this Contract.

    CONTRACTOR shall provide sufficient Performance Bond or an irrevocable letter of credit,

drawn or issued by any federal or state-chartered bank or savings and loan association that is insured by or for which insurance administered by the federal deposit insurance corporation or a credit union insured by the national credit union share insurance fund in an amount equal to one hundred percent (100%) of the approximate total amount guaranteeing the full and faithful execution of the work and performance of the Contract.

CONTRACTOR shall provide a good and sufficient Payment Bond or an irrevocable letter of credit, drawn on or issued by any federally or state-chartered bank or savings and loan association that is insured by or for which insurance administered by the federal deposit insurance corporation or a credit union insured by the national credit union share insurance fund in an amount equal to one hundred percent (100%) of the approximate total amount guaranteeing the full and proper protection of all claimant's supplying labor and materials in the execution of the work provided for and for the use of each such claimant.

12. COMPLIANCE WITH LAWS: CONTRACTOR shall comply with applicable federal, state, and local laws, rules and regulations. CONTRACTOR or subcontractors doing work on this project shall be required to obtain registration with the Montana Secretary of State's Office and the Montana Department of Labor and Industry. CONTRACTOR is responsible for obtaining any and all permits required to perform the Contract.

13. NONDISCRIMINATION: CONTRACTOR shall not discriminate against any employee or applicant for employment on the basis of race, color, religion, creed, political ideas, sex, age, marital status, physical or mental disability, national origin, or sexual orientation.

14. MONTANA PREVAILING WAGE: All employees employed by CONTRACTOR or their subcontractor(s) in performance of this Contract which exceeds twenty-five thousand dollars ($25,000.00) will be paid wages at rates as may be required by the laws of the State of Montana in accordance with the schedule of Montana Prevailing Wage Rates established by the Montana Department of Labor and Industry. Rates applicable to this Contract are attached as **Exhibit X** and, by this reference, made part of this Contract.

    Each CONTRACTOR (Prime and sub) must submit (through the prime CONTRACTOR) certified payrolls for each week from the time the project begins through completion. Certified payrolls must be numbered sequentially and submitted on a weekly basis whether or not work was performed. If no work was performed, CONTRACTOR shall note this on the payroll.

15. PREFERENCE: CONTRACTOR unequivocally agrees to give preference to the employment of bona fide Montana residents in compliance with MCA 18-2-403 (1). Pursuant to MCA 18-2-409, except for projects involving the expenditure of federal aid funds or where residency preference laws are specifically prohibited by federal law, the CONTRACTOR shall ensure that at least 50% of the workers of the CONTRACTOR (including workers employed by subcontractors) working on the project shall be bona fide Montana residents.

16. SPECIAL FUEL TAX: ***This Section only applies if CONTRACTOR is doing work pertaining to a public road.*** As stated in the Montana Codes Annotated (MCA) 15-70-403(8-9), fuels

used by CONTRACTOR and their subcontractor(s) in connection with any work performed under contracts pertaining to the construction, reconstruction, or improvement of a highway or street and its appurtenances awarded by any public agencies, including federal, state, county, municipal or other political subdivisions, must be fuel on which Montana fuel tax has been paid.

17. PLACE OF PERFORMANCE, CONSTRUCTION, AND VENUE: Performance of this Contract is in Lewis and Clark County, Montana and venue for any litigation arising from performance of this Contract is the 1st Judicial District in and for the County of Lewis and Clark, State of Montana. This Contract shall be construed under and governed by the laws of the State of Montana.

18. ATTORNEY FEES: Should either party be required to resort to litigation, arbitration, or mediation to enforce the terms of this Contract, the prevailing party, whether plaintiff or defendant, shall be entitled to costs, including reasonable attorney's fees and expert witness fees. If the court, arbitrator, or mediator awards relief to both parties, each party shall bear its own costs in their entirety.

19. FAILURE TO PERFORM: Upon any material default or substantial failure to perform this Contract by either party, the other party shall be entitled to the following remedy:
    a. Stop performing or accepting performance of the work until the matter is resolved;
    b. Within a reasonable time of discovery of the defect or failure to perform, provide the other party with a written description of the defect or failure, and:
        i. If the defect or failure to perform can be cured, demand specific remedial action within a reasonable time certain; or
        ii. If the defect or failure to perform cannot be cured, specify any alternative performance which would be acceptable in lieu of the required performance and a time within which the alternative performance shall be required; or
        iii. If the defect or failure to perform cannot be cured and no reasonable alternative performance is acceptable, notify the other party of the termination of the Contract as of a date certain and state therein whether an action for breach of the Contract will be brought.
        iv. Where appropriate, obtain completion of the performance of the remaining balance of the Contract within the original party.
    c. If the defect or failure to perform is not corrected or alternative performance completed within the time certain specified, the party alleging breach may initiate an action in the 1st Judicial District in and for the County of Lewis and Clark, State of Montana. If an action is brought, the prevailing party shall be entitled to attorney's fees as well as other costs of suit.

20. TERMINATION: Either party may terminate this Contract upon thirty (30) days written notice to the other party. If this Contract is terminated prior to completion, COUNTY shall pay CONTRACTOR for completed and accepted work within thirty (30) days of termination. CONTRACTOR shall not be entitled to payment for incomplete or unacceptable work.

COUNTY:

Date: _____

_____
Candace Payne, Chair
Board of County Commissioners
Lewis and Clark County

ATTEST:

_____
Amy Reeves, Clerk and Recorder

(Seal)

CONTRACTOR:

Date: _____

_____
Individual's Name
Individual's Title Within the Company
Company's Name

State of _____

County of _____

This instrument was acknowledged before me on _____ (date) by Individual's Name as Individual's Title Within the Company of Company's Name.

_____
(Signature of Notarial Officer)

(Seal)

EXHIBIT A

FUNDING AGENCY SPECIAL PROVISIONS

EXHIBIT A

The contract to which this addendum is attached is made using federal assistance provided to Lewis and Clark County by the US Department of Treasury under the American Rescue Plan Act ("ARPA"), Sections 602(b) and 603(b) of the Social Security Act, Pub. L. No. 117-2 (March 11, 2021).

The following terms and conditions apply to the CONTRACTOR, as a contractor of Lewis and Clark County, according to the County's Award Terms and Conditions signed on June 15, 2021; by ARPA and its implementing regulations; and as established by the Treasury Department.

1. **Equal Opportunity.** CONTRACTOR shall comply with Executive Order 11246, "Equal Employment Opportunity," as amended by EO 11375, "Amending Executive Order 11246 Relating to Equal Employment Opportunity," and as supplemented by regulations at 41 CFR part 60, "Office of Federal Contract Compliance Programs, Equal Employment Opportunity, Department of Labor."

2. **Minority and Women Business Enterprises.** CONTRACTOR hereby agrees to comply with the following when applicable: The requirements of Executive Orders 11625 and 12432 (concerning Minority Business Enterprise), and 12138 (concerning Women's Business Enterprise), *when applicable.* Accordingly, CONTRACTOR hereby agrees to take affirmative steps to assure that women and minority businesses are utilized when possible as sources of supplies, equipment, construction and services. Affirmative steps shall include the following:
    a. Including qualified women's business enterprises and small and minority businesses on solicitation lists;
    b. Assuring that women's enterprises and small and minority businesses are solicited whenever they are potential sources;
    c. When economically feasible, dividing total requirements into smaller tasks or quantities so as to permit maximum participation by small and minority business, and women's business enterprises;
    d. Where the requirement permits, establishing delivery schedules which will encourage participation by women's business enterprises and small and minority business;
    e. Using the services and assistance of the Small Business Administration, and the U.S. Office of Minority Business Development Agency of the Department of Commerce; and
    f. If any subcontracts are to be let, requiring the prime Contractor to take the affirmative steps in a through e above.

    For the purposes of these requirements, a Minority Business Enterprise (MBE) is defined as an enterprise that is at least 51 percent owned and controlled in its daily operation by members of the following groups: Black, Hispanic, Asian or Pacific Islander, American Indian, or Alaskan Natives. A Women Business Enterprise (WBE) is defined as an enterprise that is at least 51 percent owned and controlled in its daily operation by women.

3. **Suspension and Debarment.** This contract is a covered transaction for purposes of 2 CFR pt. 180 and 2 CFR pt. 3000. As such, the CONTRACTOR is required to verify that none of CONTRACTOR's principals (defined at 2 CFR § 180.995) or its affiliates (defined at 2 CFR § 180.905) are excluded (defined at 2 CFR § 180.940) or disqualified (defined at 2 CFR § 180.935).

The CONTRACTOR must comply with 2 CFR pt. 180, subpart C and 2 CFR pt. 3000, subpart C, and must include a requirement to comply with these regulations in any lower tier covered transaction it enters into.

This certification is a material representation of fact relied upon by Lewis and Clark County. If it is later determined that the CONTRACTOR did not comply with 2 CFR pt. 180, subpart C and 2 CFR pt. 3000, subpart C, in addition to remedies available to the County, the Federal Government may pursue available remedies, including but not limited to suspension and/or debarment.

The CONTRACTOR agrees to comply with the requirements of 2 CFR pt. 180, subpart C and 2 CFR pt. 3000, subpart C while this offer is valid and throughout the period of any contract that may arise from this offer. The CONTRACTOR further agrees to include a provision requiring such compliance in its lower tier covered transactions.

4. **Byrd Anti-Lobbying Amendment, 31 U.S.C. § 1352, as amended*.** CONTRACTOR certifies that it will not and has not used Federal appropriated funds to pay any person or organization for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, officer or employee of Congress, or an employee of a Member of Congress in connection with obtaining any Federal contract, grant, or any other award covered by 31 U.S.C. § 1352. CONTRACTOR shall also disclose any lobbying with non-Federal funds that takes place in connection with obtaining any Federal award. Such disclosures are forwarded from tier to tier up to the recipient who in turn will forward the certification(s) to the awarding agency.

   *Purchases over $100,000 - CONTRACTOR must sign the certification on the last page of this exhibit.

5. **Access to Records.** The CONTRACTOR agrees to provide the Lewis and Clark County, the U.S. Department of Treasury, the Comptroller General of the United States, or any of their authorized representatives access to any books, documents, papers, and records of the CONTRACTOR which are directly pertinent to this contract for the purposes of making audits, examinations, excerpts, and transcriptions. The CONTRACTOR agrees to permit any of the foregoing parties to reproduce by any means or to copy excerpts and transcriptions as reasonably needed and agrees to cooperate with all such requests.

   The CONTRACTOR agrees to provide the Treasury Department or authorized representatives access to construction or other work sites pertaining to the work being completed under the contract.

   No language in this contract is intended to prohibit audits or internal reviews by the Treasury Department or the Comptroller General of the United States.

6. **Rights to Inventions Made Under a Contract or Agreement.** Contracts or agreements for the performance of experimental, developmental, or research work shall provide for the rights of the Federal Government and the recipient in any resulting invention in accordance with 37 CFR part 401, "Rights to Inventions Made by Nonprofit Organizations and Small Business Firms Under Government Grants, Contracts and Cooperative Agreements," and any applicable implementing regulations.

7. **Contract Work Hours and Safety Standards Act (40 U.S.C. 327 through 333). (Applies**

only to purchases over $100,000, when laborers or mechanics are used.) Where applicable, all contracts in excess of $100,000 that involve the employment of mechanics or laborers shall include a provision for compliance with 40 U.S.C. 3702 and 3704 of the Contract Work Hours and Safety Standards Act, as supplemented by Department of Labor regulations (29 CFR part 5). Under Section 3702 of the Act, each contractor shall be required to compute the wages of every mechanic and laborer on the basis of a standard workweek of 40 hours. Work in excess of the standard workweek is permissible provided that the worker is compensated at a rate of not less than 1 1/2 times the basic rate of pay for all hours worked in excess of 40 hours in the workweek. The requirements of 40 U.S.C. 3704 are applicable to construction work and provides that no laborer or mechanic shall be required to work in surroundings or under working conditions which are unsanitary, hazardous or dangerous. These requirements do not apply to the purchases of supplies or materials or articles ordinarily available on the open market, or contracts for transportation or transmission of intelligence.

8. **Clean Air Act & Federal Water Pollution Control Act. (applies to purchases of more than $150,000.).** The CONTRACTOR agrees to comply with all applicable standards, orders or regulations issued pursuant to the Clean Air Act, as amended, 42 U.S.C. § 7401 et seq.

   The CONTRACTOR agrees to comply with all applicable standards, orders, or regulations issued pursuant to the Federal Water Pollution Control Act, as amended, 33 U.S.C. 1251 et seq.

   The CONTRACTOR agrees to report each violation of the Clean Air Act and the Water Pollution Control Act to the Lewis and Clark County and understands and agrees that the County will, in turn, report each violation as required to assure notification to the Federal Emergency Management Agency, and the appropriate Environmental Protection Agency Regional Office.

   CONTRACTOR agrees to include these requirements in each subcontract exceeding $150,000 financed in whole or in part with Federal assistance.

9. **Prohibition on certain telecommunications and video surveillance services or equipment (Huawei and ZTE).** CONTRACTOR is prohibited from obligating or expending loan or grant funds to:
   a. Procure or obtain;
   b. Extend or renew a contract to procure or obtain; or
   c. Enter into a contract (or extend or renew a contract) to procure or obtain equipment, services, or systems that uses covered telecommunications equipment or services as a substantial or essential component of any system, or as critical technology as part of any system. As described in Public Law 115–232, section 889, covered telecommunications equipment is telecommunications equipment produced by Huawei Technologies Company or ZTE Corporation (or any subsidiary or affiliate of such entities).
      i. For the purpose of public safety, security of government facilities, physical security surveillance of critical infrastructure, and other national security purposes, video surveillance and telecommunications equipment produced by Hytera Communications Corporation, Hangzhou Hikvision Digital Technology Company, or Dahua Technology Company (or any subsidiary or affiliate of such entities).

ii. Telecommunications or video surveillance services provided by such entities or using such equipment.
iii. Telecommunications or video surveillance equipment or services produced or provided by an entity that the Secretary of Defense, in consultation with the Director of the National Intelligence or the Director of the Federal Bureau of Investigation, reasonably believes to be an entity owned or controlled by, or otherwise connected to, the government of a covered foreign country.

10. **Procurement of Recovered Materials: (applies only if the work involves the use of materials).** In the performance of this contract, the CONTRACTOR shall make maximum use of products containing recovered materials that are EPA-designated items unless the product cannot be acquired:
    a. Competitively within a timeframe providing for compliance with the contract performance schedule;
    b. Meeting contract performance requirements; or
    c. At a reasonable price.

    Information about this requirement, along with the list of EPA- designated items, is available at EPA's Comprehensive Procurement Guidelines web site, https://www.epa.gov/smm/comprehensive- procurement-guideline-cpg-program.

    The CONTRACTOR also agrees to comply with all other applicable requirements of Section 6002 of the Solid Waste Disposal Act.

11. **Publications.** Any publications produced with funds from this award must display the following language: "This project [is being] [was] supported, in whole or in part, by federal award number SLFRP4035 awarded to Lewis and Clark County by the U.S. Department of the Treasury."

12. **Increasing Seat Belt Use in the United States.** Pursuant to Executive Order 13043, 62 FR 19217 (Apr. 18, 1997), CONTRACTOR is encouraged to adopt and enforce on-the-job seat belt policies and programs for your employees when operating company-owned, rented or personally owned vehicles.

13. **Reducing Text Messaging While Driving.** Pursuant to Executive Order 13513, 74 FR 51225 (Oct. 6, 2009), CONTRACTOR is encouraged to adopt and enforce policies that ban text messaging while driving and establish workplace safety policies to decrease accidents caused by distracted drivers.

14. **Title VI of the Civil Rights Act of 1964 – Protections to persons with Limited English Proficiency.** The CONTRACTOR and any of the CONTRACTOR's sub-grantees, contractors, subcontractors, successors, transferees, and assignees shall comply with Title VI of the Civil Rights Act of 1964, which prohibits recipients of federal financial assistance from excluding from a program or activity, denying benefits of, or otherwise discriminating against a person on the basis of race, color, or national origin (42 U.S.C. § 2000d et seq.), as implemented by the Department of the Treasury's Title VI regulations, 31 CFR Part 22, which are herein incorporated by reference and made a part of this contract (or agreement). Title VI also includes protection to persons with "Limited English Proficiency" in any program or activity receiving federal financial assistance, 42 U.S.C. § 2000d et seq., as implemented by the Department of the Treasury's Title VI regulations, 31 CFR Part 22,

which are herein incorporated by reference and made a part of this contract or agreement.

15. **Drug-Free Workplace.** The Drug-Free Workplace Act of 1988 (41 U.S.C. § 701 et seq.) requires that all organizations receiving grants from any Federal agency agree to maintain a drug-free workplace. You as the recipient must comply with drug-free workplace requirements in Subpart B (or Subpart C, if the recipient is an individual) of part 382, which adopts the Governmentwide implementation (2 CFR §182) of sec. 5152-5158 of the Drug-Free Workplace Act of 1988 (Pub. L. 100-690, Title V, Subtitle D; 41 U.S.C. 701-707). By signing the application, the AOR agrees that the recipient will provide a drug-free workplace and will comply with the requirement to notify SAMHSA if an employee is convicted of violating a criminal drug statute. Failure to comply with these requirements may be cause for debarment. Government wide requirements for Drug-Free Workplace for Financial Assistance are found in 2 CFR § 182; HHS implementing regulations are set forth in 2 CFR § 382.400.

16. **Mandatory Disclosures.** Consistent with 45 CFR § 75.113, applicants and recipients must disclose in a timely manner, in writing to the COUNTY, all information related to violations, or suspected violations, of Federal criminal law involving fraud, bribery, or gratuity violations potentially affecting the Federal award. Subrecipients must disclose, in a timely manner, in writing to the COUNTY all information related to violations, or suspected violations, of Federal criminal law involving fraud, bribery, or gratuity violations potentially affecting the Federal award. Failure to make required disclosures can result in any of the remedies described in 45 CFR § 75.371 – Remedies for noncompliance, including suspension or debarment (see 2 CFR §§ 180 & 376 and 31 U.S.C. 3321).

17. **Trafficking Victims Protection Act of 2000 (22 U.S.C. 7104(G)), as amended, and 2 CFR § 175.** The Trafficking Victims Protection Act of 2000 authorizes termination of financial assistance provided to a private entity, without penalty to the Federal government, if the recipient or subrecipient engages in certain activities related to trafficking in persons. SAMHSA may unilaterally terminate this award, without penalty, if a private entity recipient, or a private entity subrecipient, or their employees:

    a) Engage in severe forms of trafficking in persons during the period of time that the award is in effect;

    b) Procure a commercial sex act during the period of time that the award is in effect; or,

    c) Use forced labor in the performance of the award or subawards under the award.

- This form is required only for purchases of more than $100,000 -

31 CFR Part 21 – New Restrictions on Lobbying - CERTIFICATION REGARDING LOBBYING

The undersigned certifies, to the best of their knowledge and belief, that:

1. No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of an agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

2. If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.

3. The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all contractors shall certify and disclose accordingly.

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

The CONTRACTOR certifies or affirms the truthfulness and accuracy of each statement of its certification and disclosure, if any. In addition, the CONTRACTOR understands and agrees that the provisions of 31 U.S.C. Ch. 38, Administrative Remedies for False Claims and Statements, apply to this certification and disclosure, if any.

_____ Date: _____

Signature of CONTRACTOR's
authorized official

_____

(Print name of person signing above)

_____

(Print title of person signing above)

EXHIBIT B

PREVAILING WAGE RATES

MONTANA
PREVAILING WAGE RATES FOR BUILDING CONSTRUCTION SERVICES 2025

Effective: January 11, 2025

Greg Gianforte, Governor
State of Montana

Sarah Swanson, Commissioner
Department of Labor & Industry

To obtain copies of prevailing wage rate schedules, or for information relating to public works projects and payment of prevailing wage rates, visit ESD at erd.dli.mt.gov/labor-standards or contact:

Employment Standards Division
Montana Department of Labor and Industry
P. O. Box 8011
Helena, MT 59604
Phone 406-444-6543

The department welcomes questions, comments, and suggestions from the public. In addition, we'll do our best to provide information in an accessible format, upon request, in compliance with the Americans with Disabilities Act.

MONTANA PREVAILING WAGE REQUIREMENTS

The Commissioner of the Department of Labor and Industry, in accordance with Sections 18-2-401 and 18-2-402 of the Montana Code Annotated (MCA), has determined the standard prevailing rate of wages for the occupations listed in this publication.

The wages specified herein control the prevailing rate of wages for the purposes of Section 18-2-401, et seq., MCA. It is required each employer pay (as a minimum) the rate of wages, including fringe benefits, travel allowance, zone pay and per diem applicable to the district in which the work is being performed as provided in the attached wage determinations.

All Montana Prevailing Wage Rates are available on the internet at https://erd.dli.mt.gov/labor-standards/state-prevailing-wage-rates or by contacting the department at (406) 444-6543.

In addition, this publication provides general information concerning compliance with Montana's Prevailing Wage Law and the payment of prevailing wages. For detailed compliance information relating to public works contracts and payment of prevailing wage rates, please consult the regulations on the internet at erd.dli.mt.gov/labor-standards or contact the department at (406) 444-6543.

SARAH SWANSON
Commissioner
Department of Labor and Industry
State of Montana

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MONTANA PREVAILING WAGE REQUIREMENTS:

WAGE RATES:

A. Date of Publication January 13, 2025

B. Definition of Building Construction

For the purposes of Prevailing Wage, the Commissioner of Labor and Industry has determined that building construction occupations are defined to be those performed by a person engaged in a recognized trade or craft, or any skilled, semi-skilled, or unskilled manual labor related to the construction, alteration, or repair of a public building or facility, and does not include engineering, superintendence, management, office or clerical work.

The Administrative Rules of Montana (ARM), 24.17.501(2) – 2(c), states *"Building construction projects generally are the constructions of sheltered enclosures with walk-in access for housing persons, machinery, equipment, or supplies. It includes all construction of such structures, incidental installation of utilities and equipment, both above and below grade level, as well as incidental grading, utilities and paving.*

Examples of building construction include, but are not limited to, alterations and additions to buildings, apartment buildings (5 stories and above), arenas (closed), auditoriums, automobile parking garages, banks and financial buildings, barracks, churches, city halls, civic centers, commercial buildings, court houses, detention facilities, dormitories, farm buildings, fire stations, hospitals, hotels, industrial buildings, institutional buildings, libraries, mausoleums, motels, museums, nursing and convalescent facilities, office buildings, out-patient clinics, passenger and freight terminal buildings, police stations, post offices, power plants, prefabricated buildings, remodeling buildings, renovating buildings, repairing buildings, restaurants, schools, service stations, shopping centers, stores, subway stations, theaters, warehouses, water and sewage treatment plants (buildings only), etc."

C. Definition of Public Works Contract

Section 18-2-401(11)(a), MCA defines "public works contract" as *"…a contract for construction services let by the state, county, municipality, school district, or political subdivision or for nonconstruction services let by the state, county, municipality, or political subdivision in which the total cost of the contract is in excess of $25,000…"*.

D. Prevailing Wage Schedule

This publication covers only Building Construction occupations and rates. These rates will remain in effect until superseded by a more current publication. Current prevailing wage rate schedules for Heavy Construction, Highway Construction, and Nonconstruction Services occupations can be found on the internet at https://erd.dli.mt.gov/labor-standards/state-prevailing-wage-rates/ or by contacting the department at (406) 444-6543.

E. Rates to Use for Projects

ARM, 24.17.127(1)(c), states *"The wage rates applicable to a particular public works project are those in effect at the time the bid specifications are advertised."*

F. Wage Rate Adjustments for Multiyear Contracts

Section 18-2-417, MCA states:

"(1) Any public works contract that by the terms of the original contract calls for more than 30 months to fully perform must include a provision to adjust, as provided in subsection (2), the standard prevailing rate of wages to be paid to the workers performing the contract.

(2) The standard prevailing rate of wages paid to workers under a contract subject to this section must be adjusted 12 months after the date of the award of the public works contract. The amount of the adjustment must be a 3% increase. The adjustment must be made and applied every 12 months for the term of the contract.

(3) Any increase in the standard rate of prevailing wages for workers under this section is the sole responsibility of the contractor and any subcontractors and not the contracting agency."

G. Fringe Benefits

Section 18-2-412, MCA states:

"(1) To fulfill the obligation…a contractor or subcontractor may:

(a) pay the amount of fringe benefits and the basic hourly rate of pay that is part of the standard prevailing rate of wages directly to the worker or employee in cash;

(b) make an irrevocable contribution to a trustee or a third person pursuant to a fringe benefit fund, plan, or program that meets the requirements of the Employee Retirement Income Security Act of 1974 or that is a bona fide program approved by the U. S. department of labor; or

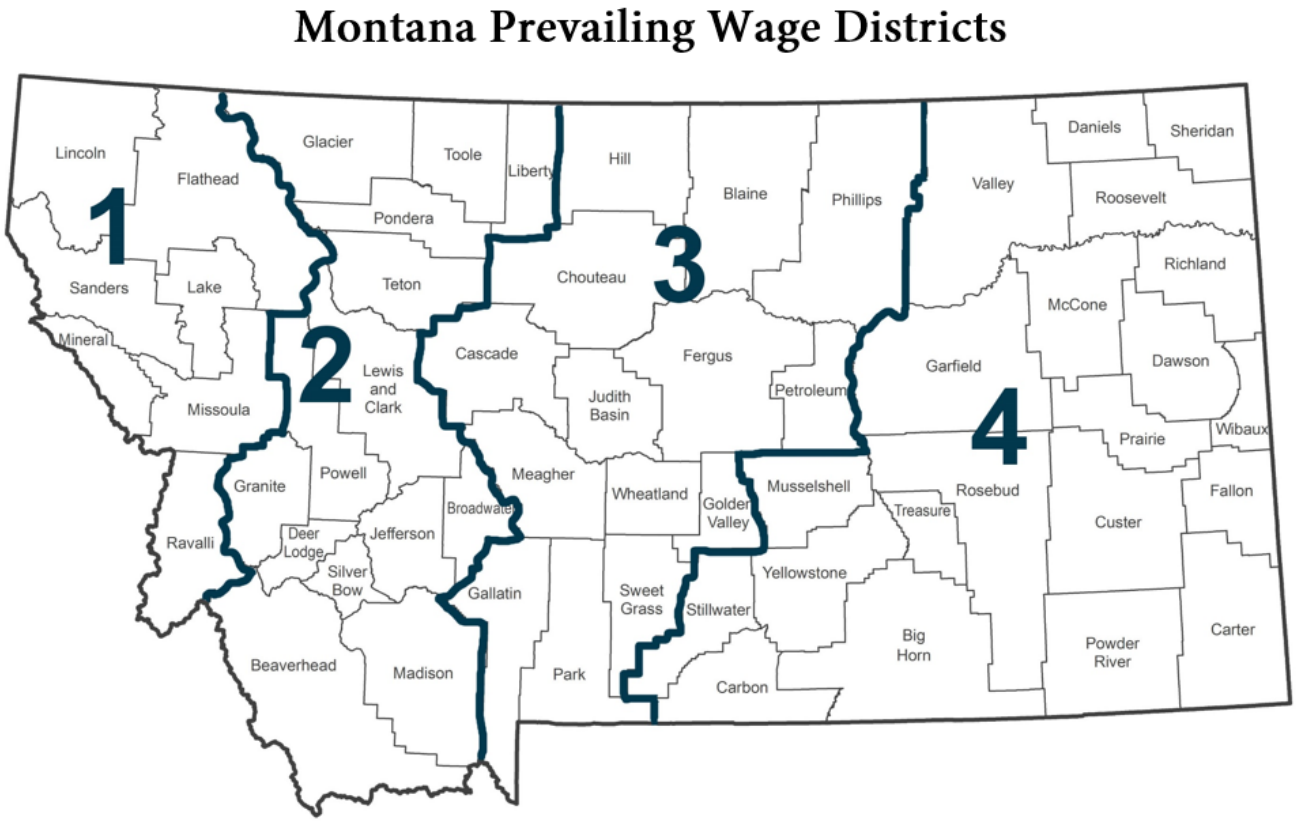
(c) make payments using any combination of methods set forth in subsections (1)(a) and (1)(b) so that the aggregate of payments and contributions is not less than the standard prevailing rate of wages, including fringe benefits and travel allowances, applicable to the district for the particular type of work being performed.

(2) The fringe benefit fund, plan, or program described in subsection (1)(b) must provide benefits to workers or employees for health care, pensions on retirement or death, life insurance, disability and sickness insurance, or bona fide programs that meet the requirements of the Employee Retirement Income Security Act of 1974 or that are approved by the U. S. department of labor."

Fringe benefits are paid for all hours worked (straight time and overtime hours). However, fringe benefits are not to be considered a part of the hourly rate of pay for calculating overtime, unless there is a collectively bargained agreement in effect that specifies otherwise.

H. Prevailing Wage Districts

Montana counties are aggregated into 4 districts for the purpose of prevailing wage. The prevailing wage districts are composed of the following counties:



I. Dispatch City

ARM, 24.17.103(11), defines dispatch city as *"...the courthouse in the city from the following list which is closest to the center of the job: Billings, Bozeman, Butte, Great Falls, Helena, Kalispell, Miles City, Missoula and Sidney."* A dispatch city shall be considered the point of origin only for jobs within the counties identified in that district (as shown below):

District 1 – Kalispell and Missoula: includes Flathead, Lake, Lincoln, Mineral, Missoula, Ravalli, and Sanders;
District 2 – Butte and Helena: includes Beaverhead, Broadwater, Deer Lodge, Glacier, Granite, Jefferson, Lewis and Clark, Liberty, Madison, Pondera, Powell, Silver Bow, Teton, and Toole;
District 3 – Bozeman and Great Falls: includes Blaine, Cascade, Chouteau, Fergus, Gallatin, Golden Valley, Hill, Judith Basin, Meagher, Park, Petroleum, Phillips, Sweet Grass, and Wheatland;
District 4 – Billings, Miles City and Sidney: includes Big Horn, Carbon, Carter, Custer, Daniels, Dawson, Fallon, Garfield, McCone, Musselshell, Powder River, Prairie, Richland, Roosevelt, Rosebud, Sheridan, Stillwater, Treasure, Valley, Wibaux, and Yellowstone.

J. Zone Pay

Zone pay is not travel pay. ARM, 24.17.103(25), defines zone pay as *"...an amount added to the base pay; the combined sum then becomes the new base wage rate to be paid for all hours worked on the project. Zone pay must be determined by measuring the road miles one way over the shortest practical maintained route from the dispatch city to the center of the job."* See section I above for a list of dispatch cities.

K. Computing Travel Benefits

ARM, 24.17.103(23), states *" 'Travel pay,' also referred to as 'travel allowance,' is and must be paid for travel both to and from the job site, except those with special provisions listed under the classification. The rate is determined by measuring the road miles one direction over the shortest practical maintained route from the dispatch city or the employee's home, whichever is closer, to the center of the job."* See section I above for a list of dispatch cities.

L. Per Diem

ARM, 24.17.103(19), states *" 'Per diem' typically covers costs associated with board and lodging expenses. Per diem is paid when an employee is required to work at a location outside the daily commuting distance and is required to stay at that location overnight or longer."*

M. Apprentices

Wage rates for apprentices registered in approved federal or state apprenticeship programs are contained in those programs. Additionally, Section 18-2-416(2), MCA states *"...The full amount of any applicable fringe benefits must be paid to the apprentice while the apprentice is working on the public works contract."* Apprentices not registered in approved federal or state apprenticeship programs will be paid the appropriate journey level prevailing wage rate when working on a public works contract.

N. Posting Notice of Prevailing Wages

Section 18-2-406, MCA provides that contractors, subcontractors and employers who are *"...performing work or providing construction services under public works contracts, as provided in this part, shall post in a prominent and accessible site on the project or staging area, not later than the first day of work and continuing for the entire duration of the project, a legible statement of all wages and fringe benefits to be paid to the employees."*

O. Employment Preference

Sections 18-2-403 and 18-2-409, MCA requires contractors to give preference to the employment of bona fide Montana residents in the performance of work on public works contracts.

P. Projects of a Mixed Nature

Section 18-2-418, MCA states:

"(1) The contracting agency shall determine, based on the preponderance of labor hours to be worked, whether the public works construction services project is classified as a highway construction project, a heavy construction project, or a building construction project.

(2) Once the project has been classified, employees in each trade classification who are working on that project must be paid at the rate for that project classification"

Q. Occupations Definitions

You can find definitions for these occupations on the following Bureau of Labor Statistics website:
http://www.bls.gov/oes/current/oes_stru.htm

R. Welder Rates

Welders receive the rate prescribed for the craft performing an operation to which welding is incidental.

S. Foreman Rates

Rates are no longer set for foremen. However, if a foreman performs journey level work, the foreman must be paid at least the journey level rate.

WAGE RATES

BOILERMAKERS

No Rate Established

Duties Include:
Construct, assemble, maintain, and repair stationary steam boilers, boiler house auxiliaries, process vessels, and pressure vessels.

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BRICK, BLOCK, AND STONE MASONS

	Wage	Benefit
District 1	$33.81	$18.06
District 2	$33.81	$18.06
District 3	$33.81	$18.06
District 4	$33.81	$18.06

Travel:
All Districts
0-70 mi. free zone
>70-90 mi. $60.00/day
>90 mi. $80.00/day

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CARPENTERS

	Wage	Benefit
District 1	$30.24	$14.33
District 2	$30.24	$14.33
District 3	$30.24	$14.33
District 4	$30.24	$14.33

Zone Pay:
All Districts
0-30 mi. free zone
>30-60 mi. base pay + $4.00/hr.
>60 mi. base pay + $6.00/hr.

Duties Include:
Install roll and batt insulation, and hardwood floors.

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CARPET INSTALLERS

No Rate Established

Duties Include:
Lay and install carpet from rolls or blocks on floors. Install padding and trim flooring materials.

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CEMENT MASONS AND CONCRETE FINISHERS

	Wage	Benefit
District 1	$37.54	$17.04
District 2	$37.54	$17.04
District 3	$37.54	$17.04
District 4	$26.39	$17.04

Duties Include:
Smooth and finish surfaces of poured concrete, such as floors, walks, sidewalks, or curbs. Align forms for sidewalks, curbs, or gutters.

Travel and Per Diem:
All Districts
0-30 mi free zone
30-60 mi base pay+2.95/hr.
>60 mi base pay+4.75/hr.

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CONSTRUCTION EQUIPMENT OPERATORS GROUP 1

	Wage	Benefit
District 1	$27.20	$15.20
District 2	$30.03	$13.63
District 3	$32.36	$13.38
District 4	$32.36	$13.15

This group includes but is not limited to:
Air Compressor; Auto Fine Grader; Belt Finishing; Boring Machine (Small); Cement Silo; Crane, A-Frame Truck Crane; Crusher Conveyor; DW-10, 15, and 20 Tractor Roller; Farm Tractor; Forklift; Form Grader; Front-End Loader, under 1 cu. yd; Oiler, Herman Nelson Heater; Mucking Machine; Oiler, All Except Cranes/Shovels; Pumpman.

Travel Pay
District 1
0-45 mi. free zone
>45-85 mi. $60.00/day
>85 mi. $90.00/day

Zone Pay
District 2
0-30 mi. free zone
>30-60 mi. base pay + $3.50/hr.
>60 mi. base pay + $5.50/hr.

Districts 3 and 4
0-30 mi. free zone
>30-60 mi. base pay + $3.05/hr.
>60 mi. base pay + $4.85/hr.

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CONSTRUCTION EQUIPMENT OPERATORS GROUP 2

	Wage	Benefit
District 1	$30.82	$13.55
District 2	$31.76	$13.42
District 3	$31.40	$14.15
District 4	$28.60	$11.70

This group includes but is not limited to:
Air Doctor; Backhoe\Excavator\Shovel, up to and incl. 3 cu. yds; Bit Grinder; Bitunimous Paving Travel Plant; Boring Machine, Large; Broom, Self-Propelled; Concrete Travel Batcher; Concrete Float & Spreader; Concrete Bucket Dispatcher; Concrete Finish Machine; Concrete Conveyor; Distributor; Dozer, Rubber-Tired, Push, & Side Boom; Elevating Grader\Gradall; Field Equipment Serviceman; Front-End Loader, 1 cu. yd up to and incl. 5 cu. yds; Grade Setter; Heavy Duty Drills, All Types; Hoist\Tugger, All; Hydralift Forklifts & Similar; Industrial Locomotive; Motor Patrol (except finish); Mountain Skidder; Oiler, Cranes\Shovels; Pavement Breaker, EMSCO; Power Saw, Self-Propelled; Pugmill; Pumpcrete\Grout Machine; Punch Truck; Roller, other than Asphalt; Roller, Sheepsfoot (Self-Propelled); Roller, 25 tons and over; Ross Carrier; Rotomill, under 6 ft; Trenching Machine; Washing /Screening Plant.

Travel Pay
District 1
0-45 mi. free zone
>45-85 mi. $60.00/day
>85 mi. $90.00/day

Zone Pay
District 2
0-30 mi. free zone
>30-60 mi. base pay + $3.50/hr.
>60 mi. base pay + $5.50/hr.

Districts 3 and 4
0-30 mi. free zone
>30-60 mi. base pay + $3.05/hr.
>60 mi. base pay + $4.85/hr.

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CONSTRUCTION EQUIPMENT OPERATORS GROUP 3

	Wage	Benefit
District 1	$33.45	$12.53
District 2	$33.40	$13.65
District 3	$34.16	$13.82
District 4	$31.51	$13.88

This group includes but is not limited to:
Asphalt Paving Machine; Asphalt Screed; Backhoe\Excavator\Shovel, over 3 cu. yds; Cableway Highline; Concrete Batch Plant; Concrete Curing Machine; Concrete Pump; Cranes, Creter; Cranes, Electric Overhead; Cranes, 24 tons and under; Curb Machine\Slip Form Paver; Finish Dozer; Front-End Loader, over 5 cu. yds; Mechanic\Welder; Pioneer Dozer; Roller Asphalt (Breakdown & Finish); Rotomill, over 6 ft; Scraper, Single, Twin, or Pulling Belly-Dump; YO-YO Cat Haul Truck, Articulating Trucks, Vac Truck.

Travel Pay
District 1
0-45 mi. free zone
>45-85 mi. $60.00/day
>85 mi. $90.00/day

Zone Pay
Districts 2 - 4
0-30 mi. free zone
>30-60 mi. base pay + $3.50/hr.
>60 mi. base pay + $5.50/hr.

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CONSTRUCTION EQUIPMENT OPERATORS GROUP 4

	Wage	Benefit
District 1	$35.67	$13.45
District 2	$35.67	$13.75
District 3	$34.23	$14.31
District 4	$35.67	$14.34

This group includes but is not limited to:
Asphalt\Hot Plant Operator; Cranes, 25 tons up to and incl. 44 tons; Crusher Operator; Finish Motor Patrol; Finish Scraper.

Travel Pay
District 1
0-45 mi. free zone
>45-85 mi. $60.00/day
>85 mi. $90.00/day

Zone Pay
Districts 2 - 4
0-30 mi. free zone
>30-60 mi. base pay + $3.50/hr.
>60 mi. base pay + $5.50/hr.

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CONSTRUCTION EQUIPMENT OPERATORS GROUP 5

	Wage	Benefit
District 1	$35.05	$14.76
District 2	$36.77	$14.95
District 3	$36.77	$15.02
District 4	$36.77	$15.11

This group includes but is not limited to:
Cranes, 45 tons up to and incl. 74 tons.

Travel Pay
District 1
0-45 mi. free zone
>45-85 mi. $60.00/day
>85 mi. $90.00/day

Zone Pay
Districts 2 - 4
0-30 mi. free zone
>30-60 mi. base pay + $3.50/hr.
>60 mi. base pay + $5.50/hr.

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CONSTRUCTION EQUIPMENT OPERATORS GROUP 6

	Wage	Benefit
District 1	$37.86	$16.50
District 2	$37.86	$16.50
District 3	$37.86	$16.50
District 4	$37.20	$16.55

This group includes but is not limited to:
Cranes, 75 tons up to and incl. 149 tons; Cranes, Whirley (All).

Zone Pay:
All Districts
0-30 mi. free zone
>30-60 mi. base pay + $3.50/hr.
>60 mi. base pay + $5.50/hr.

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CONSTRUCTION EQUIPMENT OPERATORS GROUP 7

	Wage	Benefit
District 1	$38.96	$16.35
District 2	$38.96	$16.31
District 3	$38.96	$16.50
District 4	$38.96	$16.31

This group includes but is not limited to:
Cranes, 150 tons up to and incl. 250 tons; Cranes, over 250 tons—add $1.00 for every 100 tons over 250 tons; Crane, Tower (All); Crane Stiff-Leg or Derrick; Helicopter Hoist.

Zone Pay:
All Districts
0-30 mi. free zone
>30-60 mi. base pay + $3.50/hr.
>60 mi. base pay + $5.50/hr.

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CONSTRUCTION LABORERS GROUP 1/FLAG PERSON FOR TRAFFIC CONTROL

	Wage	Benefit
District 1	$24.55	$12.00
District 2	$24.55	$12.00
District 3	$24.55	$12.00
District 4	$24.55	$12.00

Zone Pay:
All Districts
0-15 mi. free zone
>15-30 mi. base pay + $0.65/hr.
>30-50 mi. base pay + $0.85/hr.
>50 mi. base pay + $1.25/hr.

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CONSTRUCTION LABORERS GROUP 2

	Wage	Benefit
District 1	$22.44	$7.71
District 2	$24.72	$11.38
District 3	$28.46	$12.00
District 4	$24.43	$9.44

This group includes but is not limited to:
General Labor; Asbestos Removal; Burning Bar; Bucket Man; Carpenter Tender; Caisson Worker; Cement Mason Tender; Cement Handler (dry); Chuck Tender; Choker Setter; Concrete Worker; Curb Machine-lay Down; Crusher and Batch Worker; Heater Tender; Fence Erector; Landscape Laborer; Landscaper; Lawn Sprinkler Installer; Pipe Wrapper; Pot Tender;
Powderman Tender; Rail and Truck Loaders and Unloaders; Riprapper; Sign Erection; Guardrail and Jersey Rail; Spike Driver; Stake Jumper; Signalman; Tail Hoseman; Tool Checker and Houseman and Traffic Control Worker.

Zone Pay:
All Districts
0-15 mi. free zone
>15-30 mi. base pay + $0.65/hr.
>30-50 mi. base pay + $0.85/hr.
>50 mi. base pay + $1.25/hr.

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CONSTRUCTION LABORERS GROUP 3

	Wage	Benefit
District 1	$25.55	$12.00
District 2	$25.55	$12.00
District 3	$25.55	$12.00
District 4	$25.55	$12.00

This group includes but is not limited to:
Concrete Vibrator; Dumpman (Grademan); Equipment Handler; Geotextile and Liners; High-Pressure Nozzleman; Jackhammer (Pavement Breaker) Non-Riding Rollers; Pipelayer; Posthole Digger (Power); Power Driven Wheelbarrow; Rigger; Sandblaster; Sod Cutter-Power and Tamper.

Zone Pay:
All Districts
0-15 mi. free zone
>15-30 mi. base pay + $0.65/hr.
>30-50 mi. base pay + $0.85/hr.
>50 mi. base pay + $1.25/hr.

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CONSTRUCTION LABORERS GROUP 4

	Wage	Benefit
District 1	$26.48	$11.57
District 2	$25.60	$12.00
District 3	$25.60	$12.00
District 4	$25.60	$12.00

This group includes but is not limited to:
Hod Carrier***; Water Well Laborer; Blaster; Wagon Driller; Asphalt Raker; Cutting Torch; Grade Setter; High-Scaler; Power Saws (Faller & Concrete) Powderman; Rock & Core Drill; Track or Truck Mounted Wagon Drill and Welder incl. Air Arc.

Zone Pay:
All Districts
0-15 mi. free zone
>15-30 mi. base pay + $0.65/hr.
>30-50 mi. base pay + $0.85/hr.
>50 mi. base pay + $1.25/hr.

***Hod Carriers will receive the same amount of travel and/or subsistence pay as bricklayers when requested to travel.

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DRYWALL APPLICATORS

No Rate Established

Duties Include:
Drywall and ceiling tile installation.

Zone Pay:
All Districts
0-30 mi. free zone
>30-60 mi. base pay + $4.00/hr.
>60 mi. base pay + $6.00/hr.

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ELECTRICIANS: INCLUDING BUILDING AUTOMATION CONTROL

	Wage	Benefit
District 1	$36.88	$15.78
District 2	$36.00	$15.87
District 3	$36.50	$16.76
District 4	$40.00	$16.95

Duties Include:
Electrical wiring; equipment and fixtures; street lights; electrical control systems. Installation and/or adjusting of building automation controls also during testing and balancing, commissioning and retro-commissioning.

Travel:
District 1

No mileage due when traveling in employer's vehicle.

The following travel allowance is applicable when traveling in employee's vehicle:

0-15 mi. free zone
>15-45 mi. $0.585/mi. in excess of the free zone.
>45 mi. $75.00/day

Districts 2 & 3
No mileage due when traveling in employer's vehicle.

The following travel allowance is applicable when traveling in employee's vehicle:

0-08 mi. free zone
>08-50 mi. current federal mileage rate/mi. in excess of the free zone.
>50 mi. $71.57/day

District 4
No mileage due when traveling in employer's vehicle.

The following travel allowance is applicable when traveling in employee's vehicle:

0-18 mi. free zone
>18-60 mi. federal mileage rate/mi.

Per Diem
District 4
>60 mi. $80.00/day
Per Diem in Big Sky and West Yellowstone $125/day.

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ELEVATOR CONSTRUCTORS

	Wage	Benefit
District 1	$64.87	$46.38
District 2	$64.87	$46.38
District 3	$64.87	$46.38
District 4	$64.87	$46.38

Travel:
All Districts
0-15 mi. free zone
>15-25 mi. $49.73/day
>25-35 mi. $99.45/day
>35 mi. $112.90/day

Special Provision:
.93/mile when added to amounts above if using employee vehicle.

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FLOOR LAYERS

No Rate Established

Apply blocks, strips, or sheets of shock-absorbing, sound-deadening, or decorative coverings to floors.

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GLAZIERS

	Wage	Benefit
District 1	$24.13	$3.66
District 2	$24.13	$3.66
District 3	$24.13	$3.66
District 4	$23.73	$4.02

Travel and Per Diem:
All Districts
No travel or per diem established.

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HEATING AND AIR CONDITIONING

	Wage	Benefit
District 1	$32.95	$14.16
District 2	$33.15	$15.35
District 3	$34.69	$16.88
District 4	$35.76	$18.44

Duties Include:
Testing and balancing, commissioning and retro-commissioning of all air-handling equipment and duct work.

All Districts
0-45 mi. free zone
>45 mi.
- $0.25/mi. in employer vehicle.
- $0.65/mi. in employee vehicle.

Per Diem:
All Districts
$85/day

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INSULATION WORKERS - MECHANICAL (HEAT AND FROST)

	Wage	Benefit
District 1	$43.81	$21.99
District 2	$43.81	$21.99
District 3	$43.81	$21.99
District 4	$43.81	$21.99

Duties Include:
Insulate pipes, ductwork or other mechanical systems.

Travel:
0-30 mi. free zone
>30-40 mi. $25.00/day
>40-50 mi. $35.00/day
>50-60 mi. $45.00/day
>60 mi. $130.00/day plus
- $0.56/mi. if transportation is not provided.
- $0.20/mi. if in company vehicle.

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IRONWORKERS – REINFORCING IRON AND REBAR WORKERS

	Wage	Benefit
District 1	$36.83	$26.92
District 2	$34.83	$24.68
District 3	$34.83	$25.37
District 4	$34.16	$25.83

Duties Include:
Structural steel erection; assemble prefabricated metal buildings; cut, bend, tie, and place rebar; energy producing windmill type towers; metal bleacher seating; handrail fabrication and ornamental steel.

Travel:
All Districts
0-45 mi. free zone
>45-85 mi. $100.00/day
>85 mi. $150.00/day

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IRONWORKERS – STRUCTURAL IRON AND STEEL WORKERS

	Wage	Benefit
District 1	$34.94	$26.37
District 2	$34.83	$25.37
District 3	$34.83	$25.37
District 4	$34.83	$25.37

Duties Include:
Structural steel erection; assemble prefabricated metal buildings; cut, bend, tie, and place rebar; energy producing windmill type towers; metal bleacher seating; handrail fabrication and ornamental steel.

Travel:
All Districts
0-45 mi. free zone
>45-85 mi. $100.00/day
>85 mi. $150.00/day

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MILLWRIGHTS

	Wage	Benefit
District 1	$40.45	$21.25
District 2	$40.45	$21.25
District 3	$40.45	$21.25
District 4	$40.45	$21.25

Zone Pay:
All Districts
0-30 mi. free zone
>30-60 mi. base pay + $4.00/hr.
>60 mi. base pay + $6.00/hr.

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PAINTERS: INCLUDING PAPERHANGERS

	Wage	Benefit
District 1	$29.40	$21.48
District 2	$20.30	$21.48
District 3	$29.40	$21.48
District 4	$26.64	$21.48

Travel and Per Diem:
All Districts
No travel or per diem established.

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PILE BUCKS

No Rate Established

Duties Include:
Set up crane; set up hammer; weld tips on piles; set leads; insure piles are driven straight with the use of level or plum bob. Give direction to crane operator as to speed and direction of swing. Cut piles to grade.

Zone Pay:
All Districts
0-30 mi. free zone
>30-60 mi. base pay + $4.00/hr.
>60 mi. base pay + $6.00/hr.

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PILOT CAR DRIVERS

No Rate Established

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PLASTERERS

No Rate Established

Duties Include:
All materials beyond the substrate, such as a moisture barrier, any type of drainage installation between the moisture barrier and insulation or EPS board, the attachment of the EPS board, installation of fiberglass mesh embedded in the base coat, any water-resistant coat that is applied on top of the insulation to serve as a weather barrier, and the application of the finish coat.

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PLUMBERS, PIPEFITTERS, AND STEAMFITTERS

	Wage	Benefit
District 1	$40.90	$17.47
District 2	$44.90	$17.47
District 3	$44.90	$17.47
District 4	$40.90	$20.86

Duties Include:
Assemble, install, alter, and repair pipe-lines or pipe systems that carry water, steam, air, other liquids or gases. Testing of piping systems, commissioning and retro-commissioning. Workers in this occupation may also install heating and cooling equipment and mechanical control systems.

Travel:
Disrict 1
0-30 mi. free zone
>30-50 mi. $35.00/day
>50-75 mi. $45.00/day
>75 mi. $100.00/day

Special Provision
If transportation is not provided, mileage at $0.35/mi. for one trip out and one trip back is added to the amounts above. However, if the employee is traveling more than 75 miles/day, only subsistence at the rate of $85.00/day is required.

Districts 2 & 3
0-45 mi. free zone
>45 mi.

- $0.00/mi. in employer vehicle.
- $0.65/mi. in employee vehicle.

Special Provision:
At the contractors' option, mileage for one trip out and one trip back per week may be paid plus subsistence at the rate of $135.00/day.

District 4
0-70 free zone
>70 mi.

- On jobs when employees do not work consecutive days: $0.55/mi. if employer doesn't provide transportation. Not to exceed two trips.
- On jobs when employees work any number of consecutive days: $110.00/day.

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ROOFERS

	Wage	Benefit
District 1	$32.97	$9.40
District 2	$32.97	$9.40
District 3	$32.97	$9.40
District 4	$25.08	$5.19

Duties Include:
Metal roofing, covers roofs, walls and foundations with water proofing, insulation and vapor barriers in addition to metal flashings. Roofing includes shingles, low slope membranes, metal roofs, insulation, spray foam, coatings and vapor barriers. Wall coverings include metal panels, insulated metal panels and other waterproofing or rain screen systems. Foundation systems include waterproofing and insulation. Excludes prefabricated metal buildings.

Travel:
District 1
0-50 mi. free zone
>50 mi.
- $0.00/mi. in employer vehicle.
- $0.35/mi. in employee vehicle.

District 2 and 3
0-35 mi. free zone
>35 mi.
- $0.00/mi. in employer vehicle.
- $0.40/mi. in employee vehicle.

District 4
0-50 mi. free zone
>50 mi.
- $0.00/mi. in employer vehicle.
- $0.35/mi. in employee vehicle.

Per Diem:
District 1
$84.00/day

District 2 and 3
Employer pays for room + $30.00/day.

District 4
Employer pays for room + $25.00/day.

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SHEET METAL WORKERS

	Wage	Benefit
District 1	$38.14	$21.61
District 2	$38.14	$21.61
District 3	$38.14	$21.61
District 4	$38.14	$21.61

Duties Include:
Testing and balancing, commissioning and retro-commissioning of all air-handling equipment and duct work. Manufacture, fabrication, assembling, installation, dismantling, and alteration of all HVAC systems, air conveyer systems, and exhaust systems. All lagging over insulation and all duct lining.

All Districts

0-45 mi. free zone
46-65 mi. $35/day
>65 mi. $155/day for overnight stay
>65 mi. if employee is driving/riding in a company vehicle and returns home the same day, drive time shall be paid both ways, and no subsistence paid. Drive time will be at straight time and there shall be no benefits paid for drive time. Drive time will be outside the regular shift.

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SOLAR PHOTOVOLTAIC INSTALLERS

	Wage	Benefit
District 1	$36.50	$16.76
District 2	$36.50	$16.76
District 3	$36.50	$16.76
District 4	$36.50	$16.76

Travel:

Districts 1, 2 and 3
No mileage due when traveling in employer's vehicle.

The following travel allowance is applicable when traveling in employee's vehicle:

0-08 mi. free zone
>08-50 mi. federal mileage rate/mi. in excess of the free zone.
>50 mi. $60.57/day

District 4
No mileage due when traveling in employer's vehicle.

The following travel allowance is applicable when traveling in employee's vehicle:

0-18 mi. free zone
>18-60 mi. federal mileage rate/mi.
>60 mi. $75.00/day

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SPRINKLER FITTERS

	Wage	Benefit
District 1	$44.11	$32.36
District 2	$44.11	$23.55
District 3	$38.70	$20.37
District 4	$44.11	$21.97

Duties Include:
Duties Include but not limited to any and all fire protection systems: Installation, dismantling, inspection, testing, maintenance, repairs, adjustments, and corrections of all fire protection and fire control systems, including both overhead and underground water mains, all piping, fire hydrants, standpipes, air lines, tanks, and pumps used in connection with sprinkler and alarm systems.

Travel
All Districts

The following travel allowance is applicable when traveling in employee's vehicle.

0-60 mi. free zone
>60-80 mi. $19.00/day
>80-100 mi. $29.00/day
>100 mi. $105.00/day + the IRS rate per mile and $8.92 for every 15 miles traveled for one trip out and one trip back

No travel allowance required when in employer's vehicle except when staying the night.

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TAPERS

No Rate Established

Travel and Per Diem:
All Districts
No travel or per diem established.

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TELECOMMUNICATIONS EQUIPMENT INSTALLERS

	Wage	Benefit
District 1	$39.66	$14.43
District 2	$22.00	$11.06
District 3	$22.00	$11.27
District 4	$22.00	$11.27

Travel:
All Districts
The federal mileage rate/mi. in effect when travel occurs if using own vehicle.

Per Diem:
All Districts
Employer pays for meals and lodging up to $75.00/day. When jobsite is located in Big Sky, West Yellowstone, and Gardiner, lodging and meals will be provided by the employer for all actual and reasonable expenses incurred.

Duties Include:
Install voice; sound; vision and data systems. This occupation includes burglar alarms, fire alarms, fiber optic systems, and video systems for security or entertainment

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TERRAZZO WORKERS AND FINISHERS

No Rate Established

Duties Include:
Finish work on hard tile, marble, and wood tile to floors, ceilings, and roof decks

Travel and Per Diem
No travel or per diem established.

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TILE AND STONE SETTERS

No Rate Established

Duties Include:
Apply hard tile, stone, and comparable materials to walls, floors, ceilings, countertops, and roof decks.

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TRUCK DRIVERS

Pilot Car Driver **No Rate Established**

	Wage	Benefit
District 1	$23.68	$ 7.67
District 2	$23.80	$ 6.13
District 3	$23.80	$ 6.13
District 4	$23.68	$ 7.67

Truck drivers include but are not limited to:
Combination Truck & Concrete Mixer; Distributor Driver; Dry Batch Trucks; DumpTrucks & Similar Equipment; Flat Trucks; Lowboys, Four-Wheel Trailers, Float Semitrailer; Powder Truck Driver (Bulk Unloader Type); Servicemen; Service Truck Drivers, Fuel Truck Drivers, Tiremen; Trucks with Power Equipment; Truck Mechanic; Water Tank Drivers, Petroleum Product Drivers.

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Zone Pay:
All Districts
No zone pay established.

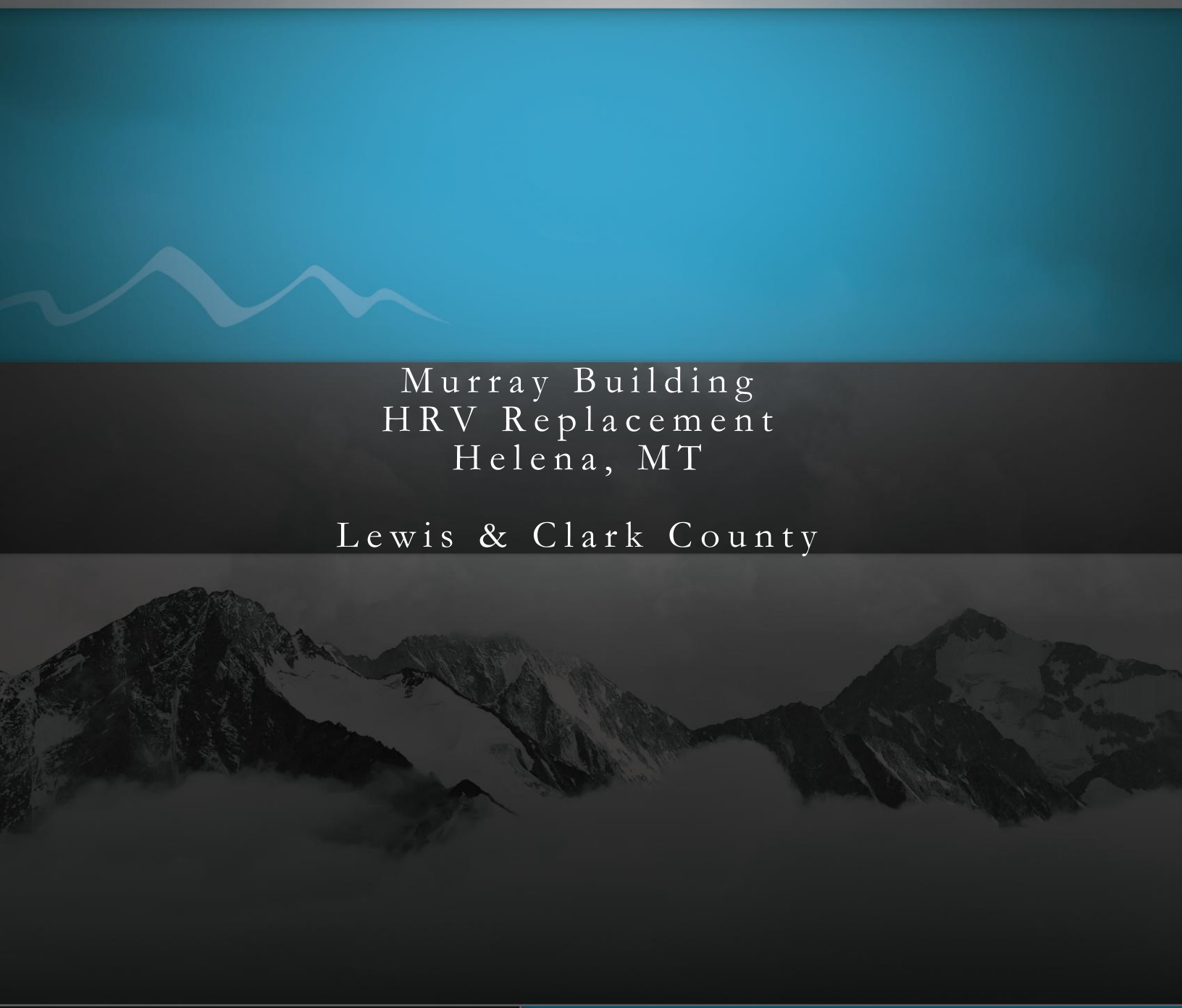
APPENDIX A

PROJECT SPECIFICATIONS

ACE | INC
ASSOCIATED • CONSTRUCTION • ENGINEERING

MURRAY BUILDING HRV REPLACEMENT
Helena, MT
Lewis & Clark County

ACE Inc. - Helena
3060 Cabernet, Suite 3
Helena, MT 59601



Murray Building
HRV Replacement
Helena, MT

Lewis & Clark County

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MURRAY BUILDING HRV REPLACEMENT
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SECTION 011000 – SUMMARY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Project information.
2. Work covered by Contract Documents.
3. Contractor's use of site and premises.
4. Coordination with occupants.
5. Work restrictions.
6. Specification and Drawing conventions.

B. Related Requirements:

1. Section 015000 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

1.2 PROJECT INFORMATION

A. Project Identification: LEWIS & CLARK COUNTY – MURRAY BUILDING HRV REPLACEMENT

1. Project Location: 1930 9th Ave., Helena, MT

B. Owner: LEWIS AND CLARK COUNTY

1. Owner's Representatives:
   a. Audra Zacherl, Assistant Director – Lewis & Clark County Public Works
   b. Mac McCarley, Buildings Supervisor – Lewis & Clark County Public Works

C. MEP Engineer: Associated Construction Engineering, Inc.

1. Engineer's Representative: Ryan Gramm – Mechanical Engineer.

1.3 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of Project is defined by the Contract Documents and consists of the following:

1. Replacement of and exhaust heat recovery air handling unit located on the roof.

B. Type of Contract:

1. Project will be constructed under a single prime contract which the owner is anticipating will be the Mechanical Contractor and shall include, but is not limited to, all labor, materials and supervision necessary to furnish and install the work as shown on the

Drawings and Specifications prepared by the Associated Construction Engineering, 3060 Cabernet Dr. Suite 3, Helena, Montana, 59601.

1.4 CONTRACTOR'S USE OF SITE AND PREMISES

A. Restricted Use of Site: Contractor shall have limited use of Project site for construction operations as indicated on Drawings by the Contract limits and as indicated by requirements of this Section.
   1. Driveways, Walkways, and Entrances: Keep driveways, loading areas and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or for storage of materials. DO NOT BLOCK FIRE EXITS, TYPICAL TRAVEL PATHS FOR MILITARY EQUIPMENT OR EMERGENCY EXITS.

B. All work must be coordinated with the Owner at all times and Owner must be informed about any work scheduling 48 hours in advance of work being conducted and shall require Owner's written approval.
   1. Any heatin g and cooling system shutdowns and shutdown durations shall be coordinated with the owner, in writing, 2 weeks in advance of anticipated shutdown. Writing notice to proceed shall be received from the owner prior to beginning any work.

C. The Contractor shall protect existing building and site structures from any and all damage during this work and if damages occur shall repair same to its original condition as approved by the Owner.

D. The Contractor shall confine his apparatus, the storage of materials and the operation of his workmen to limits by law, ordinances, permits or direction of the Owner and shall not unreasonably encumber the premises with materials.

E. The Contractor shall not load or permit any part of any structure to be loaded with weights that will endanger the building or its occupants. Note that the existing piping distribution tunnels are not strong enough to run any equipment over. These areas are clearly defined on the site plan. Plan work to avoid having to cross these areas.

F. Contractor and Owner shall establish a staging area for storage of materials and equipment.

G. The Contractor and all workers entering the site shall check in with the Owner as well as the building manager each day prior to entering the site or beginning any work.

H. Do not unreasonably encumber the site with materials or equipment. Confine stockpiling of materials to the areas designated by the Owner. If additional storage is necessary, obtain and pay for such storage off-site.

I. All precautions must be made by the Contractor to insure full and proper safety of all building personnel, workers, and related peoples as well as construction personnel and its related people. All application, material handling, and associated equipment shall conform to and be operated in conformance with OSHA safety requirements. Comply with Federal, State, Local and Owner fire and safety requirements.

J. The Contractor shall erect and maintain, as required by law, conditions and progress of the work, warning signs, barricades and other reasonable safeguards for safety and protection.

K. The Contractor is to coordinate with the Owner for the location of Job Site Trailer Office if required.

L. Existing Premises Conditions: The Contractor is responsible for adequately documenting the existing condition of the premises, specifically the condition of the ceiling systems and cleanliness of areas. Any damage to the premises which is found after construction and is not so documented will be the responsibility of the Contractor to repair or replace.

1.5 COORDINATION WITH OCCUPANTS

A. Full Owner Occupancy: Owner will occupy site and existing building(s) during entire construction period. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's day-to-day operations. Maintain existing exits unless otherwise indicated.

1.6 WORK RESTRICTIONS

A. Comply with restrictions on construction operations.

1. Comply with limitations on use of public streets, work on public streets, rights of way, and other requirements of authorities having jurisdiction.

B. On-Site Work Hours: Limit work in the existing building to normal business working hours of 07:30 a.m. to 05:00 p.m., Monday through Friday, unless otherwise indicated. Coordinate with Owner.

C. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after providing temporary utility services according to requirements indicated:

1. Notify Owner not less than 72 hours in advance of proposed utility interruptions.
2. Obtain Owner's written permission before proceeding with utility interruptions.

D. Noise, Vibration, Dust, and Odors: Coordinate operations that may result in high levels of noise and vibration, dust, odors, or other disruption to Owner occupancy with Owner.

1. Notify Owner not less than 72 hours in advance of proposed disruptive operations.
2. Obtain Owner's written permission before proceeding with disruptive operations.

E. Smoking and Controlled Substance Restrictions: Use of tobacco products, alcoholic beverages, and other controlled substances on Owner's property is not permitted. Comply with all State and Federal Regulations.

1.7 SPECIFICATION AND DRAWING CONVENTIONS

A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:

1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
2. Text Color: Text used in the Specifications, including units of measure, manufacturer and product names, and other text may appear in multiple colors or underlined as part of a hyperlink; no emphasis is implied by text with these characteristics.
3. Hypertext: Text used in the Specifications may contain hyperlinks. Hyperlinks may allow for access to linked information that is not residing in the Specifications. Unless otherwise indicated, linked information is not part of the Contract Documents.
4. Specification requirements are to be performed by Contractor unless specifically stated otherwise.

B. Division 00 Contracting Requirements: General provisions of the Contract, including General and Supplementary Conditions, apply to all Sections of the Specifications.

C. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 011000

SECTION 013300 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Submittal schedule requirements.
2. Administrative and procedural requirements for submittals.

1.2 DEFINITIONS

A. Action Submittals: Written and graphic information and physical samples that require Engineer's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."

B. Administrative Submittals include, but are not limited to, the following items: contractor’s license(s), bid bond, performance bond, labor & material bond, insurance certificates (workers' compensation, general liability, owner's protective liability, property), change orders, change directives, schedule of amounts for contract payment, applications for payment, contractor's construction schedule. Refer to other Division 1 Sections and other contract documents for requirements and specifications regarding administrative submittals.

1.3 SUBMITTAL SCHEDULE

A. Submittal Schedule: Submit, as an action submittal, a list of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Engineer and additional time for handling and reviewing submittals required by those corrections.

1.4 SUBMITTAL FORMATS

A. Submittal Information: Include the following information in each submittal:

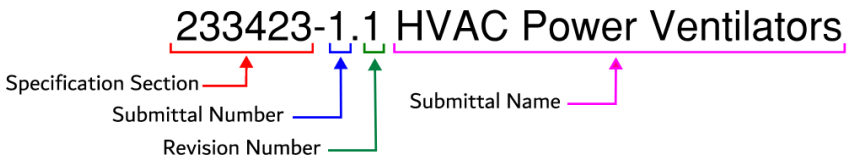
1. Project name.
2. Date.
3. Name of Engineer.
4. Name of Contractor.
5. Name of firm or entity that prepared submittal.
6. Names of subcontractor, manufacturer, and supplier.
7. Unique submittal number, including revision identifier. Include Specification Section number with sequential alphanumeric identifier; and alphanumeric suffix for resubmittals.
8. Category and type of submittal.
9. Submittal purpose and description.
10. Number and title of Specification Section, with paragraph number and generic name for each of multiple items.

11. Drawing number and detail references, as appropriate.
12. Indication of full or partial submittal.
13. Location(s) where product is to be installed, as appropriate.
14. Other necessary identification.
15. Remarks.
16. Signature of transmitter.

B. Options: Identify options requiring selection by Architect.

C. Deviations and Additional Information: On each submittal, clearly indicate deviations from requirements in the Contract Documents, including minor variations and limitations; include relevant additional information and revisions, other than those requested by Engineer on previous submittals. Indicate by highlighting on each submittal or noting on attached separate sheet.

D. Electronic Submittals: Prepare submittals as PDF package, incorporating complete information into each PDF file. Name PDF file with submittal number.
1. Submittal .pdf document naming shall be as follows:



E. Submittals for Utilizing Web-Based Project Management Software: Prepare submittals as PDF files, or other format indicated by Project management software.

1.5 SUBMITTAL PROCEDURES

A. Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.

1. Email: Prepare submittals as PDF package, and transmit to Architect by sending via email. Include PDF transmittal form. Include information in email subject line as requested by Architect.
2. Web-Based Project Management Software: Prepare submittals in PDF form, and upload to web-based Project management software website. Enter required data in web-based software site to fully identify submittal.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.

C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Engineer's receipt of submittal. No extension of the

Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.

1. Initial Review: Allow 10 business days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Engineer will advise Contractor when a submittal being processed must be delayed for coordination.
2. Resubmittal Review: Allow 10 business days for review of each resubmittal.

D. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.

E. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

F. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Engineer's action stamp.

1.6 SUBMITTAL REQUIREMENTS

A. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.

1. If information must be specially prepared for submittal because standard published data are unsuitable for use, submit as Shop Drawings, not as Product Data.
2. Mark each copy of each submittal to show which products and options are applicable.
3. Include the following information, as applicable:

    a. Manufacturer's catalog cuts.
    b. Manufacturer's product specifications.
    c. Standard color charts.
    d. Statement of compliance with specified referenced standards.
    e. Testing by recognized testing agency.
    f. Application of testing agency labels and seals.
    g. Notation of coordination requirements.
    h. Availability and delivery time information.

4. For equipment, include the following in addition to the above, as applicable:

    a. Wiring diagrams that show factory-installed wiring.
    b. Printed performance curves.
    c. Operational range diagrams.
    d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.

5. Submit Product Data before Shop Drawings, and before or concurrent with Samples.

B. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.

1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:

    a. Identification of products.

b. Schedules.
c. Compliance with specified standards.
d. Notation of coordination requirements.
e. Notation of dimensions established by field measurement.
f. Relationship and attachment to adjoining construction clearly indicated.
g. Seal and signature of professional engineer if specified.

C. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other materials.

1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
2. Identification: Permanently attach label on unexposed side of Samples that includes the following:

a. Project name and submittal number.
b. Generic description of Sample.
c. Product name and name of manufacturer.
d. Sample source.
e. Number and title of applicable Specification Section.
f. Specification paragraph number and generic name of each item.

3. Email Transmittal: Provide PDF transmittal. Include digital image file illustrating Sample characteristics, and identification information for record.
4. Web-Based Project Management Software: Prepare submittals in PDF form, and upload to web-based Project software website. Enter required data in web-based software site to fully identify submittal.
5. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.

6. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.

a. Number of Samples: Submit one full set of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Engineer will return submittal with options selected.

1.7 DELEGATED DESIGN SERVICES

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.

1. If criteria indicated are insufficient to perform services or certification required, submit a written request for additional information to Architect.

B. Delegated Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF file signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.

1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

1.8 CONTRACTOR'S REVIEW

A. Action Submittals and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Engineer

B. Contractor's Approval: Indicate Contractor's approval for each submittal with a uniform approval stamp or indication in web-based Project management software. Include name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

1. Engineer will not review submittals received from Contractor that do not have Contractor's review and approval.

1.9 ENGINEER’S REVIEW

A. Action Submittals: Engineer will review each submittal, indicate corrections or revisions required.

1. PDF Submittals: Engineer will indicate, via markup on each submittal, the appropriate action.

2. Submittals by Web-Based Project Management Software: Engineer will indicate, on Project management software website, the appropriate action.

B. Informational Submittals: Engineer will review each submittal and will not return it, or will return it if it does not comply with requirements. Engineer will forward each submittal to appropriate party.

C. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.

D. Engineer will return without review submittals received from sources other than Contractor.

E. Submittals not required by the Contract Documents will be returned by Engineer without action.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013300

SECTION 014000 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for quality assurance and quality control.

B. Testing and inspection services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.

1. Specific quality-assurance and quality-control requirements for individual work results are specified in their respective Specification Sections. Requirements in individual Sections may also cover production of standard products.
2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and quality-control procedures that facilitate compliance with the Contract Document requirements.
3. Requirements for Contractor to provide quality-assurance and quality-control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.

1.2 DEFINITIONS

A. Field Quality-Control Tests and Inspections: Tests and inspections that are performed on-site for installation of the Work and for completed Work.

B. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, subcontractor, or sub-subcontractor, to perform a particular construction operation, including installation, erection, application, assembly, and similar operations.

1. Use of trade-specific terminology in referring to a Work result does not require that certain construction activities specified apply exclusively to specific trade(s).

C. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria. Unless otherwise indicated, copies of reports of tests or inspections performed for other than the Project do not meet this definition.

D. Product Tests: Tests and inspections that are performed by a nationally recognized testing laboratory (NRTL) in accordance with 29 CFR 1910.7, by a testing agency accredited in accordance with NIST's National Voluntary Laboratory Accreditation Program (NVLAP), or by a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.

E. Source Quality-Control Tests and Inspections: Tests and inspections that are performed at the source (e.g., plant, mill, factory, or shop).

F. Testing Agency: An entity engaged to perform specific tests, inspections, or both. The term "testing laboratory" has the same meaning as the term "testing agency."

G. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work, to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.

H. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work, to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Contractor's quality-control services do not include contract administration activities performed by Architect.

1.3 CONFLICTING REQUIREMENTS

A. Conflicting Standards and Other Requirements: If compliance with two or more standards or requirements is specified and the standards or requirements establish different or conflicting requirements for minimum quantities or quality levels, inform the Architect regarding the conflict and obtain clarification prior to proceeding with the Work. Refer conflicting requirements that are different, but apparently equal, to Architect for clarification before proceeding.

B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified is the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

1.4 INFORMATIONAL SUBMITTALS

A. Contractor's Quality-Control Plan: For quality-assurance and quality-control activities and responsibilities.

B. Qualification Data: For Contractor's quality-control personnel.

C. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

D. Schedule of Tests and Inspections: Prepare in tabular form and include the following:

1. Specification Section number and title.
2. Entity responsible for performing tests and inspections.
3. Description of test and inspection.
4. Identification of applicable standards.
5. Identification of test and inspection methods.
6. Number of tests and inspections required.
7. Time schedule or time span for tests and inspections.
8. Requirements for obtaining samples.
9. Unique characteristics of each quality-control service.

E. Reports: Prepare and submit certified written reports and documents as specified.

F. Permits, Licenses, and Certificates: For Owner's record, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents established for compliance with standards and regulations bearing on performance of the Work.

1.5 REPORTS AND DOCUMENTS

A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:

1. Date of issue.
2. Project title and number.
3. Name, address, telephone number, and email address of testing agency.
4. Dates and locations of samples and tests or inspections.
5. Names of individuals making tests and inspections.
6. Description of the Work and test and inspection method.
7. Identification of product and Specification Section.
8. Complete test or inspection data.
9. Test and inspection results and an interpretation of test results.
10. Record of temperature and weather conditions at time of sample-taking and testing and inspection.
11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
12. Name and signature of laboratory inspector.
13. Recommendations on retesting and reinspecting.

B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:

1. Name, address, telephone number, and email address of technical representative making report.
2. Statement on condition of substrates and their acceptability for installation of product.
3. Statement that products at Project site comply with requirements.
4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
6. Statement of whether conditions, products, and installation will affect warranty.
7. Other required items indicated in individual Specification Sections.

C. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:

1. Name, address, telephone number, and email address of factory-authorized service representative making report.
2. Statement that equipment complies with requirements.
3. Results of operational and other tests and a statement of whether observed

performance complies with requirements.
4. Statement of whether conditions, products, and installation will affect warranty.
5. Other required items indicated in individual Specification Sections.

1.6 QUALITY ASSURANCE

A. Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.

B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units. As applicable, procure products from manufacturers able to meet qualification requirements, warranty requirements, and technical or factory-authorized service representative requirements.

C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

D. Installer Qualifications: A firm or individual experienced in installing, erecting, applying, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that is similar in material, design, and extent to those indicated for this Project.

F. Testing and Inspecting Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspection indicated, as documented in accordance with ASTM E329, and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.

G. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

H. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect, demonstrate, repair, and perform service on installations of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

1.7 QUALITY CONTROL

A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.

1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspection they are engaged to perform.
2. Payment for these services will be made from testing and inspection allowances specified in Section 012100 "Allowances," as authorized by Change Orders.
3. Costs for retesting and reinspecting construction that replaces or is necessitated by Work that failed to comply with the Contract Documents will be charged to Contractor.

B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities, whether specified or not, to verify and document that the Work complies with requirements.

1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
2. Engage a qualified testing agency to perform quality-control services.
3. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspection will be performed.
4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
5. Testing and inspection requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

C. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.

D. Testing Agency Responsibilities: Cooperate with Architect, Commissioning Authority and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.

1. Notify Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
2. Determine the locations from which test samples will be taken and in which in-situ tests are conducted.
3. Conduct and interpret tests and inspections, and state in each report whether tested and inspected Work complies with or deviates from requirements.
4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
6. Do not perform duties of Contractor.

E. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Section 013300 "Submittal Procedures."

F. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical

representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.

G. Contractor's Associated Requirements and Services: Cooperate with agencies and representatives performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:

1. Access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Adequate quantities of representative samples of materials that require testing and inspection. Assist agency in obtaining samples.
4. Facilities for storage and field curing of test samples.
5. Preliminary design mix proposed for use for material mixes that require control by testing agency.
6. Security and protection for samples and for testing and inspection equipment at Project site.

H. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and quality-control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspection.

1. Schedule times for tests, inspections, obtaining samples, and similar activities.

I. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents. Coordinate and submit concurrently with Contractor's Construction Schedule. Update and submit with each Application for Payment.

1. Schedule Contents: Include tests, inspections, and quality-control services, including Contractor- and Owner-retained services, commissioning activities, and other Project-required services paid for by other entities.
2. Distribution: Distribute schedule to Owner, Architect, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

1.8 SPECIAL TESTS AND INSPECTIONS

A. Special Tests and Inspections: Owner will engage a qualified special inspector to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner, as indicated in the Statement of Special Inspections attached to this Section, and as follows:

1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures, and reviewing the completeness and adequacy of those procedures to perform the Work.
2. Notifying Architect and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
3. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect with copy to Contractor and to authorities having jurisdiction.

4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
5. Interpreting tests and inspections, and stating in each report whether tested and inspected Work complies with or deviates from the Contract Documents.
6. Retesting and reinspecting corrected Work.

PART 2 - PRODUCTS (Not Used)
PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:

1. Date test or inspection was conducted.
2. Description of the Work tested or inspected.
3. Date test or inspection results were transmitted to Architect.
4. Identification of testing agency or special inspector conducting test or inspection.

B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Architect's reference during normal working hours.

1. Submit log at Project closeout as part of Project Record Documents.

3.2 REPAIR AND PROTECTION

A. General: On completion of testing, inspection, sample-taking, and similar services, repair damaged construction and restore substrates and finishes.

1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 017300 "Execution."

B. Protect construction exposed by or for quality-control service activities.

C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 014000

SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.

B. Related Requirements:

1. Section 011000 "Summary" for work restrictions and limitations on utility interruptions.

1.2 USE CHARGES

A. Installation, removal, and use charges for temporary facilities to be included in the Contract Sum unless otherwise indicated. Allow other entities engaged in the Project to use temporary services and facilities without cost, including, but not limited to, Owner, Engineer, testing agencies, and authorities having jurisdiction.

B. Water and Sewer Service from Existing System: Water from Owner's existing water system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

C. Electric Power Service from Existing System: Electric power from Owner's existing system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

1.3 QUALITY ASSURANCE

A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

C. Accessible Temporary Egress: Comply with applicable provisions in the DOJ's 2010 ADA Standards for Accessible Design.

1.4 PROJECT CONDITIONS

A. Temporary Use of Permanent Facilities: Engage Installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

PART 2 - PRODUCTS

2.1 EQUIPMENT

A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.

B. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.

1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
2. Heating, Cooling, and Dehumidifying Units: Listed and labeled for type of fuel being consumed, by a qualified testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.
3. Permanent HVAC System: If Owner authorizes use of permanent HVAC system for temporary use during construction, provide filter with MERV of **8** at each return-air grille in system and remove at end of construction.

PART 3 - EXECUTION

3.1 TEMPORARY UTILITY INSTALLATION

A. General: Install temporary service or connect to existing service.

1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.

B. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction.

C. Sanitary Facilities: Provide temporary toilets, wash facilities, safety shower and eyewash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.

D. Temporary Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.

E. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.

3.2 SUPPORT FACILITIES INSTALLATION

A. Comply with the following:

1. Provide construction for temporary field offices, shops, and sheds located within construction area or within 30 feet of building lines that is noncombustible in accordance with ASTM E136. Comply with NFPA 241.
2. Utilize designated area within existing building for temporary field offices.
3. Maintain support facilities until Architect schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.

B. Parking: Use designated areas of Owner's existing parking areas for construction personnel.

C. Storage and Staging: Use designated areas of Project site for storage and staging needs.

D. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.

1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

3.3 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.

1. Where access to adjacent properties is required in order to affect protection of existing facilities, obtain written permission from adjacent property owner to access property for that purpose.

B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.

END OF SECTION 015000

SECTION 017300 – EXECUTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes general administrative and procedural requirements governing execution of the Work, including, but not limited to, the following:

1. Installation.
2. Cutting and patching.
3. Progress cleaning.
4. Starting and adjusting.
5. Protection of installed construction.
6. Correction of the Work.

B. Related Requirements:
1. Section 017700 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, replacing defective work, and final cleaning.

1.2 DEFINITIONS

A. Cutting: Removal of in-place construction necessary to permit installation or performance of subsequent work.

B. Patching: Fitting and repair work required to restore construction to original conditions after installation of subsequent work.

1.3 QUALITY ASSURANCE

A. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.

1. Structural Elements: When cutting and patching structural elements, or when encountering the need for cutting and patching of elements whose structural function is not known, notify Architect of locations and details of cutting and await directions from Architect before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection.
2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.
3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety.
4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner

that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

B. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of specified products and equipment.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Comply with requirements specified in other Sections.

1. For projects requiring compliance with sustainable design and construction practices and procedures, use products for patching that comply with sustainable design requirements.

B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of in-place materials. Use materials that are not considered hazardous.

C. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

1. Use cleaning products that comply with Green Seal's GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

PART 3 - EXECUTION

3.1 PREPARATION

A. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

B. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

C. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a request for information to Engineer.

3.2 CONSTRUCTION LAYOUT

A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks and existing conditions. If discrepancies are discovered, notify Engineer and Owner promptly.

3.3 INSTALLATION

A. Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.

1. Make vertical work plumb, and make horizontal work level.
2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
4. Maintain minimum headroom clearance of 96 inches in occupied spaces and 90 inches in unoccupied spaces, unless otherwise indicated on Drawings.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

C. Install products at the time and under conditions that will ensure satisfactory results as judged by Architect. Maintain conditions required for product performance until Substantial Completion.

D. Conduct construction operations, so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy of type expected for Project.

E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on-site and placement in permanent locations.

F. Tools and Equipment: Select tools or equipment that minimize production of excessive noise levels.

G. Templates: Obtain and distribute to the parties involved templates for Work specified to be factory prepared and field installed. Check Shop Drawings of other portions of the Work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions with manufacturer.

1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
2. Allow for building movement, including thermal expansion and contraction.
3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

I. Joints: Make joints of uniform width. Where joint locations in exposed Work are not indicated, arrange joints for the best visual effect, as judged by Architect. Fit exposed connections together to form hairline joints.

3.4 CUTTING AND PATCHING

A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.

C. Temporary Support: Provide temporary support of Work to be cut.

D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

E. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching in accordance with requirements in Section 011000 "Summary."

F. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to prevent interruption to occupied areas.

G. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
4. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.
5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
6. Proceed with patching after construction operations requiring cutting are complete.

H. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as

practicable, as judged by Architect. Provide materials and comply with installation requirements specified in other Sections, where applicable.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.

    a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
    b. Restore damaged pipe covering to its original condition.

3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.

    a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch, corner to corner of wall and edge to edge of ceiling. Provide additional coats until patch blends with adjacent surfaces.

4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.

I. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.5 PROGRESS CLEANING

A. Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.

1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F.
3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, in accordance with regulations.

    a. Use containers intended for holding waste materials of type to be stored.

4. Coordinate progress cleaning for joint-use areas where Contractor and other contractors are working concurrently.

B. Site: Maintain Project site free of waste materials and debris.

C. Work Areas: Clean areas where Work is in progress to the level of cleanliness necessary for proper execution of the Work.

1. Remove liquid spills promptly.
2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

D. Installed Work: Keep installed work clean. Clean installed surfaces in accordance with written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

F. Exposed Surfaces: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Section 015000 "Temporary Facilities and Controls."

H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

J. Limiting Exposures: Supervise construction operations to ensure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.6 STARTING AND ADJUSTING

A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

B. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.

C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Manufacturer's Field Service: Comply with qualification requirements in Section 014000 "Quality Requirements."

3.7 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

B. Protection of Existing Items: Provide protection and ensure that existing items to remain undisturbed by construction are maintained in condition that existed at commencement of the Work.

C. Comply with manufacturer's written instructions for temperature and relative humidity.

3.8 CORRECTION OF THE WORK

A. Repair or remove and replace damaged, defective, or nonconforming Work. Restore damaged substrates and finishes.

1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.

B. Repair Work previously completed and subsequently damaged during construction period. Repair to like-new condition.

C. Restore permanent facilities used during construction to their specified condition.

D. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.

E. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.

F. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION 017300

SECTION 017700 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for Contract closeout, including, but not limited to, the following:

1. Substantial Completion procedures.
2. Final Completion procedures.
3. Submittal of Project warranties.
4. Final cleaning.

B. Related Requirements:

1. Section 017823 "Operation and Maintenance Data" for additional operation and maintenance manual requirements.

1.2 ACTION SUBMITTALS

A. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.

B. Certified List of Incomplete Items: Final submittal at Final Completion.

1.3 CLOSEOUT SUBMITTALS

A. Certificates of Release: From authorities having jurisdiction.

B. Certificate of Insurance: For continuing coverage.

1.4 SUBSTANTIAL COMPLETION PROCEDURES

A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's "punch list"), indicating the value of each item on the list and reasons why the Work is incomplete.

B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction, permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
2. Submit closeout submittals specified in other Division 01 Sections, including Project Record Documents, operation and maintenance manuals, damage or settlement surveys, and similar final record information.

3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
4. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Engineer Label with manufacturer's name and model number.
5. Submit testing, adjusting, and balancing records.
6. Complete startup and testing of systems and equipment.
7. Perform preventive maintenance on equipment used prior to Substantial Completion.
8. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.
9. Complete final cleaning requirements.
10. Touch up paint and otherwise repair and restore marred exposed finishes to eliminate visual defects.
11. Complete owners required substantial completion documentation.

C. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10 days prior to date the Work will be completed and ready for final inspection and tests. On receipt of request, Architect and Owner will either proceed with inspection or notify Contractor of unfulfilled requirements.

1.5 FINAL COMPLETION PROCEDURES

A. Submittals Prior to Final Completion: Before requesting final inspection for determining Final Completion, complete the following:

1. Submit a final Application for Payment.
2. Certified List of Incomplete Items: Submit certified copy of Engineer's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Engineer. Certified copy of the list will state that each item has been completed or otherwise resolved for acceptance.
3. Complete owners final acceptance documentation and coordinated all other final requirements with owner for project closeout.

B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the Work will be completed and ready for final inspection and tests. On receipt of request, Engineer and Owner will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

1.6 SUBMITTAL OF PROJECT WARRANTIES

A. Time of Submittal: Submit written warranties on request of Engineer for designated portions of the Work where warranties are indicated to commence on dates other than date of Substantial Completion, or when delay in submittal of warranties might limit Owner's rights under warranty.

B. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.

C. Warranty Electronic File: Provide warranties and bonds in PDF format. Assemble complete warranty and bond submittal package into a single electronic PDF file with bookmarks enabling navigation to each item. Provide bookmarked table of contents at beginning of document.

1. Submit on digital media acceptable to Engineer by email to Engineer and Owner.

D. Provide additional copies of each warranty to include in operation and maintenance manuals.

1.7 INDEMNITY

A. The Contractor shall indemnify and save harmless the Owner and it's respective agents, employees and other representatives against and from all claims, demands, suits, actions and judgements of any kind or nature arising from or incidental to the Contractor's performance of this Contract, and the Contractor shall pay all expenses incidental to such claims and actions and shall assume without expense to the Owner or its representatives the defense of any such claims or actions.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 - EXECUTION

3.1 FINAL CLEANING

A. Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.

1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:

a. Clean Project site of rubbish, waste material, litter, and other foreign substances.
b. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
c. Remove debris and surface dust from limited-access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
d. Clean flooring, removing debris, dirt, and staining; clean in accordance with manufacturer's instructions.

e. Vacuum and mop concrete.
f. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean in accordance with manufacturer's instructions if visible soil or stains remain.
g. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
h. Remove labels that are not permanent.
i. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
j. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
k. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
l. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.

m. Clean luminaires, lamps, globes, and reflectors to function with full efficiency.
n. Clean strainers.
o. Leave Project clean and ready for occupancy.

C. Pest Control: Comply with pest control requirements in Section 015000 "Temporary Facilities and Controls." Prepare written report.

D. Construction Waste Disposal: Comply with waste-disposal requirements in Section 015000 "Temporary Facilities and Controls."

3.2 CORRECTION OF THE WORK

A. Complete repair and restoration operations required by "Correction of the Work" Article in Section 017300 "Execution" before requesting inspection for determination of Substantial Completion.

END OF SECTION 017700

SECTION 017823 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:

1. Operation and maintenance documentation directory manuals.
2. Emergency manuals.
3. Systems and equipment operation manuals.
4. Systems and equipment maintenance manuals.
5. Product maintenance manuals.

1.2 CLOSEOUT SUBMITTALS

A. Submit operation and maintenance manuals indicated. Provide content for each manual as specified in individual Specification Sections, and as reviewed and approved at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.

1. Engineer and Owner will comment on whether content of operation and maintenance submittals is acceptable.
2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.

B. Format: Submit operation and maintenance manuals in the following format:

1. Submit on digital media acceptable to Architect by email to Engineer and Owner. Enable reviewer comments on draft submittals.

C. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 10 days before commencing demonstration and training. Engineer and Owner will return copy with comments.

1. Correct or revise each manual to comply with Engineer and Owner’s comments. Submit copies of each corrected manual within 15 days of receipt of Engineer and Owner’s comments and prior to commencing demonstration and training.

2. Provide (2) physical copies of O&M manuals in a tabulated 3-ring binder to the owner, along with a final digital copy.

D. Comply with Section 017700 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

1.3 FORMAT OF OPERATION AND MAINTENANCE MANUALS

A. O&M Manuals shall be sorted and indexed by specification section.

B. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.

1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
2. File Names and Bookmarks: Bookmark individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.

C. Manuals, Paper Copy: Submit manuals in the form of hard-copy, bound and labeled volumes.

1. Binders: Heavy-duty, three-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
2. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.

a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 017823

SECTION 230000 - MECHANICAL GENERAL REQUIREMENTS

PART 1 - GENERAL

1.1 MECHANICAL REQUIREMENTS

A. The mechanical requirements are supplemental to the General Requirements of these Specifications. The Mechanical Sections shall apply to phases of the work specified, shown on the Drawings, or required to provide for the complete installation of Mechanical Systems for this project.

B. The work shall include all items, articles, materials, operations and methods listed, mentioned, or scheduled in these specifications and the accompanying drawings. All material, equipment, and labor shall be furnished together with all incidental items required by good practice to provide the complete systems described.

C. Examine and refer to all Architectural, Civil, Structural, Electrical, Utility, Landscape and Mechanical drawings and specifications for construction conditions which may affect the mechanical work. Inspect the building site and existing facilities for verification of present conditions. Make proper provisions for these conditions in performance of the work and cost thereof.

D. See general requirements for listed Alternate Bids. Note alternates listed and include any changes in work and price required to meet the requirements of the respective alternate.

1.2 CODES AND STANDARDS

A. Work shall meet the requirements of the plans and specifications and shall not be less than the minimum requirements of applicable sections of the latest Codes and Standards of the following Organizations:

1. American Gas Association (AGA)
2. American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
3. American Society of Mechanical Engineers (ASME)
4. American Water Works Association (AWWA)
5. National Electrical Code (NEC)
6. National Electrical Manufacturers Association (NEMA)
7. National Fire Protection Association (NFPA)
8. International Plumbing Code
9. Uniform Plumbing Code
10. Occupational Safety & Health Act (OSHA)
11. Plastic Pipe Institute (PPI)
12. Sheet Metal and Air Conditioning Contractors National Association (SMACNA)
13. International Mechanical Code (IMC)
14. International Building Code (IBC)
15. Requirements of the Serving Utility Company
16. Local and State Codes and Ordinances
17. SMACNA Seismic Manual

1.3 FEES AND PERMITS

A. The Mechanical Contractor shall pay all fees and arrange for all permits required for work done under his contract and under his supervision by subcontract **including all boiler permits and inspections.**

B. All usage contracts between the Owner and the serving utilities company, such as membership and usage charges or fees, etc., for the purpose of obtaining the services for the utility company shall be applied for and paid for by the Owner.

C. All permits and fees for connection to the utility, including inspection and staking costs imposed by the utility company or required for proper installation, and all necessary manholes, encasements, valves, service boxes, meters, meter housings or vaults complete as required by the utility company of jurisdictional agency, shall be applied for and paid by the Mechanical Contractor.

D. Exception: The gas service from the main to and including the gas meter will be furnished and installed by the gas company and paid for by the Owner.

1.4 MATERIALS AND EQUIPMENT

A. Manufacturers trade names and catalog numbers listed are intended to indicate the quality of equipment or materials desired. Manufacturers not listed must have prior approval. Written prior approval must be obtained from the Architect/Engineer ten (10) days prior to bid opening. Requests are to be submitted sufficiently ahead of the deadline to give ample time for examination. The items approved will be listed in an addendum and only this list of equipment will be accepted in lieu of specified products. Submittals must indicate the specific item or items to be furnished in lieu of those specified, together with complete technical and comparative data on specified items and proposed items. See list of prior approved manufacturers at end of this section.

B. Mechanical equipment may be installed with manufacturer’s standard finish and color except where specific color, finish or choice is indicated. If the manufacturer has no standard finish, equipment shall have a prime coat and two finish coats of gray enamel.

C. This Contractor shall be responsible for materials and equipment installed under this contract. Contractor shall also be responsible for the protection of materials and equipment of others from damage as a result of his work.

D. Manufactured material and equipment shall be applied, installed, connected, erected, used, cleaned and conditioned as directed by manufacturer unless herein specified to the contrary.

E. This Contractor shall make the required arrangement with General Contractor for the introduction into the building of equipment too large to pass through finished openings.

F. Store materials and equipment indoors at the job site or, if this is not possible, store on raised platforms and protect from the weather by means of waterproof covers. Coverings shall permit circulation of air around the materials to prevent condensation of moisture. Screen or cap openings in equipment to prevent the entry of vermin.

1.5 INTENT OF DRAWINGS

A. The drawings are partly diagrammatic and do not necessarily show exact location of piping and ductwork unless specifically dimensioned. Riser and other diagrams are schematic and do not necessarily show the physical arrangement of the equipment. They shall not be used for obtaining lineal runs of piping or ductwork, nor shall they be used for shop drawings for piping and ductwork fabrication or ordering. Discrepancies shown on different plans, or between plans and actual field conditions shall be brought to the attention of the Architect/Engineer for resolution.

1.6 RESPONSIBILITY

A. The Mechanical Contractor shall be responsible for the installation of a satisfactory and complete system in accordance with the intent of the drawing and specifications. Provide, at no extra cost, all incidental items required for completion of the work even though they are not specifically mentioned or indicated on the drawings or in the specifications.

B. The drawings do not attempt to show complete details of the building construction which affect the mechanical installation; and reference is therefore required to the Architectural, Civil, Structural, Landscape and Electrical drawings and specifications and to shop drawings of all trades for additional details which affect the installation of the work covered under this Division of the Contract.

C. Location of mechanical system components shall be checked for conflicts with openings, structural members and components of other systems having fixed locations. In the event of any conflicts, the Architect/Engineer shall be consulted and his decision shall govern. Necessary changes shall be made at the Contractor’s expense.

D. Determine, and be responsible for, the proper location and character of inserts for hangers, chases, sleeves, and other openings in the construction required for the work, and obtain this information well in advance of the construction progress so work will not be delayed.

E. Final location of inserts, hangers, etc., required for each installation, must be coordinated with facilities required for other installations to prevent interference.

F. Take extreme caution not to install work that connects to equipment until such time as complete Shop Drawings of such equipment have been approved by the Architect/Engineer. Any work installed by the Contractor, prior to approval of Shop Drawings, will be at the Contractor's risk.

G. At all times during the performance of this Contract, properly protect work from damage and protect the Owner's property from injury of loss. Make good any damage, injury or loss, except such as may be directly due to errors in the Bidding Documents or caused by Agents or Employees of the Owner. Adequately protect adjacent property as provided by law and the Bidding Documents. Provide and maintain passageways, guard fences, lights and other facilities for protection required by Public Authority or Local conditions.

H. The Contractor shall be responsible for damages due to the work of their Contractors, to the building or its contents, people, etc.

1.7 REVIEW

A. All work and material is subject to review at any time by the Architect/Engineer or his representative. If the Architect/Engineer or his representative finds material that does not conform

with these specifications or that is not properly installed or finished, correct the deficiencies in a manner satisfactory to the Architect/Engineer at the Contractor's expense.

1.8 WORKMANSHIP

A. GENERAL

1. Work under this contract shall be performed by workmen skilled in the particular trade, including work necessary to properly complete the installation in a workmanlike manner to present a neat and finished appearance.

B. EXCAVATION AND BACKFILL

1. Provide all excavating and backfilling as required, with backfilling only after approval of the Architect. Backfill to be free of all debris and decayable matter. See Excavation and Backfill requirements in DIVISION 31 – EARTH MOVING.

C. CUTTING, PATCHING, AND FRAMING

1. Obtain Architect's/Engineer's approval before performing any cutting on structural members or patching of building surfaces. Any damage to the building or equipment by this Contractor shall be the responsibility of this Contractor and shall be repaired by skilled craftsmen of the trades involved at the Contractor's expense.
2. Chases, openings, sleeves, hangers, anchors, recesses, equipment pads, framing for equipment, provided by others only if so noted on the drawings. Otherwise, they will be provided by this Contractor for his work. Whether chases, etc., are provided by this Contractor or others, this Contractor is responsible for correct size and locations.

1.9 COORDINATION

A. This Contractor shall plan his work to proceed with a minimum interference with other trades and it shall be his responsibility to inform the General Contractor of all openings required in the building structure for installation of work, and to provide sleeves as required. Dimensions of equipment installed and/or provided by others shall be checked in order that correct clearances and connections may be made.

1.10 CLEAN UP

A. Keep the premises free from accumulation of waste material or rubbish caused by his work or employees.

B. Upon completion of work, remove materials, scraps and debris relative to his work and leave the premises, including tunnels, crawl spaces, and pipe chases in clean and orderly condition. Remove all dirt and debris from the interior and exterior of all devices and equipment. After construction is completed, wash all mechanical equipment.

1.11 DUST PROTECTION

A. Contractor will provide suitable dust protection for all existing areas prior to beginning of cutting or demolition. Contractor will obtain approval of partition from Owner before proceeding with work involved in these rooms.

1.12 TEMPORARY FACILITIES

A. OFFICES

1. Contractor may provide a temporary office for himself and for the periodic use by the Architect\Engineer.

B. REMOVAL

1. Contractor shall completely remove his temporary installations when no longer needed and the premises shall be completely clean, disinfected, patched, and refinished to match adjacent areas.

C. LADDERS AND SCAFFOLDS

1. The Contractor shall provide their own ladders, scaffolds, etc. of final construction for access to their work in various portions of the building as may be required. When no longer needed, they shall be removed by the Contractor.

D. PROTECTION DEVICES

1. The Contractor shall provide and maintain his own necessary barricades, fences, signal lights, etc., required by all governing authorities or shown on the drawings. When no longer needed, they shall be removed by the Contractor. The Contractor shall assume all responsibility for which the Owner may be held responsible because of lack of above items.

E. TEMPORARY WATER

1. The Contractor shall provide all water required by his trade for construction. Temporary drinking water shall be provided by Contractor from a proven safe source dispensed by single service containers, until such time as the construction water outlet has been installed, disinfected, and approved for drinking purposes.

F. TEMPORARY FIRE PROTECTION

1. The Contractor shall provide all necessary first-aid hand fire extinguishers for Class A, B, C and special hazards as may exist in his own work area only in accordance with good and safe practice and as required by jurisdictional safety authority. The Contractor shall provide general area fire extinguishers only.

1.13 SHOP DRAWINGS

A. Provide eight digital copies of manufacturer's literature and/or certified prints as soon as possible but within thirty (30) days after awarding of Contract, for items of materials, equipment, or systems where called for in specifications. Shop drawings and literature complete showing item used, size, dimensions, capacity, rough-in, etc., as required for complete check and installation. Manufacturers literature showing more than one item shall be clearly marked as to which item is being furnished or it will be rejected and returned without review.

B. Each copy of each item submitted must be clearly marked as follows for purposes of identification and record. Submittals not marked (typewritten only) as described below will be rejected and returned without review.

Date:
Name of Project:
Branch of Work:
Submitted by:
Specification or Plan Reference:

C. Prior to their submission, each submittal shall be thoroughly checked by the Contractor for compliance with the Contract Document requirements, accuracy of dimensions, relationship to the work of other trades, and conformance with sound, safe practices as to erection and installation. Each submittal shall then bear a stamp evidencing such checking and shall show corrections made, if any. Submittals requiring extensive corrections shall be revised before submission. Each submittal not stamped and signed by the Contractor evidencing such checking will be rejected and returned without review.

D. All submittals will be examined when submitted in proper form for compliance. Such review shall not relieve the Contractor of responsibility for errors, for deviation from the contract Documents, nor for violation of sound safety practices.

E. The Contractor shall keep in the field office one print of each submittal which has been reviewed and stamped by the Architect or Engineer.

F. Submittals will be required for each item of material and equipment furnished as noted in specifications.

G. Submittals which are incomplete relative to quality requirements, capacity, engineering data, dimensional data or detailed list of specialty or control equipment will be rejected. Lists shall include descriptive coding as specified or shown on drawings.

H. Submittals shall be properly bound in a three-ring binder or equivalent method. Unbound submittals shall be returned without review.

1.14 OPERATION AND MAINTENANCE MANUALS

A. At the time orders are placed for any item of equipment requiring service or operating maintenance, the Contractor shall request the manufacturer furnish three (3) copies of OPERATION AND MAINTENANCE INSTRUCTIONS for each piece of equipment. These shall be included in the brochure of equipment.

1.15 BROCHURE OF EQUIPMENT

A. Upon completion of work, prepare three copies of "Brochure of Equipment" containing data pertinent to equipment and systems on job. Binders containing materials shall be one or more three ring binders of sufficient number to hold all literature. Contained in binders shall be: Installation, maintenance, and operating instructions for each piece of equipment; parts lists; wiring diagrams; one copy of each shop drawing and literature submittal; record drawings, etc.

B. All literature shall be clean, unused and filed under divider headings corresponding to the specifications.

C. These brochures shall be submitted to the Architect/Engineer and approved by him before authorization of final payment.

1.16 AS-BUILT DRAWINGS

A. The Contractor shall furnish to the Owner and Architect/Engineer a marked print showing the location of all concealed or underground pipe or conduit runs and other equipment installed other than as shown on the drawings. Dimension underground lines from established building lines. Indicate all installed pull boxes in conduit runs.

B. The Contractor shall furnish to the Architect/Engineer a marked print showing the location of all mechanical equipment, plumbing fixtures, piping, ductwork, diffusers, grilles, etc. The location of any item which deviates from the bid documents shall be accurately drawn and dimensioned.

C. All underground piping and ductwork shall be dimensioned from nearest column and/or exterior walls. The location of all maintenance related items such as duct access doors, fire dampers, isolation valves, filters, etc., shall be highlighted on as built drawing.

1.17 PLACING SYSTEMS IN OPERATION

A. At the completion of the work and at such time as the Owner shall direct, prior to final acceptance, the Contractor performing this work shall put into satisfactory operation the various systems installed under the specifications. At no additional cost to the Owner, furnish the services of a person completely familiar with the installations performed under this specification, to instruct the Owner's operating personnel in the proper operation and servicing of the equipment and systems. These services shall be available for a period of no less than one (1) day.

1.18 WARRANTY

A. The Contractor shall guarantee that all materials and labor installed are new and of first quality and that any material or labor found defective shall be replaced without cost to the Owner within one (1) year after substantial completion of the Contract or one (1) full season of heating and cooling operation, whichever is the greater. The guarantee shall list the date of the beginning of the one (1) year period, which shall be the date that the Substantial Completion Certificate is issued.

B. Any damage to the building, caused by defective work or material of the Contractor within the above-mentioned period, shall be satisfactorily repaired without cost to the Owner.

C. The guarantee does not include maintenance of equipment. The Owner shall accept full responsibility for proper operation and maintenance of equipment immediately upon final completion and occupancy of the building.

D. Final acceptance by the Owner will not occur until all operating instructions are mounted in Equipment Rooms and Operating Personnel thoroughly indoctrinated in the operation of all mechanical equipment by the Contractor.

E. Any equipment, including heat exchangers, boilers, pumps, air handlers, motors, etc., used for temporary heat, shall be brought up to a new condition before final acceptance by the Owner and shall be guaranteed by the Contractor as new equipment.

END OF SECTION 230000

SECTION 230593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Balancing Air Systems:

a. Constant-volume air systems.

1.2 DEFINITIONS

A. AABC: Associated Air Balance Council.

B. NEBB: National Environmental Balancing Bureau.

C. TAB: Testing, adjusting, and balancing.

D. TABB: Testing, Adjusting, and Balancing Bureau.

E. TAB Specialist: An entity engaged to perform TAB Work.

1.3 INFORMATIONAL SUBMITTALS

A. Strategies and Procedures Plan: Within 60 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures as specified in "Preparation" Article.

B. Certified TAB reports.

1.4 QUALITY ASSURANCE

A. TAB Contractor Qualifications: Engage a TAB entity certified by NEBB.

1. TAB Field Supervisor: Employee of the TAB contractor and certified by NEBB.
2. TAB Technician: Employee of the TAB contractor and who is certified by NEBB as a TAB technician.

B. Certify TAB field data reports and perform the following:

1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
2. Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this Specification.

C. TAB Report Forms: Use standard TAB contractor's forms approved by Commissioning Authority.

D. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."

E. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."

F. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.7.2.3 - "System Balancing."

PART 2 - PRODUCTS

A. Approved test and balance contractor shall be:

1. RGO, Inc.
2. Precision Air & Water.
3. Statera Technical Services.
4. Bighorn Testing.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.

B. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are accessible.

C. Examine the approved submittals for HVAC systems and equipment.

D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.

E. Examine ceiling plenums and underfloor air plenums used for supply, return, or relief air to verify that they meet the leakage class of connected ducts as specified in Section 233113 "Metal Ducts" and are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.

F. Examine equipment performance data including fan and pump curves.

1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.

G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

H. Examine test reports specified in individual system and equipment Sections.

I. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.

J. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected and functioning.

K. Examine strainers. Verify that startup screens are replaced by permanent screens with indicated perforations.

L. Examine three-way valves for proper installation for their intended function of diverting or mixing fluid flows.

M. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

N. Examine system pumps to ensure absence of entrained air in the suction piping.

O. Examine operating safety interlocks and controls on HVAC equipment.

P. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

Q. See Section 230800 "Commissioning of HVAC" for further requirements.

3.2 PREPARATION

A. Prepare a TAB plan that includes strategies and step-by-step procedures.

B. Complete system-readiness checks and prepare reports. Verify the following:

1. Permanent electrical-power wiring is complete.
2. Hydronic systems are filled, clean, and free of air.
3. Automatic temperature-control systems are operational.
4. Equipment and duct access doors are securely closed.
5. Balance, smoke, and fire dampers are open.
6. Isolating and balancing valves are open and control valves are operational.
7. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
8. Windows and doors can be closed so indicated conditions for system operations can be met.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" and in this Section.

1. Comply with requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.

1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
2. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Section 230713 "Duct Insulation," Section 230716 "HVAC Equipment Insulation," Section 230719 "HVAC Piping Insulation."

C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.

D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of systems' "as-built" duct layouts.

C. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.

D. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.

E. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

F. Verify that motor starters are equipped with properly sized thermal protection.

G. Check dampers for proper position to achieve desired airflow path.

H. Check for airflow blockages.

I. Check condensate drains for proper connections and functioning.

J. Check for proper sealing of air-handling-unit components.

K. Verify that air duct system is sealed as specified in Section 233113 "Metal Ducts."

L. Leakage test to comply with IECC requirements for ductwork designed to operate at static pressures greater than 3 inches water gauge.

M. Allowable leakage shall not exceed 4.0 as determined by equation 4-8 in 2018 IECC.

(Equation 4-8)

$CL \geq 4.0$

$CL = F/P^{0.65}$

Where:

F = The measured leakage rate in cfm per 100 square feet of duct surface.

P = The static pressure of the test.

3.5 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.

1. Measure total airflow.

    a. Where sufficient space in ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow.

2. Measure fan static pressures as follows to determine actual static pressure:

    a. Measure outlet static pressure as far downstream from the fan as practical and upstream from restrictions in ducts such as elbows and transitions.
    b. Measure static pressure directly at the fan outlet or through the flexible connection.
    c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from the flexible connection, and downstream from duct restrictions.
    d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.

3. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.

    a. Report the cleanliness status of filters and the time static pressures are measured.

4. Measure static pressures entering and leaving other devices, such as sound traps, heat-recovery equipment, and air washers, under final balanced conditions.
5. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
6. Obtain approval from Commissioning Authority for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
7. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.

B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.

1. Measure airflow of submain and branch ducts.

    a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.

2. Measure static pressure at a point downstream from the balancing damper, and adjust volume dampers until the proper static pressure is achieved.
3. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.

C. Measure air outlets and inlets without making adjustments.

1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.

D. Adjust air outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using branch volume dampers rather than extractors and the dampers at air terminals.

1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.
2. Adjust patterns of adjustable outlets for proper distribution without drafts.

3.6 PROCEDURES FOR MOTORS

A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:

1. Manufacturer's name, model number, and serial number.
2. Motor horsepower rating.
3. Motor rpm.
4. Efficiency rating.
5. Nameplate and measured voltage, each phase.
6. Nameplate and measured amperage, each phase.
7. Starter thermal-protection-element rating.

B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass of the controller to prove proper operation. Record observations including name of controller manufacturer, model number, serial number, and nameplate data.

3.7 PROCEDURES FOR HEAT-TRANSFER COILS

A. Measure, adjust, and record the following data for each water coil:

1. Entering- and leaving-water temperature.
2. Water flow rate.
3. Water pressure drop.
4. Dry-bulb temperature of entering and leaving air.
5. Wet-bulb temperature of entering and leaving air for cooling coils.
6. Airflow.
7. Air pressure drop.

B. Measure, adjust, and record the following data for each electric heating coil:

1. Nameplate data.
2. Airflow.
3. Entering- and leaving-air temperature at full load.

4. Voltage and amperage input of each phase at full load and at each incremental stage.
5. Calculated kilowatt at full load.
6. Fuse or circuit-breaker rating for overload protection.

C. Measure, adjust, and record the following data for each steam coil:

1. Dry-bulb temperature of entering and leaving air.
2. Airflow.
3. Air pressure drop.
4. Inlet steam pressure.

D. Measure, adjust, and record the following data for each refrigerant coil:

1. Dry-bulb temperature of entering and leaving air.
2. Wet-bulb temperature of entering and leaving air.
3. Airflow.
4. Air pressure drop.
5. Refrigerant suction pressure and temperature.

3.8 TOLERANCES

A. Set HVAC system's air flow rates and water flow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent.
2. Air Outlets and Inlets: Plus or minus 10 percent.
3. Heating-Water Flow Rate: Plus or minus 10 percent.
4. Cooling-Water Flow Rate: Plus or minus 10 percent.

3.9 REPORTING

A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

B. Status Reports: Prepare biweekly progress reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.10 FINAL REPORT

A. Provide final report in draft form. Finalize after input from commissioning agent, owner, and architect/engineer.

B. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.

1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
2. Include a list of instruments used for procedures, along with proof of calibration.
3. Refer to Section 230800 for further requirements.

C. Final Report Contents: In addition to certified field-report data, include the following:

1. Pump curves.
2. Fan curves.
3. Manufacturers' test data.
4. Field test reports prepared by system and equipment installers.
5. Other information relative to equipment performance; do not include Shop Drawings and product data.

D. General Report Data: In addition to form titles and entries, include the following data:

1. Title page.
2. Name and address of the TAB contractor.
3. Project name.
4. Project location.
5. Architect's name and address.
6. Engineer's name and address.
7. Contractor's name and address.
8. Report date.
9. Signature of TAB supervisor who certifies the report.
10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
11. Summary of contents including the following:

    a. Indicated versus final performance.
    b. Notable characteristics of systems.
    c. Description of system operation sequence if it varies from the Contract Documents.

12. Nomenclature sheets for each item of equipment.
13. Data for terminal units, including manufacturer's name, type, size, and fittings.
14. Notes to explain why certain final data in the body of reports vary from indicated values.
15. Test conditions for fans and pump performance forms including the following:

    a. Settings for outdoor-, return-, and exhaust-air dampers.
    b. Conditions of filters.
    c. Cooling coil, wet- and dry-bulb conditions.
    d. Face and bypass damper settings at coils.
    e. Fan drive settings including settings and percentage of maximum pitch diameter.
    f. Inlet vane settings for variable-air-volume systems.
    g. Settings for supply-air, static-pressure controller.
    h. Other system operating conditions that affect performance.

E. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:

1. Quantities of outdoor, supply, return, and exhaust airflows.
2. Water and steam flow rates.
3. Duct, outlet, and inlet sizes.
4. Pipe and valve sizes and locations.
5. Terminal units.
6. Balancing stations.
7. Position of balancing devices.

3.11 ADDITIONAL TESTS

A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

C. Refer to drawings for preliminary testing requirements.

D. Refer to Section 230800 for further testing requirements.

END OF SECTION 230593

SECTION 231123 - FACILITY NATURAL-GAS PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipes, tubes, and fittings.
2. Piping specialties.
3. Joining materials.
4. Manual gas shutoff valves.
5. Motorized gas valves.
6. Earthquake valves.
7. Pressure regulators.
8. Dielectric fittings.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Piping specialties.
2. Corrugated, stainless steel tubing with associated components.
3. Valves. Include pressure rating, capacity, settings, and electrical connection data of selected models.
4. Pressure regulators. Indicate pressure ratings and capacities.
5. Service meters. Indicate pressure ratings and capacities. Include bypass fittings and meter bars.
6. Dielectric fittings.

B. Shop Drawings: For facility natural-gas piping layout. Include plans, piping layout and elevations, sections, and details for fabrication of pipe anchors, hangers, supports for multiple pipes, alignment guides, expansion joints and loops, and attachments of the same to building structure. Detail location of anchors, alignment guides, and expansion joints and loops.

1. Shop Drawing Scale: 1/4 inch per foot.
2. Detail mounting, supports, and valve arrangements for service-meter assembly and pressure regulator assembly.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans and details, drawn to scale, on which natural-gas piping is shown and coordinated with other installations, using input from installers of the items involved.

B. Certificates:

1. Welding certificates.

C. Site Survey: Plans, drawn to scale, on which natural-gas piping is shown and coordinated with other services and utilities.

D. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

A. Qualifications:

1. Steel Support Welding: Qualify procedures and personnel in accordance with AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. Pipe Welding: Qualify procedures and operators in accordance with the ASME Boiler and Pressure Vessel Code.

1.6 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 in accordance with requirements indicated:

1. Notify Owner no fewer than two days in advance of proposed interruption of natural-gas service.
2. Do not proceed with interruption of natural-gas service without Owner's written permission.

1.7 COORDINATION

A. Coordinate requirements for access panels and doors for valves installed and concealed behind finished surfaces. Comply with requirements in Section 083113 "Access Doors and Frames."

B. Coordinate requirements for piping identification for natural-gas piping. Comply with requirements in Section 220553 "Identification of Plumbing Piping and Equipment."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Comply with NFPA 54.

B. Minimum Operating-Pressure Ratings:

1. Piping and Valves: 100 psig minimum unless otherwise indicated.
2. Service Regulators: 65 psig minimum unless otherwise indicated.
3. Minimum Operating Pressure of Service Meter: 5 psig.

C. Natural-Gas System Pressure within Buildings:

1. Single Pressure: More than 0.5 psig, but not more than 2 psig.
2. Two pressure ranges. Primary pressure is more than 0.5 psig, but not more than 2 psig, and is reduced to secondary pressure of 0.5 psig or less.
3. Two pressure ranges. Primary pressure is more than 2 psig, but not more than 5 psig, and is reduced to secondary pressure of more than 0.5 psig, but not more than 2 psig.
4. Three pressure ranges. Primary pressure is more than 2 psig, but not more than 5 psig, and is reduced to secondary pressures of more than 0.5 psig, but not more than 2 psig, and is reduced again to pressures of 0.5 psig or less.

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. Seismic Performance: Natural-gas piping system is to withstand the effects of earthquake motions determined in accordance with ASCE/SEI 7. See Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

1. The term "withstand" means "the piping system will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
2. Component Importance Factor: 1.0.

2.2 PIPES, TUBES, AND FITTINGS

A. Steel Pipe: ASTM A53/A53M, 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 A234/A234M for butt welding and socket welding.
3. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.
4. Protective Coating for Underground Piping: Factory-applied, three-layer coating of epoxy, adhesive, and PE.

    a. Joint Cover Kits: Epoxy paint, adhesive, and heat-shrink PE sleeves.

B. Annealed-Temper Copper Tube: Comply with ASTM B837, Type G.

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.

2.3 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. Quick-Disconnect Devices: Comply with ANSI Z21.41.

1. Copper-alloy convenience outlet and matching plug connector.
2. Seals: Nitrile.
3. Hand operated with automatic shutoff when disconnected.
4. For indoor or outdoor applications.
5. Adjustable, retractable restraining cable.

C. Y-Pattern Strainers:

1. Body: ASTM A126, 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: 60-mesh startup strainer, and perforated stainless steel basket with 50 percent free area.
4. CWP Rating: 125 psig.

D. Weatherproof Vent Cap:

1. 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.

2.4 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.

2.5 MANUAL GAS SHUTOFF VALVES

A. 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. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for valves 1 inch and smaller.
6. Service Mark: Valves NPS 1-1/4 to NPS 2 having initials "WOG" permanently marked on valve body.

B. 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" permanently marked on valve body.

C. One-Piece, Bronze Ball Valve with Bronze Trim: MSS SP-110.

1. Body: Bronze, complying with ASTM B584.
2. Ball: Chrome-plated brass.
3. Stem: Bronze; blowout proof.
4. Seats: Reinforced TFE; blowout proof.
5. Packing: Separate packnut with adjustable-stem packing threaded ends.
6. Ends: Threaded, flared, or socket as indicated in "Underground, Manual Gas Shutoff Valve Schedule" and "Aboveground, Manual Gas Shutoff Valve Schedule" articles.
7. CWP Rating: 600 psig.
8. Listing: Valves NPS 1 and smaller are to be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
9. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

D. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim: MSS SP-110.

1. Body: Bronze, complying with ASTM B584.
2. Ball: Chrome-plated bronze.
3. Stem: Bronze; blowout proof.
4. Seats: Reinforced TFE; blowout proof.
5. Packing: Threaded-body packnut design with adjustable-stem packing.
6. Ends: Threaded, flared, or socket as indicated in "Underground, Manual Gas Shutoff Valve Schedule" and "Aboveground, Manual Gas Shutoff Valve Schedule" articles.
7. CWP Rating: 600 psig.
8. Listing: Valves NPS 1 and smaller are to be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
9. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

E. Two-Piece, Regular-Port Bronze Ball Valves with Bronze Trim: MSS SP-110.

1. Body: Bronze, complying with ASTM B584.
2. Ball: Chrome-plated bronze.
3. Stem: Bronze; blowout proof.
4. Seats: Reinforced TFE.
5. Packing: Threaded-body packnut design with adjustable-stem packing.
6. Ends: Threaded, flared, or socket as indicated in "Underground, Manual Gas Shutoff Valve Schedule" and "Aboveground, Manual Gas Shutoff Valve Schedule" articles.
7. CWP Rating: 600 psig.
8. Listing: Valves NPS 1 and smaller are to be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
9. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

F. Bronze Plug Valves: MSS SP-78.

1. Body: Bronze, complying with ASTM B584.
2. Plug: Bronze.
3. Ends: Threaded, socket, or flanged as indicated in "Underground, Manual Gas Shutoff Valve Schedule" and "Aboveground, Manual Gas Shutoff Valve Schedule" articles.
4. Operator: Square head or lug type with tamperproof feature where indicated.
5. Pressure Class: 125 psig.
6. Listing: Valves NPS 1 and smaller are to be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
7. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

G. PE Ball Valves: Comply with ASME B16.40.

1. Body: PE.
2. Ball: PE.
3. Stem: Acetal.
4. Seats and Seals: Nitrile.
5. Ends: Plain or fusible to match piping.
6. CWP Rating: 80 psig.
7. Operating Temperature: Minus 30 to plus 140 deg F.
8. Operator: Nut or flat head for key operation.
9. Include plastic valve extension.
10. Include tamperproof locking feature for valves where indicated on Drawings.

H. Valve Boxes:

1. Cast-iron, two-section box.
2. Top section with cover with "GAS" lettering.
3. Bottom section with base to fit over valve and barrel a minimum of 5 inches in diameter.
4. Adjustable cast-iron extensions of length required for depth of bury.
5. Include tee-handle, steel operating wrench with socket end fitting valve nut or flat head, and with stem of length required to operate valve.

2.6 MOTORIZED GAS VALVES

A. Electrically Operated Valves: Comply with UL 429.

1. Pilot operated.
2. Body: Brass or aluminum.
3. Seats and Disc: NBR.
4. Springs and Valve Trim: Stainless steel.
5. 120 V ac, 60 Hz, Class B, continuous-duty molded coil, and replaceable.
6. NEMA ICS 6, Type 4, coil enclosure.
7. Normally closed.
8. Visual position indicator.

2.7 PRESSURE REGULATORS

A. General Requirements:

1. Single stage and suitable for natural gas.
2. Steel jacket and corrosion-resistant components.
3. Elevation compensator.
4. End Connections: Threaded for regulators NPS 2 and smaller; flanged for regulators NPS 2-1/2 and larger.

B. Line Pressure Regulators: Comply with ANSI Z21.80A.

1. Body and Diaphragm Case: Cast iron or die-cast aluminum.
2. Springs: Zinc-plated steel; interchangeable.
3. Diaphragm Plate: Zinc-plated steel.
4. Seat Disc: NBR; resistant to gas impurities, abrasion, and deformation at the valve port.
5. Orifice: Aluminum; interchangeable.
6. Seal Plug: UV-stabilized, mineral-filled nylon.
7. Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet, and no pressure sensing piping external to regulator.
8. Pressure regulator is to maintain discharge pressure setting downstream and is to not exceed 150 percent of design discharge pressure at shutoff.
9. Overpressure Protection Device: Factory mounted on pressure regulator.
10. Atmospheric Vent: Factory- or field-installed, stainless steel screen in opening if not connected to vent piping.
11. Maximum Inlet Pressure: 5 psig.

C. Appliance Pressure Regulators: Comply with ANSI Z21.18.

1. Body and Diaphragm Case: Die-cast aluminum.
2. Springs: Zinc-plated steel; interchangeable.
3. Diaphragm Plate: Zinc-plated steel.
4. Seat Disc: NBR.
5. Seal Plug: UV-stabilized, mineral-filled nylon.
6. Factory-Applied Finish: Minimum three-layer polyester and polyurethane paint finish.
7. Regulator may include vent limiting device, instead of vent connection, if approved by authorities having jurisdiction.
8. Maximum Inlet Pressure: 5 psig.

2.8 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

B. Dielectric Unions:

1. Description:

a. Standard: ASSE 1079.
b. Pressure Rating: 125 psig minimum at 180 deg F.
c. End Connections: Solder-joint copper alloy and threaded ferrous.

2.9 LABELING AND IDENTIFYING

A. Detectable Warning Tape: Acid- and alkali-resistant, PE film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description and rated pressure of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored yellow.

B. Label and identify gas piping and pressure outside a multitenant building by tenant.

PART 3 - EXECUTION

3.1 PREPARATION

A. Close equipment shutoff valves before turning off natural gas to premises or piping section.

B. Inspect natural-gas piping in accordance with NFPA 54 to determine that natural-gas utilization devices are turned off in piping section affected.

C. Comply with NFPA 54 requirements for preventing accidental ignition.

3.2 INSTALLATION OF OUTDOOR PIPING

A. Comply with NFPA 54 for installation and purging of natural-gas piping.

B. Install underground, natural-gas piping buried at least 36 inches below finished grade. Comply with requirements in Section 312000 "Earth Moving" for excavating, trenching, and backfilling.

1. If natural-gas piping is installed less than 36 inches below finished grade, install it in containment conduit.

C. Install underground, PE, natural-gas piping in accordance with ASTM D2774.

D. Steel Piping with Protective Coating:

1. Apply joint cover kits to pipe after joining to cover, seal, and protect joints.
2. Repair damage to PE coating on pipe as recommended in writing by protective coating manufacturer.
3. Replace pipe having damaged PE coating with new pipe.

E. Copper Tubing with Protective Coating:

1. Apply joint cover kits over tubing to cover, seal, and protect joints.
2. Repair damage to PE coating on pipe as recommended in writing by protective coating manufacturer.

F. Install fittings for changes in direction and branch connections.

G. Install pressure gauge upstream and downstream from each service regulator. Pressure gauges are specified in Section 230500 "Common Work Results for HVAC."

3.3 INSTALLATION OF INDOOR PIPING

A. Comply with NFPA 54 for installation and purging of natural-gas piping.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Arrange for pipe spaces, chases, slots, sleeves, and openings in building structure during progress of construction, to allow for mechanical installations.

D. Do not install piping in concealed locations unless sleeved with the sleeve open at both ends.

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. Where installing piping above accessible ceilings, allow sufficient space for ceiling panel removal.

G. Locate valves for easy access. Do not locate valves within return air plenums.

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. Provide Miro-block style piping supports where piping is routed on roofs, with feet appropriate for the roof construction.

L. Verify final equipment locations for roughing-in.

M. Comply with requirements in Sections specifying gas-fired appliances and equipment for roughing-in requirements.

N. 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.

O. Extend relief vent connections for service regulators, line regulators, and overpressure protection devices to outdoors and terminate with weatherproof vent cap.

P. 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.

Q. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.

R. Connect branch piping from top or side of horizontal piping.

S. Install unions in pipes NPS 2 and smaller, adjacent to each valve, at final connection to each piece of equipment. Unions are not required at flanged connections.

T. Do not use natural-gas piping as grounding electrode.

U. Install strainer on inlet of each line-pressure regulator and automatic or electrically operated valve.

V. Install pressure gauge upstream and downstream from each line regulator. Pressure gauges are specified in Section 230500 "Common Work Results for HVAC."

W. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 230500 "Common Work Results for HVAC."

X. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 230500 "Common Work Results for HVAC."

3.4 INSTALLATION OF VALVES

A. Install manual gas shutoff valve for each gas appliance ahead of corrugated stainless steel tubing, aluminum, or copper connector.

B. Install underground valves with valve boxes.

C. Install regulators and overpressure protection devices with maintenance access space adequate for servicing and testing.

D. Install earthquake valves aboveground outside buildings according to listing.

E. Install anode for metallic valves in underground PE piping.

F. Do not install valves in return-air plenums.

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. Welded Joints:

1. Construct joints in accordance with AWS D10.12/D10.12M, using qualified processes and welding operators.
2. Bevel plain ends of steel pipe.
3. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.

E. Brazed Joints: Construct joints in accordance with AWS's "Brazing Handbook," "Pipe and Tube" Chapter.

F. Flared Joints: Cut tubing with roll cutting tool. Flare tube end with tool to result in flare dimensions complying with SAE J513. Tighten finger tight, and then use wrench. Do not overtighten.

G. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join in accordance with ASTM D2657.

1. Plain-End Pipe and Fittings: Use butt fusion.
2. Plain-End Pipe and Socket Fittings: Use socket fusion.

3.6 INSTALLATION OF HANGERS AND SUPPORTS

A. Comply with requirements for seismic-restraint devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."

B. Comply with requirements in Section 230529 "Hangers and Supports for HVAC Piping and Equipment" for hangers, supports, and anchor devices.

C. Install hangers for steel piping and copper tubing, with maximum horizontal spacing and minimum rod diameters, to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

D. Install hangers for corrugated stainless steel tubing, with maximum horizontal spacing and minimum rod diameters, to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

E. Support horizontal piping within 12 inches of each fitting.

F. Support vertical runs of steel piping and copper tubing to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

G. Support vertical runs of corrugated stainless steel tubing to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

3.7 PIPING 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 in accordance with NFPA 70.

C. Where installing piping adjacent to appliances, allow space for 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.

3.8 LABELING AND IDENTIFICATION

A. Comply with requirements in Section 230553 "Identification for HVAC Piping and Equipment" for piping and valve identification.

B. Install detectable warning tape directly above gas piping, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.9 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Test, inspect, and purge natural gas in accordance with NFPA 54 and authorities having jurisdiction.
2. Natural-gas piping will be considered defective if it does not pass tests and inspections.

B. Prepare test and inspection reports.

3.10 OUTDOOR PIPING SCHEDULE

A. Aboveground natural-gas piping is to 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.

B. All outdoor exposed steel piping shall be painted with minimum (2) coats of UV resistant outdoor rated paint. Apply primer as required by paint manufacturer. Do not paint valves, strainers or other piping accessories.

END OF SECTION 231123

SECTION 233113 - METAL DUCTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Single-wall rectangular ducts and fittings.
2. Single-wall round ducts and fittings.
3. Sheet metal materials.
4. Duct liner.
5. Sealants and gaskets.
6. Hangers and supports.
7. Seismic-restraint devices.

B. Related Sections:

1. Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
2. Section 233300 "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of the following products:

1. Liners and adhesives.
2. Sealants and gaskets.
3. Seismic-restraint devices.

B. Shop Drawings:

1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
2. Factory- and shop-fabricated ducts and fittings.
3. Duct layout indicating sizes, configuration, liner material, and static-pressure classes.
4. Elevation of topof ducts.
5. Dimensions of main duct runs from building grid lines.
6. Fittings.
7. Reinforcement and spacing.
8. Seam and joint construction.
9. Penetrations through fire-rated and other partitions.
10. Equipment installation based on equipment being used on Project.

11. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
12. Hangers and supports, including methods for duct and building attachment, seismic restraints, and vibration isolation.

C. Delegated-Design Submittal:

1. Sheet metal thicknesses.
2. Joint and seam construction and sealing.
3. Reinforcement details and spacing.
4. Materials, fabrication, assembly, and spacing of hangers and supports.
5. Design Calculations: Calculations, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation for selecting hangers and supports and seismic restraints.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: A single set of plans or BIM model, drawn to scale, showing the items described in this Section, and coordinated with all building trades.

B. Welding certificates.

C. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel in accordance with the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports
2. AWS D9.1/D9.1M, "Sheet Metal Welding Code," for duct joint and seam welding.

PART 2 - PRODUCTS

2.1 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 with performance requirements and design criteria indicated in "Duct Schedule" Article.

B. Structural Performance: Duct hangers and supports and seismic restraints shall withstand the effects of gravity and seismic loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and ASCE/SEI 7. Seismically brace duct hangers and supports in accordance with SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems."

C. Airstream Surfaces: Surfaces in contact with airstream shall comply with requirements in ASHRAE 62.1.

D. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment," and Section 7 - "Construction and System Startup."

E. ASHRAE/IES Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

F. Duct Dimensions: Unless otherwise indicated, all duct dimensions indicated on Drawings are inside clear dimensions and do not include insulation or duct wall thickness.

2.2 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.

1. Construct ducts of galvanized sheet steel unless otherwise indicated.
2. For ducts exposed to weather, construct of Type 316 stainless steel indicated by manufacturer to be suitable for outdoor installation.

B. Transverse Joints: Fabricate joints in accordance with 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."

1. For ducts with longest side less than 36 inches, select joint types in accordance with Figure 2-1.
2. For ducts with longest side 36 inches or greater, use flange joint connector Type T-22, T-24, T-24A, T-25a, or T-25b. Factory-fabricated flanged duct connection system may be used if submitted and approved by engineer of record.
3. Where specified for specific applications, all joints shall be welded.

C. Longitudinal Seams: Select seam types and fabricate in accordance with 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."

1. Where specified for specific applications, all joints shall be welded.

D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Ch. 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."

2.3 SINGLE-WALL ROUND AND FLAT OVAL DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Ch. 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.

1. Construct ducts of galvanized sheet steel unless otherwise indicated.
2. For ducts exposed to weather, construct of Type 316 stainless steel indicated by manufacturer to be suitable for outdoor installation.
3. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Elgen Manufacturing.
    b. GSI; a DMI Company.
    c. Linx Industries; a DMI company (formerly Lindab).
    d. McGill AirFlow LLC.
    e. MKT Metal Manufacturing.
    f. Nordfab Ducting.
    g. SEMCO, LLC; part of FlaktGroup.
    h. Set Duct Manufacturing.
    i. Sheet Metal Connectors, Inc.
    j. Spiral Manufacturing Co., Inc.
    k. Stamped Fittings 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 in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.

D. Longitudinal Seams: Select seam types and fabricate in accordance with 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 in accordance with 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."

2.4 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A653/A653M.

1. Galvanized Coating Designation: G90.
2. Finishes for Surfaces Exposed to View: Mill phosphatized.

C. Carbon-Steel Sheets: Comply with ASTM A1008/A1008M, with oiled, matte finish for exposed ducts.

D. Stainless-Steel Sheets: Comply with ASTM A480/A480M, Type 304 or 316, as indicated in "Duct Schedule" Article; cold rolled, annealed, sheet. Exposed surface finish shall be No. 2B, No. 2D, No. 3, or No. 4 as indicated in "Duct Schedule" Article.

E. Aluminum Sheets: Comply with ASTM B209 Alloy 3003, H14 temper; with mill finish for concealed ducts, and standard, one-side bright finish for duct surfaces exposed to view.

F. 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 in accordance with ASTM D3363.
4. Surface-Burning Characteristics: Maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested in accordance with UL 723; certified by an NRTL.
5. Shop-Applied Coating Color: White.
6. Antimicrobial coating on sheet metal is not required for duct containing liner treated with antimicrobial coating.

G. Reinforcement Shapes and Plates: ASTM A36/A36M, 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.

H. 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.

2.5 DUCT LINER

A. Fibrous-Glass Duct Liner: Comply with ASTM C1071, 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; SAINT-GOBAIN.
b. Johns Manville; a Berkshire Hathaway company.
c. Knauf Insulation.
d. Owens Corning.
e. Sekisui Voltek, LLC.

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. Solvent-Based Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C916.

B. Flexible Elastomeric Duct Liner: Preformed, cellular, closed-cell, sheet materials complying with ASTM C534/C534M, Type II, Grade 1; and with NFPA 90A or NFPA 90B.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Aeroflex USA.
    b. Armacell LLC.
    c. Ductmate Industries, Inc; a DMI company.
    d. K-Flex USA.
    e. Sekisui Voltek, LLC.

2. Surface-Burning Characteristics: Maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested in accordance with UL 723; certified by an NRTL.
3. Liner Adhesive: As recommended by insulation manufacturer and complying with NFPA 90A or NFPA 90B.

C. Fiberglass-Free Duct Liner: Made from partially recycled cotton or polyester products and containing no fiberglass. Airstream surface overlaid with fire-resistant facing to prevent surface erosion by airstream, complying with NFPA 90A or NFPA 90B. Treat natural-fiber products with antimicrobial coating.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Acoustical Surfaces, Inc.
    b. Ductmate Industries, Inc; a DMI company.

2. Maximum Thermal Conductivity: 0.24 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature when tested in accordance with ASTM C518.
3. Surface-Burning Characteristics: Maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested in accordance with ASTM E84; certified by an NRTL.
4. Liner Adhesive: As recommended by insulation manufacturer and complying with NFPA 90A or NFPA 90B.

D. Insulation Pins and Washers:

1. Cupped-Head, 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 with integral 1-1/2-inch galvanized carbon-steel washer.
2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick stainless steel; with beveled edge sized as required to hold insulation securely in place, but not less than 1-1/2 inches in diameter.

E. 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 fpmor greater.
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.

    a. Sheet Metal Inner Duct Perforations: 3/32-inch diameter, with an overall open area of 23 percent.

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.

2.6 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 in accordance with 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: 4 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.

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 (both PVC coated and bare), stainless steel, or aluminum sheets.
10. Maximum Static-Pressure Class: 10-inch wg, positive or negative.
11. Service: Indoor or outdoor.
12. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

D. Flanged Joint Sealant: Comply with ASTM C920.

1. General: Single-component, acid-curing, silicone, elastomeric.
2. Type: S.
3. Grade: NS.
4. Class: 25.
5. Use: O.

E. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

F. Round Duct Joint O-Ring Seals:

1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for10-inch wg static-pressure class, positive or negative.
2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.7 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Galvanized-steel rods and nuts.

B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."

D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A603.

E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A492.

F. Steel Cable End Connections: Galvanized-steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

H. Trapeze and Riser Supports:

1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

2.8 SEISMIC-RESTRAINT DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. CADDY; brand of nVent Electrical plc.
2. Cooper B-line; brand of Eaton, Electrical Sector.
3. Ductmate Industries, Inc; a DMI company.
4. Elgen Manufacturing.
5. Hilti, Inc.
6. Kinetics Noise Control, Inc.
7. Mason Industries, Inc.
8. Unistrut; Atkore International.

B. General Requirements for Restraint Components: Rated strengths, features, and applications shall be as defined in reports by an agency acceptable to authorities having jurisdiction.

1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.

C. Channel Support System: Shop- or field-fabricated support assembly made of slotted steel channels rated in tension, compression, and torsion forces and with accessories for attachment to braced component at one end and to building structure at the other end. Include matching components and corrosion-resistant coating.

D. Restraint Cables: ASTM A603, galvanized-steel cables with end connections made of galvanized-steel assemblies with brackets, swivel, and bolts designed for restraining cable service; and with an automatic-locking and clamping device or double-cable clips.

E. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections or Reinforcing steel angle clamped to hanger rod.

F. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type. Select anchor bolts with strength required for anchor and as tested in accordance with ASTM E488/E488M.

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 in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

C. Install ducts in maximum practical lengths with fewest possible joints.

D. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

E. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

F. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

G. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.

H. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.

I. 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.

J. Install fire, combination fire/smoke, and smoke dampers where indicated on Drawings and as required by code, and by local authorities having jurisdiction. Comply with requirements in Section 233300 "Air Duct Accessories" for fire and smoke dampers and specific installation requirements of the damper UL listing.

K. Install heating coils, cooling coils, air filters, dampers, and all other duct-mounted accessories in air ducts where indicated on Drawings.

L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials both before and after installation. Comply with SMACNA's "IAQ Guidelines for Occupied

Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."

M. Elbows: Use long-radius elbows wherever they fit.

1. Fabricate 90-degree rectangular mitered elbows to include turning vanes.
2. Fabricate 90-degree round elbows with a minimum of three segments for 12 inches and smaller and a minimum of five segments for 14 inches and larger.

N. Branch Connections: Use lateral or conical branch connections.

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 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 ADDITIONAL INSTALLATION REQUIREMENTS FOR LABORATORY EXHAUST AND FUME HOOD EXHAUST DUCTS

A. Install ducts in accordance with NFPA 45, "Fire Protection for Laboratories Using Chemicals."

B. Install exhaust ducts without dips and traps that may hold water. Slope ducts a minimum of 2 percent back to hood or inlet. Where indicated on Drawings, install trapped drain piping.

C. Connect duct to fan, fume hood, and other equipment indicated on Drawings.

3.4 DUCTWORK EXPOSED TO WEATHER

A. All external joints are to be welded or have secure watertight mechanical connections. Seal all openings to provide weatherproof construction.

B. Construct ductwork to resist external loads of wind, snow, ice, and other effects of weather. Provide necessary supporting structures.

C. Single Wall:

1. Ductwork shall be Type 316 stainless steel.
2. Ductwork shall be galvanized steel.

a. If duct outer surface is uninsulated, protect outer surface with suitable paint. Paint materials and application requirements are specified in Section 099113 "Exterior Painting."

3. Where ducts have external insulation, provide weatherproof aluminum jacket. See Section 230713 "Duct Insulation."

3.5 DUCT SEALING

A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

B. Seal ducts at a minimum to the following seal classes in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":

1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
2. Outdoor, Supply-Air Ducts: Seal Class A.
3. Outdoor, Exhaust Ducts: Seal Class C.
4. Outdoor, Return-Air Ducts: Seal Class C.
5. Unconditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class B.
6. Unconditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class A.
7. Unconditioned Space, Exhaust Ducts: Seal Class C.
8. Unconditioned Space, Return-Air Ducts: Seal Class B.
9. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class C.
10. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class B.
11. Conditioned Space, Exhaust Ducts: Seal Class B.
12. Conditioned Space, Return-Air Ducts: Seal Class C.

3.6 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Where practical, install concrete inserts before placing concrete.
2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
5. Do not use powder-actuated concrete fasteners for seismic restraints.

C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum

Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.

D. Hangers Exposed to View: Threaded rod and angle or channel supports.

E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.

F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.7 SEISMIC-RESTRAINT-DEVICE INSTALLATION

A. Install ducts with hangers and braces designed to support the duct and to restrain against seismic forces required by applicable building codes. Comply with SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems."

1. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.
2. Brace a change of direction longer than 12 feet.

B. Select seismic-restraint devices with capacities adequate to carry present and future static and seismic loads.

C. Install cables so they do not bend across edges of adjacent equipment or building structure.

D. Install cable restraints on ducts that are suspended with vibration isolators.

E. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction.

F. Attachment to Structure: If specific attachment is not indicated, anchor bracing and restraints to structure, to flanges of beams, to upper truss chords of bar joists, or to concrete members.

G. Drilling for and Setting Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcement or embedded items during drilling. Notify Architect if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Set anchors to manufacturer's recommended torque, using a torque wrench.
5. Install zinc-coated steel anchors for interior applications and stainless-steel anchors for applications exposed to weather.

3.8 CONNECTIONS

A. Make connections to equipment with flexible connectors complying with Section 233300 "Air Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.9 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 099113 "Exterior Painting" and Section 099123 "Interior Painting."

3.10 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 totaling no less than 100 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. Testing of each duct section is to be performed with access doors, coils, filters, dampers, and other duct-mounted devices in place as designed. No devices are to be removed or blanked off so as to reduce or prevent additional leakage.
5. Test for leaks before applying external insulation.
6. 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.
7. 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 in accordance with "Description of Method 3 - NADCA 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.

3.11 DUCT CLEANING

A. Clean new duct system(s) before testing, adjusting, and balancing.

B. For cleaning of existing ductwork, see Section 230130.52 "Existing HVAC Air Distribution System Cleaning."

C. Use duct cleaning methodology as indicated in NADCA ACR.

D. Use service openings for entry and inspection.

1. Provide openings with access panels appropriate for duct static-pressure and leakage class at dampers, coils, and any other locations where required for inspection and cleaning access. Provide insulated panels for insulated or lined duct. Patch insulation and liner as recommended by duct liner manufacturer. Comply with Section 233300 "Air Duct Accessories" for access panels and doors.
2. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.
3. Remove and reinstall ceiling to gain access during the cleaning process.

E. 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.

F. 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.

G. 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 in accordance with NADCA ACR. 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 in accordance with manufacturer's written instructions after removal of surface deposits and debris.

3.12 STARTUP

A. Air Balance: Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC."

3.13 DUCT SCHEDULE

A. Fabricate ducts with galvanized sheet steel except as otherwise indicated and as follows:

1. Fabricate all ducts to achieve SMACNA pressure class, seal class, and leakage class as indicated below.
2. Underground Ducts: Concrete-encased, PVC-coated, galvanized sheet steel with thicker coating on duct exterior.

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: 24
    d. SMACNA Leakage Class for Round and Flat Oval: 12.

2. Ducts Connected to Variable-Air-Volume Air-Handling Units and Energy Recovery Units:

    a. Pressure Class: Positive 4-inch wg.
    b. Minimum SMACNA Seal Class: A.
    c. SMACNA Leakage Class for Rectangular: 2.
    d. SMACNA Leakage Class for Round and Flat Oval: 2.

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: 8.
    d. SMACNA Leakage Class for Round and Flat Oval: 8.

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: B.
   c. SMACNA Leakage Class for Rectangular: 24.
   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: 8.
   d. SMACNA Leakage Class for Round and Flat Oval: 8.

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: 8.
   d. SMACNA Leakage Class for Round and Flat Oval: 8.

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: 16.
   d. SMACNA Leakage Class for Round and Flat Oval: 16.

2. Ducts Connected to Air-Handling Units and Energy Recovery Units:

   a. Pressure Class: Positive or negative 2-inch wg.
   b. Minimum SMACNA Seal Class: B if negative pressure, and A if positive pressure.
   c. SMACNA Leakage Class for Rectangular: 8.
   d. SMACNA Leakage Class for Round and Flat Oval: 8.

3. Ducts Connected to Fans Exhausting Fume Hood, Laboratory, and Process (ASHRAE 62.1, Class 3 and Class 4) Air:

   a. Type 316, stainless-steel sheet.

      1) Exposed to View: No. 4 finish.
      2) Concealed: No. 2B finish.

   b. PVC-coated, galvanized sheet steel with thicker coating on duct interior.
   c. Pressure Class: Positive or negative 3-inch wg.
   d. Minimum SMACNA Seal Class A.
   e. SMACNA Leakage Class 2.
   f. Airtight/watertight.

4. Ducts Connected to Equipment Not Listed above:

    a. Pressure Class: Positive or negative 2-inch wg.
    b. Minimum SMACNA Seal Class: B if negative pressure; A if positive pressure.
    c. SMACNA Leakage Class for Rectangular: 8.
    d. SMACNA Leakage Class for Round and Flat Oval: 8.

E. Outdoor-Air (Not Filtered, Heated, or Cooled) Ducts:

1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:

    a. Pressure Class: Positive or negative 2-inch wg.
    b. Minimum SMACNA Seal Class: B.
    c. SMACNA Leakage Class for Rectangular: 8.
    d. SMACNA Leakage Class for Round and Flat Oval: 8.

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: 8.
    d. SMACNA Leakage Class for Round and Flat Oval: 8.

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: 8.
    d. SMACNA Leakage Class for Round and Flat Oval: 8.

F. Intermediate Reinforcement:

1. Galvanized-Steel Ducts: Galvanized steel.
2. Stainless-Steel Ducts:

    a. Exposed to Airstream: Match duct material.
    b. Not Exposed to Airstream: Match duct material.

3. Aluminum Ducts: Aluminum.

G. Liner:
1. Supply-Air Ducts: Fibrous glass, Type I, 1 inch(es thick.
2. Return-Air Ducts: Fibrous glass, Type I, 2 inch(es thick.
3. Exhaust-Air Ducts: Fibrous glass, Type I, 1 inch(es thick.
4. Supply Fan Plenums: Fibrous glass, Type II, 1 inch(es thick.
5. Return- and Exhaust-Fan Plenums: Fibrous glass, Type II, 2 inches thick.
6. Transfer Ducts: Fibrous glass, Type I, 1 inch(es thick.

H. Elbow Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."

a. Velocity 1000 fpm or Lower:

1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.
2) Mitered Type RE 4 without vanes.

b. Velocity 1000 to 1500 fpm:

1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.
2) Radius Type RE 3 with minimum 0.5 radius-to-diameter ratio and two vanes.
3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

c. Velocity 1500 fpm or Higher:

1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
2) Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

2. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."

a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

3. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."

a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.

1) Velocity 1000 fpm or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.
2) Velocity 1000 to 1500 fpm: 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.
3) Velocity 1500 fpm or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.
4) Radius-to Diameter Ratio: 1.5.

b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.
c. Round Elbows, 14 Inches and Larger in Diameter: Standing seam.

I. 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: Conical spin in.

2. Round and Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.

a. Velocity 1000 fpm or Lower: 90-degree tap.
b. Velocity 1000 to 1500 fpm: Conical tap.
c. Velocity 1500 fpm or Higher: 45-degree lateral.

END OF SECTION 233113

SECTION 233300 - AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Backdraft and pressure relief dampers.
2. Manual volume dampers.
3. Flange connectors.
4. Turning vanes.
5. Flexible connectors.
6. Duct accessory hardware.

B. Related Requirements:

1. Section 233346 "Flexible Ducts" for insulated and non-insulated flexible ducts.
2. Section 233723 "HVAC Gravity Ventilators" for roof-mounted ventilator caps.
3. Section 284621.11 "Addressable Fire-Alarm Systems" for duct-mounted fire and smoke detectors.
4. Section 284621.13 "Conventional Fire-Alarm Systems" for duct-mounted fire and smoke detectors.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. For duct silencers, include pressure drop, dynamic insertion loss, and self-generated noise data. Include breakout noise calculations for high-transmission-loss casings.

B. Sustainable Design Submittals:

1. Product data showing compliance with ASHRAE 62.1.

C. Shop Drawings: For duct accessories. Include plans, elevations, sections, details, and attachments to other work.

1. Detail duct accessories' fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances; and method of field assembly into duct systems and other construction. Include the following:

a. Special fittings.
b. Manual volume damper installations.
c. Control-damper installations.
d. Fire-damper, smoke-damper, combination fire- and smoke-damper, ceiling, and corridor-damper installations, including sleeves; and duct-mounted access doors and remote damper operators.
e. Duct security bars.
f. Include diagrams for power, signal, and control wiring.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, or BIM model, drawn to scale, and coordinated with each other, using input from installers of the items involved.

B. Source quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Comply with NFPA 90A and NFPA 90B.

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 BACKDRAFT AND PRESSURE RELIEF DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. American Warming and Ventilating; a Mestek Architectural Group company.
2. Cesco Products; a division of MESTEK, Inc.
3. Greenheck Fan Corporation.
4. Lloyd Industries, Inc.
5. Nailor Industries Inc.
6. NCA Manufacturing, Inc.
7. Pottorff.
8. Ruskin Company.
9. Safe Air - Dowco Products.
10. United Enertech.
11. Vent Products Co., Inc.

B. Description: Gravity balanced.

C. Performance:

1. Maximum Air Velocity: 1250 fpm.
2. Maximum System Pressure: 2 inch wg.
3. AMCA Certification: Test and rate in accordance with AMCA 511.
4. Leakage:

a. Class II: Leakage shall not exceed 10 cfm/sq. ft. against 1-inch wg differential static pressure.

D. Construction:

1. Frame:

a. Hat shaped.
b. 16-gauge-thick, galvanized sheet steel, with welded or mechanically attached corners and mounting flange.

2. Blades:

a. Multiple single-piece blades.
b. Off-center pivoted, maximum 6-inch width, 0.050-inch-thick aluminum sheet with sealed edges.

3. Blade Action: Parallel.

E. Blade Seals: Extruded vinyl, mechanically locked.

F. Blade Axles:

1. Material: Aluminum.
2. Diameter: 0.20 inch.

G. Tie Bars and Brackets: Aluminum.

H. Return Spring: Adjustable tension.

I. Bearings: synthetic pivot bushings.

J. Accessories:

1. Adjustment device to permit setting for varying differential static pressure.
2. Counterweights and spring-assist kits for vertical airflow installations.
3. Chain pulls.

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. Air Balance; a division of MESTEK, Inc.
b. Aire Technologies, Inc.; a DMI company.
c. American Warming and Ventilating; a Mestek Architectural Group company.
d. Arrow United Industries.
e. Cesco Products; a division of MESTEK, Inc.
f. Greenheck Fan Corporation.
g. Lloyd Industries, Inc.
h. McGill AirFlow LLC.

i. Nailor Industries Inc.
j. Pottorff.
k. Ruskin Company.
l. Safe Air - Dowco Products.
m. United Enertech.
n. Vent Products Co., Inc.

2. Performance:

a. Leakage Rating Class III: Leakage not exceeding 40 cfm/sq. ft. against 1-inch wg differential static pressure.

3. Construction:

a. Linkage out of airstream.
b. Suitable for horizontal or vertical airflow applications.

4. Frames:

a. Hat-shaped, 16-gauge-thick, galvanized sheet steel.
b. Mitered and welded corners.
c. Flanges for attaching to walls and flangeless frames for installing in ducts.

5. Blades:

a. Multiple or single blade.
b. Parallel- or opposed-blade design.
c. Stiffen damper blades for stability.
d. Galvanized steel; 16 gauge thick.

6. Blade Axles: Galvanized steel.
7. Bearings:

a. Oil-impregnated bronze Oil-impregnated stainless steel sleeve.
b. Dampers mounted with vertical blades to have thrust bearing at each end of every blade.

8. Tie Bars and Brackets: Galvanized steel.
9. Locking device to hold damper blades in a fixed position without vibration.

B. Standard, Aluminum, Manual Volume Dampers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. American Warming and Ventilating; a Mestek Architectural Group company.
b. Arrow United Industries.
c. Cesco Products; a division of MESTEK, Inc.
d. Linx Industries; a DMI company (formerly Lindab).
e. Lloyd Industries, Inc.
f. McGill AirFlow LLC.
g. Nailor Industries Inc.
h. Pottorff.
i. RoofGoose Vent.

j. Ruskin Company.
k. Safe Air - Dowco Products.
l. United Enertech.
m. Vent Products Co., Inc.

2. Performance:

   a. Leakage Rating Class III: Leakage not exceeding 40 cfm/sq. ft. against 1-inch wg differential static pressure.

3. Construction:

   a. Linkage out of airstream.
   b. Suitable for horizontal or vertical airflow applications.

4. Frames:

   a. Hat-shaped, 0.10-inch-thick, aluminum sheet channels.
   b. Flanges for attaching to walls and flangeless frames for installing in ducts.

5. Blades:

   a. Multiple or single blade.
   b. Parallel- or opposed-blade design.
   c. Stiffen damper blades for stability.
   d. Roll-Formed Aluminum Blades: 0.10-inch-thick aluminum sheet.
   e. Extruded-Aluminum Blades: 0.050-inch-thick extruded aluminum.

6. Blade Axles: Galvanized steel.
7. Bearings:

   a. Oil-impregnated bronze.
   b. Dampers mounted with vertical blades to have thrust bearing at each end of every blade.

8. Tie Bars and Brackets: Aluminum.
9. Locking device to hold damper blades in a fixed position without vibration.

C. Jackshaft:

1. Size: 1-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.

D. 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 CONTROL DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. American Warming and Ventilating; a Mestek Architectural Group company.
2. Arrow United Industries.
3. Carnes Company.
4. Cesco Products; a division of MESTEK, Inc.
5. Greenheck Fan Corporation.
6. Lloyd Industries, Inc.
7. McGill AirFlow LLC.
8. Metal Form Manufacturing, Inc.
9. Nailor Industries Inc.
10. NCA Manufacturing, Inc.
11. Pottorff.
12. Ruskin Company.
13. Safe Air - Dowco Products.
14. United Enertech.
15. Vent Products Co., Inc.
16. Young Regulator Company.

B. General Requirements:

1. Unless otherwise indicated, use parallel-blade configuration for two-position control, equipment isolation service, and when mixing two airstreams. For other applications, use opposed-blade configuration.
2. Factory or field assemble multiple damper sections to provide a single damper assembly of size required by the application.

C. Performance:

1. AMCA Certification: Test and rate in accordance with AMCA 511.
2. Leakage:

    a. Class IA: Leakage shall not exceed 3 cfm/sq. ft. against 1-inch wg differential static pressure.
    b. Class I: Leakage shall not exceed 4 cfm/sq. ft. against 1-inch wg differential static pressure.
    c. Class II: Leakage shall not exceed 10 cfm/sq. ft. against 1-inch wg differential static pressure.
    d. Class III: Leakage shall not exceed 40 cfm/sq. ft. against 1-inch wg differential static pressure.

3. Pressure Drop: 0.05 inch wg at 1500 fpm across a 24-by-24-inch damper when tested in accordance with AMCA 500-D, Figure 5.3.
4. Velocity: Up to 3000 fpm.
5. Temperature: Minus 25 to plus 180 deg F.
6. Pressure Rating: Damper close-off pressure equal to fan shutoff pressure with a maximum blade deflection of 1/200 of blade length.

D. Construction:

1. Linkage out of airstream.
2. Suitable for horizontal or vertical airflow applications.
3. Frames:

    a. Hat, U, or angle shaped.
    b. 16-gauge-thick, galvanized sheet steel.
    c. Mitered and welded corners.
    d. Flanges for attaching to walls and flangeless frames for installing in ducts.

4. Blades:

    a. Multiple blade with maximum blade width of 8 inches.
    b. Opposed-blade design.
    c. Stainless steel.
    d. 16-gauge-thick single skin or 14-gauge-thick air foil dual skin.

5. Blade Edging Seals:

    a. Replaceable Closed-cell neoprene.
    b. Inflatable seal blade edging, or replaceable rubber seals.

6. Blade Jamb Seal: Flexible stainless steel, compression type.
7. Blade Axles: 1/2-inch diameter; galvanized steel.
8. Blade-Linkage Hardware: Zinc-plated steel and brass; ends sealed against blade bearings. Linkage mounted out of air stream.
9. Bearings:

    a. Oil-impregnated stainless steel sleeve.
    b. Dampers mounted with vertical blades to have thrust bearings at each end of every blade.

E. Damper Actuator - Electric:

1. Electric - 24 V ac.
2. UL 873, plenum rated.
3. Fully modulating with fail-safe spring return.

    a. Sufficient motor torque and spring torque to drive damper fully open and fully closed with adequate force to achieve required damper seal.
    b. Minimum 90-degree drive rotation.

4. Clockwise or counterclockwise drive rotation as required for application.
5. Environmental Operating Range:

    a. Temperature: Minus 40 to plus 130 deg F.
    b. Humidity: 5 to 95 percent relative humidity noncondensing.

6. Environmental enclosure: NEMA 2.
7. Actuator to be factory mounted and provided with a single-point wiring connection

8. Actuator to be factory mounted.

F. Controllers, Electrical Devices, and Wiring:

1. Comply with requirements for electrical devices and connections specified in Section 230923 "Direct Digital Control (DDC) System for HVAC."
2. Electrical Connection: 24 V, 60 Hz.

2.5 FLANGE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. CL WARD & Family Inc.
2. Ductmate Industries, Inc; a DMI company.
3. DynAir; a Carlisle Company.
4. Elgen Manufacturing.
5. Ward Industries; a brand of Hart & Cooley, Inc.

B. Description: Add-on or roll-formed, factory fabricated, slide-on transverse flange connectors, gaskets, and components.

C. Material: Galvanized steel.

D. Gauge and Shape: Match connecting ductwork.

2.6 TURNING VANES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Aero-Dyne Sound Control Co.
2. CL WARD & Family Inc.
3. Ductmate Industries, Inc; a DMI company.
4. Duro Dyne Inc.
5. DynAir; a Carlisle Company.
6. Elgen Manufacturing.
7. Ward Industries; a brand of Hart & Cooley, Inc.

B. Manufactured Turning Vanes for Metal Ducts: Fabricate curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

1. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.

C. Manufactured Turning Vanes for Nonmetal Ducts: Fabricate curved blades of resin-bonded fiberglass with acrylic polymer coating; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

D. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

E. Vane Construction:

1. Double wall.
2. Single wall for ducts up to 48 inches wide and double wall for larger dimensions.

2.7 FLEXIBLE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. CL WARD & Family Inc.
2. Ductmate Industries, Inc; a DMI company.
3. Duro Dyne Inc.
4. DynAir; a Carlisle Company.
5. Elgen Manufacturing.
6. Ventfabrics, Inc.
7. Ward Industries; a brand of Hart & Cooley, Inc.

B. Fire-Performance Characteristics: Adhesives, sealants, fabric materials, and accessory materials shall have flame-spread index not exceeding 25 and smoke-developed index not exceeding 50 when tested in accordance with ASTM E84.

C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

D. Materials: Flame-retardant or noncombustible fabrics.

E. Coatings and Adhesives: Comply with UL 181, Class 1.

F. Metal-Edged Connectors: Factory fabricated with a fabric strip 5-3/4 inches wide attached to two strips of 2-3/4-inch-wide, 0.028-inch- thick, galvanized sheet steel or 0.032-inch-thick aluminum sheets. Provide metal compatible with connected ducts.

G. 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.

H. 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.

I. High-Temperature System, Flexible Connectors: Glass fabric coated with silicone rubber.

1. Minimum Weight: 16 oz./sq. yd..
2. Tensile Strength: 285 lbf/inch in the warp and 185 lbf/inch in the filling.
3. Service Temperature: Minus 67 to plus 500 deg F.

J. High-Corrosive-Environment System, Flexible Connectors: Glass fabric with chemical-resistant coating.

1. Minimum Weight: 14 oz./sq. yd..
2. Tensile Strength: 450 lbf/inch in the warp and 340 lbf/inch in the filling.
3. Service Temperature: Minus 67 to plus 500 deg F.

K. 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. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Elastomeric Element: Molded, oil-resistant rubber or neoprene.
7. Coil Spring: Factory set and field adjustable for a maximum of 1/4-inch movement at start and stop.

2.8 DUCT ACCESSORY HARDWARE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. CL WARD & Family Inc.
2. Ductmate Industries, Inc; a DMI company.
3. Duro Dyne Inc.
4. DynAir; a Carlisle Company.
5. Elgen Manufacturing.
6. Hardcast; Carlisle Construction Materials.
7. United Enertech.
8. Ventfabrics, Inc.
9. Ward Industries; a brand of Hart & Cooley, Inc.

B. 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.

C. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

2.9 MATERIALS

A. Galvanized Sheet Steel: Comply with ASTM A653/A653M.

1. Galvanized Coating Designation: G60 .
2. Exposed-Surface Finish: Mill phosphatized.

B. Stainless Steel Sheets: Comply with ASTM A480/A480M, Type 304, and having a No. 2 finish for concealed ducts and finish for exposed ducts.

C. Aluminum Sheets: Comply with ASTM B209, Alloy 3003, Temper H14; with mill finish for concealed ducts and standard, one-side bright finish for exposed ducts.

D. Extruded Aluminum: Comply with ASTM B221, Alloy 6063, Temper T6.

E. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless steel ducts.

F. 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.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install duct accessories in accordance with applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116 for fibrous-glass ducts.

B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless steel accessories in stainless steel ducts, and aluminum accessories in aluminum ducts.

C. Install backdraft dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.

D. Where multiple damper sections are necessary to achieve required dimensions, provide reinforcement to fully support damper assembly when fully closed at full system design static pressure.

E. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.

1. Install steel volume dampers in steel ducts.
2. Install aluminum volume dampers in aluminum ducts.

F. Set dampers to fully open position before testing, adjusting, and balancing.

G. Install test holes at fan inlets and outlets and elsewhere as indicated and as needed for testing and balancing.

H. Install fire dampers in accordance with UL listing.

I. 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 and downstream from duct filters.
3. At outdoor-air intakes and mixed-air plenums.

4. At drain pans and seals.
5. Downstream from manual volume dampers, control dampers, backdraft dampers, and equipment.
6. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
7. At each change in direction and at maximum 50-ft. spacing.
8. Upstream and downstream from turning vanes.
9. For grease ducts, install at locations and spacing as required by NFPA 96.
10. Control devices requiring inspection.
11. Elsewhere as indicated.

J. Install access doors with swing against duct static pressure.

K. 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.

L. Label access doors according to Section 230553 "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.

M. Install flexible connectors to connect ducts to equipment.

N. For fans developing static pressures of 5 inches wg and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.

O. Install duct test holes where required for testing and balancing purposes.

P. Install thrust limits at centerline of thrust, symmetrical on both sides of equipment. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch 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 size and location of access doors are adequate to perform required operation.
3. Operate fire, smoke, and combination fire and smoke dampers to verify full range of movement and that proper heat-response device is installed.
4. Inspect turning vanes for proper and secure installation, and verify that vanes do not move or rattle.
5. Operate remote damper operators to verify full range of movement of operator and damper.

END OF SECTION 233300

SECTION 237433 – DEDICATED OUTDOOR-AIR UNITS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Heat wheels in packaged dedicated outside air units (DOAS) with air-to-air energy recovery capable of supplying up to 100% outdoor air and providing heating and cooling.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For DOAS units.

1. Include plans, elevations, sections, details, and mounting details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, lifting requirements, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.
4. Provide rated load amp draw.
5. Include Noise levels produced by equipment.
6. Fan Curves for the unit at the operating conditions.
7. Net capacity for the unit under the design conditions.
8. Filter types, quantities, and sizes.
9. Motor ratings and brake horsepower.
10. Piping diagram and coil connections.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Floor plans, roof plans, elevations, and other details, drawn to scale and coordinated with each other, using input from installers of items involved.

B. Seismic Qualification Data: Certificates, for DOAS units, accessories, and components, from manufacturer.

C. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.5 COORDINATION

A. Coordinate sizes and locations of building openings and duct connections with actual equipment provided.

1.6 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of DOAS units that fail in materials or workmanship within specified warranty period.

1. Warranty Period for DOAS Units: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. NFPA Compliance: Comply with NFPA 90A for design, fabrication, and installation of air-handling units and components.

B. ASHRAE Compliance:

1. Applicable requirements in ASHRAE 62.1.
2. Capacity ratings for energy-recovery equipment: Comply with ASHRAE 84.

C. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1.

D. UL Compliance:

1. Entire unit to be listed under UL 1812 and UL 1995 and comply with CSA Standard 22.2.

E. Comply with ASTM E84, and AHRI 410.

F. Unit to be factory tested prior to shipping: Unit to undergo the following factory tests.
1. Dielectric voltage withstand test per UL/ETL
2. Grounding continuity test
3. Refrigeration circuits fully charged.
4. End-of-Line run test to verify system operation.

2.2 CAPACITIES AND CHARACTERISTICS

A. See drawings for unit characteristics.

2.3 DOAS UNITS

A. Manufacturer: Daikin.

B. Surfaces in Contact with Airstream: Comply with requirements in ASHRAE 62.1.

C. Housing: Manufacturer's standard construction with corrosion-protection coating and exterior finish, gasketed doors with neoprene gaskets for inspection and access to internal parts, minimum 2 inches thick, thermal insulation, knockouts for electrical connections, exterior drain connection, and lifting lugs. Provide with 2”, R-13 wall insulation.

D. Condensate/Drain Pans: Drain pan shall be fabricated from stainless steel. All pans are to be pitched for complete drainage with no standing water in the unit. Provide stainless steel, 1-1/4” MPT drain connection extended to the exterior of the casing. All drain connections shall be piped and trapped separately for proper drainage.

E. Supply and Exhaust Fans: Backward-curved, Plenum fan with spring isolators.

1. Motor and Drive: Direct driven with speed changed by variable-frequency motor controller.

    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. Motor Sizes: Minimum size as indicated. If size is not indicated, provide motor large enough so driven load will not require motor to operate in service factor range above 1.0.

F. Filters:

1. Description: pleated, factory-fabricated, self-supported, disposable air filters with holding frames.
2. UL Compliance: Comply with UL 900.
3. Media: Interlaced glass fibers sprayed with nonflammable adhesive and antimicrobial coating.
4. Filter-Mounting Frames: Arranged with access doors or panels on one or both sides of unit. Design unit with filters removable from one side, or lift out from access plenum.
5. Filters shall be a minimum MERV 8 rating.

G. Wiring: Fabricate units with space within housing for electrical conduits. Wire motors and controls, so only external connections are required during installation.

1. Outdoor Enclosure: NEMA 250, Type 3R enclosure contains relays, starters, and terminal strip.
2. Include non-fused disconnect switches.

2.4 GAS FURNACE

A. Indicate airflow, efficiency, input, output, entering-air temperature, and air-temperature rise in "Capacities and Characteristics" Article or in schedule on Drawings.

B. Description: Factory assembled, piped, and wired; complying with ANSI Z21.47/CSA 2.3 and NFPA 54.

1. CSA Approval: Designed and certified by and bearing label of CSA.

C. Burners: Stainless steel.

1. Fuel: Natural gas.

2. Ignition: Electronically controlled electric spark or hot-surface igniter with flame sensor.

D. Heat-Exchanger and Drain Pan: Stainless steel.

E. Power Vent: Integral, motorized centrifugal fan interlocked with gas valve.

F. Gas Valve Train: Single-body, regulated, redundant, 24-V ac gas valve assembly containing pilot solenoid valve, pilot filter, pressure regulator, pilot shutoff, and manual shutoff.

2.5 REFRIGERANT COOLING COILS

A. Characteristics of DX cooling coil in unit:

1. Capacity Ratings: Coil rated in accordance with ARI 410 – Standard for Forced-Circulation Air-Cooling and Air-Heating Coils
2. Coil Casting Material: Stainless Steel
3. Tube Material: Copper
4. Tube Header Material: Copper
5. Fin Material: Aluminum
6. Fin and Tube Joints: Mechanical Bond.
7. Leak Test: Coils shall be leak tested with air underwater.
8. Provide adequate clearance for accessing, cleaning, servicing, and maintaining the coil per coil manufacturer’s recommendation.
9. Ensure that the coil can be removed and replaced in the field with ease.

B. ROTARY HEAT EXCHANGER:

1. Casing:

   a. Galvanized steel, stainless steel, or aluminum with manufacturer's standard factory-painted 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 and on duct divider and purge section.
   d. Support vertical rotor on grease-lubricated ball bearings having extended grease fittings or permanently lubricated bearings. Support horizontal rotors on tapered roller bearings.

2. Rotor - Aluminum, Metallic, or Polymer: Aluminum, metallic, or polymer segmented wheel, strengthened with radial spokes impregnated with nonmigrating, water-selective, molecular-sieve desiccant coating.
3. Drive: Fractional horsepower motor and gear reducer, with speed changed by variable-frequency controller. Provide permanently lubricated wheel bearings.
4. 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 4-20 mA or 1-10 V control signal.
   c. Control energy recovery to permit air economizer operation.

      1) Bypass dampers to assist energy recovery control.

   d. Pilot-Light Indicator: Display rotor rotation and speed.

e. Speed Settings: Adjustable settings for maximum and minimum rotor speed limits.
f. 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.
g. Defrost cycle.

2.6 AIR FILTRATION:

A. 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 and antimicrobial coating.
4. Filter-Media Frame: High wet-strength beverage board with perforated metal retainer, or metal grid, on outlet side.

B. Mounting Frames:
1. Panel filters arranged for flat or angular orientation, with access doors on both sides of unit. Filters shall be removable from one side or from access plenum.

C. Exhaust Filters: 2” MERV 8

D. Supply Filters: 2” MERV 8 Pre-filter, 4” MERV 13 Final Filter.

2.7 CONTROLS

A. Control Panel: Solid-state, programmable, microprocessor-based control unit for wall mounting.

B. Starting relay, factory mounted and wired, and manual motor starter for field wiring.

C. Frost Control: Vary rotary wheel speed per manufacturers sequence of operations.

D. Carbon Dioxide Sensor: Adjustable control from 600 to 2000 ppm for duct mounting, with digital display and direct digital control (DDC) system interface to energize unit.

E. Economizer Control, Stop Wheel: Stop wheel rotation or modulate wheel rotation speed when conditions are favorable for economizer operation.

F. Economizer Control, Airflow Bypass: Heat-wheel airflow bypass. See Section 230923 "Direct Digital Control (DDC) System for HVAC" for control sequence.

G. Enthalpy sensor.

H. Rotation sensor and alarm.

I. Dirty filter switch.

J. Low-Voltage Transformer: Integral transformer to provide control voltage to unit from primary incoming electrical service.

K. Variable-Speed Control: 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. Increase rotor speed to maximum when exhaust-air temperature is less than outdoor-air temperature.

2.8 SOURCE QUALITY CONTROL

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended application.

B. AHRI Compliance: Capacity ratings for air-to-air energy-recovery equipment certified as complying with AHRI 1060 (IP.

C. Fan Performance Rating: Comply with AMCA 211, and label fans with AMCA-certified rating seal. Factory test fan performance for airflow, pressure, power, air density, rotation speed, and efficiency in accordance with AMCA 210 and ASHRAE 51.

D. Fan Sound Rating: Comply with AMCA 301 or AHRI 260 (IP.

PART 3 - EXECUTION

3.1 INSTALLATION OF DOAS UNITS

A. Examine casing insulation materials and filter media before packaged, outdoor, heat wheel energy-recovery unit installation. Replace insulation materials and filter media that are wet, moisture damaged, or mold contaminated.

B. Install DOAS units to match orientation in plans

1. Install access doors in both supply and exhaust ducts, both upstream and downstream, for access to wheel surfaces, drive motor, and seals.
2. Install removable panels or access doors between supply and exhaust ducts on building side for bypass during startup.
3. Access doors and panels are specified in Section 233300 "Air Duct Accessories."

C. Equipment Mounting:

1. Refer to drawings for specific information.
2. Install roof-mounted DOAS units on existing roof mounting curb.

D. Install units with clearances for service and maintenance.

E. Do not operate equipment fans until temporary or permanent filters are in place. Replace temporary filters used during construction and testing with new, clean filters prior to test and balance, and prior to final inspection.

3.2 DUCTWORK CONNECTIONS

A. Comply with requirements for ductwork in accordance with Section 233113 "Metal Ducts."

B. Connect duct to units with flexible connections. Comply with requirements in Section 233300 "Air Duct Accessories."

C. Isolation Dampers: Install isolation dampers in accordance with Section 230923.12 "Control Dampers."

3.3 PIPING CONNECTIONS

A. Where installing piping adjacent to unit, allow service and maintenance.

B. Connect piping to units mounted on vibration isolators with flexible connectors.

C. Condensate Drain Piping: See details for requirements. Install condensate drain piping from drain pans to spill onto roof, same size as condensate drain connection.

1. Construct deep trap at connection to drain pan, and install cleanouts at changes in direction.

3.4 ELECTRICAL CONNECTIONS

A. Install electrical devices furnished by manufacturer, but not factory mounted, in accordance with NFPA 70 and NECA 1.

B. Connect wiring in accordance with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

C. Ground equipment in accordance with Section 260526 "Grounding and Bonding for Electrical Systems."

D. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.

1. Nameplate shall be laminated acrylic or melamine plastic signs, as specified in Section 260553 "Identification for Electrical Systems."
2. Nameplate shall be laminated acrylic or melamine plastic signs with a black background and engraved white letters at least 1/2 inch high.

3.5 CONTROL CONNECTIONS

A. Install control and electrical power wiring to factory control devices.

3.6 ACCESSORIES

A. Duplex, 115-V, ground-fault-interrupter outlet with 15-A overcurrent protection. Include transformer if required. Outlet shall be energized even if the unit main disconnect is open.

B. Provide with manufacturer’s option to adapt unit to previous generation of roof curb.

C. Manufacturers remote interface panel for adjust setpoint and controls of unit. Refer to drawings for placement. Provide all required wiring between control panel and unit.

D. Unit shall be wired to existing smoke detector serving previous equipment. Full test and notify engineer of any faulty equipment.

E. Hail guards.

F. Manufacturers factory safeties with alarming through remote interface.

G. Outdoor air intake weather hood.

H. Provide new supply and exhaust filters at startup, at test and balance, and at final turnover, as well as (3) full set of spare filters to owners facilities management team.

3.7 FIELD QUALITY CONTROL

A. Perform tests and inspections with assistance of factory-authorized service representative.

B. Tests and Inspections:

1. 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.

C. DOAS equipment will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

E. When requested within 12 months from the date of substantial completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two (2) visits to project during other-than-normal occupancy hours for this purpose.

3.8 DEMONSTRATION

A. Engage factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain DOAS units.

B. Engage factory authorized service representative to train Owner’s maintenance personnel on procedures and schedules related to startup and shutdowns, troubleshooting, servicing, and preventative maintenance.

C. Review data in the maintenance manuals.

D. Provide a minimum of 4 hours training to the owners facility management team.

END OF SECTION 237433

SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Copper building wire.
   2. Connectors and splices.

B. Related Requirements:
   1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this section.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Product Schedule: Indicate type, use, location, and termination locations.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

PART 2 - PRODUCTS

2.1 COPPER BUILDING WIRE

A. Description: Flexible, insulated and uninsulated, drawn copper current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V or less.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Alpha Wire; brand of Belden, Inc.
   2. Belden Inc.
   3. Cerro Wire LLC.
   4. Encore Wire Corporation.
   5. General Cable; Prysmian Group North America.
   6. Okonite Company (The).
   7. Service Wire Co.
   8. Southwire Company, LLC.
   9. WESCO.

C. Standards:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
2. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

D. Conductors: Copper, complying with ASTM B3 for bare annealed copper and with ASTM B8 for stranded conductors.

E. Conductor Insulation:

1. Type USE-2 and Type SE. Comply with UL 854.
2. Type THHN and Type THWN-2. Comply with UL 83.
3. Type THW and Type THW-2. Comply with NEMA WC-70/ICEA S-95-658 and UL 83.

2.2 METAL CLAD CABLE, TYPE MC

A. Description: A factory assembly of one or more current-carrying insulated conductors in an overall metallic sheath.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Alpha Wire; brand of Belden, Inc.
2. Belden Inc.
3. Cerro Wire LLC.
4. Encore Wire Corporation.
5. General Cable; Prysmian Group North America.
6. Okonite Company (The).
7. Service Wire Co.
8. Southwire Company, LLC.
9. WESCO.

C. Standards:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
2. Comply with UL 1569.
3. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

D. Circuits:

1. Single circuit.
2. Power-Limited Fire-Alarm Circuits: Comply with UL 1424.

E. Conductors: Copper, complying with ASTM B3 for bare annealed copper and with ASTM B8 for stranded conductors.

F. Ground Conductor: Bare or Insulated.

G. Conductor Insulation:

1. Type TFN/THHN/THWN-2. Comply with UL 83.
2. Type XHHW-2. Comply with UL 44.

H. Armor: Steel, interlocked.

I. Jacket: PVC applied over armor.

2.3 CONNECTORS AND SPLICES

A. Description: Factory-fabricated connectors, splices, and lugs of size, ampacity rating, material, type, and class for application and service indicated; listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. 3M Electrical Products.
2. ABB, Electrification Business.
3. AFC Cable Systems; Atkore International.
4. Gardner Bender.
5. Hubbell Utility Solutions; Hubbell Incorporated.
6. ILSCO.
7. Ideal Industries, Inc.
8. NSi Industries LLC.
9. O-Z/Gedney; brand of Emerson Electric Co., Automation Solutions, Appleton Group.
10. Service Wire Co.
11. TE Connectivity Ltd.
12. Burndy; brand of Hubbell Electrical Solutions; Hubbell Incorporated.

C. Jacketed Cable Connectors: For steel and aluminum jacketed cables, zinc die-cast with set screws, designed to connect conductors specified in this Section.

D. Lugs: One piece, seamless, designed to terminate conductors specified in this Section.
1. Material: Copper.
2. Type: One or Two hole with standard or long barrels.
3. Termination: Compression.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders:
1. Copper; solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
2. Copper for feeders smaller than No. 4 AWG; copper or aluminum for feeders No. 4 AWG and larger. Conductors must be solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Branch Circuits:
1. Copper:

a. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
b. Solid for No. 12 AWG and smaller; stranded for No. 10 AWG and larger.

C. Power-Limited Fire Alarm and Control: Solid for No. 12 AWG and smaller.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Exposed Feeders: 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. Exposed Branch Circuits, Including in Crawlspaces: Type THHN/THWN-2, single conductors in raceway.

E. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN/THWN-2, single conductors in raceway.

F. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN-2, single conductors in raceway.

G. Luminaire Connections Above Accessible Ceilings: Metal-clad cable, Type MC.

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 26 05 33 "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 26 05 29 "Hangers and Supports for Electrical Systems."

3.4 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 12 inch of slack.

D. Comply with requirements in Section 28 31 11 "Digital, Addressable Fire-Alarm System" for connecting, terminating, and identifying wires and cables.

3.5 IDENTIFICATION

A. Identify and color-code conductors and cables according to Section 26 05 53 "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 26 05 44 "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 07 84 13 "Penetration Firestopping."

END OF SECTION 260519

SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes grounding and bonding systems and equipment.

B. Related Requirements:

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

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with UL 467 for grounding and bonding materials and equipment.

2.2 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 B3.
2. Stranded Conductors: ASTM B8.
3. Tinned Conductors: ASTM B33.

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 inch wide and 1/16 inch thick.
7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inch wide and 1/16 inch thick.

C. Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4 by 4 inchescross section by 10 inches in length minimum, with 9/32-inch holes spaced 1-1/8 inch apart. Stand-off insulators for mounting must comply with UL 891 for use in switchboards, 600 V and must be Lexan or PVC, impulse tested at 5000 V.

2.3 CONNECTORS

A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.

B. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

C. Mechanical-Type Bus-Bar Connectors: Cast silicon bronze, solderless compression or exothermic-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

D. Beam Clamps: Mechanical type, terminal, ground wire access from four directions, with dual, tin-plated or silicon bronze bolts.

E. Cable-to-Cable Connectors: Compression type, copper or copper alloy.

F. Cable Tray Ground Clamp: Mechanical type, zinc-plated malleable iron.

G. Conduit Hubs: Mechanical type, terminal with threaded hub.

H. Ground Rod Clamps: Mechanical type, copper or copper alloy, terminal with hex head bolt or socket set screw.

I. Ground Rod Clamps: Mechanical type, copper or copper alloy, terminal with hex head bolt.

J. Lay-in Lug Connector: Mechanical type, copper rated for direct burial terminal with set screw.

K. Service Post Connectors: Mechanical type, bronze alloy terminal, in short- and long-stud lengths, capable of single and double conductor connections.

L. Signal Reference Grid Clamp: Mechanical type, stamped-steel terminal with hex head screw.

M. Straps: Solid copper, cast-bronze clamp. Rated for 600 A.

N. Tower Ground Clamps: Mechanical type, copper or copper alloy, terminal one or two-piece clamp.

O. U-Bolt Clamps: Mechanical type, copper or copper alloy, terminal listed for direct burial.

P. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

Q. Water Pipe Clamps:

1. Mechanical type, two pieces with zinc-plated or stainless-steel bolts.
   a. Material: Tin-plated aluminum or Die-cast zinc alloy.
   b. Listed for direct burial.

2. U-bolt type with malleable-iron clamp and copper ground connector rated for direct burial.

2.4 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel; 3/4 inch by 10 ft.

B. Concrete-Encased Electrode (Ufer Ground)

1. Fabricate in accordance with NFPA 70; use minimum of 20 ft bare copper conductor not smaller than shown on drawings.
   a. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building's grounding grid or to grounding electrode external to concrete.

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, sized per drawings and details

1. Bury at least 30 inch below grade.

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 inch minimum from wall, 6 inch 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 or Bolted connectors.

E. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.

3.2 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits. Provide equipment grounding conductor in all armored or metalclad cable assemblies.

B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:

1. Feeders and branch circuits.
2. Lighting circuits.
3. Receptacle circuits.
4. Single-phase motor and appliance branch circuits.
5. Three-phase motor and appliance branch circuits.
6. Flexible raceway runs.
7. Armored and metal-clad cable runs.
8. Busway Supply Circuits: Install insulated equipment grounding conductor from grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.

C. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install a separate insulated equipment grounding conductor. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.

D. 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.

E. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.

3.3 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Ground Rods: Drive rods until tops are 2 inch 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 rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.

C. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.

D. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange 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.

E. Where indicated on the plans provide a concrete-encased (“UFER”) ground. Use bare conductor no smaller than the service grounding electrode conductor and encase in bottom of concrete slab or footing no less than 2” from bottom of concrete. Bond to reinforcing bars and encase at least 20’ of bare conductor.

3.4 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, at ground test wells. Make tests at ground rods before any conductors are connected.

a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
b. Perform tests by fall-of-potential method according to IEEE 81.

B. Grounding system will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

D. Report measured ground resistances that exceed the following values:

1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 ohms.
2. Power and Lighting Equipment or System with Capacity of 500 to 1000 kVA: 5 ohms.
3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.
4. Power Distribution Units or Panelboards Serving Electronic Equipment: 1 ohm.

E. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION 260526

SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Support, anchorage, and attachment components.
2. Fabricated metal equipment support assemblies.

B. Related Requirements:

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

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Signed and sealed by a qualified professional engineer. For fabrication and installation details for electrical hangers and support systems.

1. Hangers. Include product data for components.
2. Slotted support systems.
3. Equipment supports.
4. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.

C. Delegated Design Submittals: For hangers and supports for electrical systems.

1. Include design calculations and details of hangers.

1.3 INFORMATIONAL SUBMITTALS

A. Welding certificates.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified structural professional engineer to design hanger and support system.

B. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame Rating: Class 1.
2. Self-extinguishing according to ASTM D635.

2.2 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Preformed steel channels and angles with minimum 13/32 inch diameter holes at a maximum of 8 inch on center in at least one surface.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. ABB, Electrification Business.
b. Allied Tube & Conduit; Atkore International.
c. CADDY; brand of nVent Electrical plc.
d. Cooper B-line; brand of Eaton, Electrical Sector.
e. Flex-Strut Inc.
f. G-Strut.
g. Gripple Inc.
h. Haydon Corporation.
i. MIRO Industries Inc.
j. Metal Ties Innovation.
k. Rocket Rack; Robroy Industries.
l. Unistrut; Atkore International.
m. Wesanco, Inc.

2. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
3. Material for Channel, Fittings, and Accessories: Galvanized steel.

4. Channel Width: 1-5/8 inch.

5. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
6. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
7. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.

8. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

C. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for nonarmored electrical conductors or cables in riser conduits. Plugs must have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body must be made of malleable iron.

D. Structural Steel for Fabricated Supports and Restraints: ASTM A36/A36M steel plates, shapes, and bars; black and galvanized.

E. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated or 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; brand of Eaton, Electrical Sector.
2) Empire Industries, Inc.
3) Hilti, Inc.
4) ITW Ramset/Red Head; Illinois Tool Works, Inc.
5) MKT Fastening, LLC.

2. Concrete Inserts: Steel or malleable-iron, slotted support system units are similar to MSS Type 18 units and comply with MFMA-4 or MSS SP-58.
3. Clamps for Attachment to Steel Structural Elements: MSS SP-58 units are suitable for attached structural element.
4. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM F3125/F3125M, Grade A325.
5. Toggle Bolts: All steel springhead type.
6. 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 055000 "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 SELECTION

A. Comply with the following standards for selection and installation of hangers and supports, except where requirements on Drawings or in this Section are stricter:

1. NECA NEIS 101

2. NECA NEIS 102.

3. NECA NEIS 105.

4. NECA NEIS 111.

B. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping materials and installation for penetrations through fire-rated walls, ceilings, and assemblies.

C. Comply with requirements for raceways and boxes specified in Section 260533 "Raceways and Boxes for Electrical Systems."

D. Maximum Support Spacing and Minimum Hanger Rod Size for Raceways: Space supports for EMT, IMC, and ERMC as scheduled in NECA NEIS 1, where its Table 1 lists maximum spacings that are less than those stated in NFPA 70. Minimum rod size must be 1/4 inch in diameter.

E. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.

1. Secure raceways and cables to these supports with single-bolt conduit clamps using spring friction action for retention in support channel.

F. 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 INSTALLATION OF SUPPORTS

A. Comply with NECA NEIS 101 for installation requirements except as specified in this article.

B. Raceway Support Methods: In addition to methods described in NECA NEIS 1, EMT IMC and ERMC may be supported by openings through structure members, in accordance with 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 must 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 Wood: Fasten with lag screws or through bolts.
2. To New Concrete: Bolt to concrete inserts.
3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
4. To Steel: Beam clamps (MSS SP-58, Type 19, 21, 23, 25, or 27), complying with MSS SP-69 or spring-tension clamps.
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 by means that comply with seismic-restraint strength and anchorage requirements.

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 055000 "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. Submit welding certificates.

END OF SECTION 260529

SECTION 260533 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal conduits and fittings.
2. Nonmetallic conduits and fittings.
3. Metal wireways and auxiliary gutters.
4. Nonmetal wireways and auxiliary gutters.
5. Surface raceways.
6. Boxes, enclosures, and cabinets.
7. Handholes and boxes for exterior underground cabling.

B. Related Requirements:

1. Section 078413 "Penetration Firestopping" for firestopping at conduit and box entrances.
2. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this section.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 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. Seismic Qualification Data: Certificates, for enclosures, cabinets, and conduit racks and their mounting provisions, including those for internal components, from manufacturer.

PART 2 - PRODUCTS

2.1 METAL CONDUITS AND FITTINGS

A. Metal Conduit:

1. 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.
2. GRC: Comply with ANSI C80.1 and UL 6.
3. IMC: Comply with ANSI C80.6 and UL 1242.
4. EMT: Comply with ANSI C80.3 and UL 797.
5. FMC: Comply with UL 1; zinc-coated steel or aluminum.
6. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.

B. Metal Fittings: Comply with NEMA FB 1 and UL 514B.

1. Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Fittings, General: Listed and labeled for type of conduit, location, and use.
3. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 1203 and NFPA 70.
4. Fittings for EMT:

    a. Material: Steel.
    b. Type: Compression or Set Screw.

5. 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.
6. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch, with overlapping sleeves protecting threaded joints.

C. Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 NONMETALLIC CONDUITS AND FITTINGS

A. Nonmetallic Conduit:
1. Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. See Evaluations for descriptions of nonmetallic conduit types.
3. ENT: Comply with NEMA TC 13 and UL 1653.
4. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.
5. LFNC: Comply with UL 1660.

B. Nonmetallic Fittings:
1. Fittings, General: Listed and labeled for type of conduit, location, and use.
2. Fittings for ENT and RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.
3. Fittings for LFNC: Comply with UL 514B.
4. Solvents and Adhesives: As recommended by conduit manufacturer.

2.3 METAL WIREWAYS AND AUXILIARY GUTTERS

A. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1 and Type 3R unless otherwise indicated, and sized according to NFPA 70.

1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

2.4 NONMETALLIC WIREWAYS AND AUXILIARY GUTTERS

A. Listing and Labeling: Nonmetallic wireways and auxiliary gutters shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Description: PVC, extruded and fabricated to required size and shape, and having snap-on cover, mechanically coupled connections, and plastic fasteners.

C. Fittings and Accessories: Couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings shall match and mate with wireways as required for complete system.

D. Solvents and Adhesives: As recommended by conduit manufacturer.

2.5 BOXES, ENCLOSURES, AND CABINETS

A. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.

B. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

C. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.

D. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.

E. Metal Floor Boxes:

1. Material: Cast metal or sheet metal.
2. Type: Fully adjustable.
3. Shape: Rectangular.
4. Listing and Labeling: Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

F. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb. Outlet boxes designed for attachment of luminaires weighing more than 50 lb shall be listed and marked for the maximum allowable weight.

G. Paddle Fan Outlet Boxes: Nonadjustable, designed for attachment of paddle fan weighing 70 lb.

1. Listing and labeling: Paddle fan outlet boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

H. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

I. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum or galvanized, cast iron with gasketed cover.

J. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

K. Device Box Dimensions: 4 inches square by 2-1/8 inches deep.

L. Gangable boxes are prohibited.

M. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, 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. Nonmetallic Enclosures: Plastic.
3. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.

N. Cabinets:

1. NEMA 250, Type 1 or Type 3R galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.
6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.6 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

A. General Requirements for Handholes and Boxes:

1. Boxes and handholes for use in underground systems shall be designed and identified as defined in NFPA 70, for intended location and application.
2. Boxes installed in wet areas shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel, fiberglass, or a combination of the two.

1. Standard: Comply with SCTE 77.
2. Configuration: Designed for flush burial with closed bottom unless otherwise indicated.
3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
5. Cover Legend: Molded lettering, "ELECTRIC.".
6. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed Conduit: GRC.
2. Concealed Conduit, Aboveground: EMT.
3. Underground Conduit: RNC, Type EPC-40-PVC.
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 Severe Physical Damage: EMT. To be painted color matching surrounding area, coordinate color with architect.
2. Exposed and Subject to Severe Physical Damage: GRC. To be painted color matching surrounding area, coordinate color with architect. 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. Storage rooms wherein mechanized carts, forklifts, and pallet-handling units are used.
e. Work bays.
f. Warm up bays.

3. Concealed in Ceilings and Interior Walls and Partitions: EMT.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
5. Damp or Wet Locations: 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 and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
3. EMT: Use compression, steel 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. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.

F. Install surface raceways only where indicated on Drawings.

3.2 INSTALLATION

A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.

B. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.

C. Do not install raceways or electrical items on any "explosion-relief" walls or rotating equipment.

D. Do not fasten conduits onto the bottom side of a metal deck roof.

E. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

F. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.

G. Arrange stub-ups so curved portions of bends are not visible above finished slab.

H. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches of changes in direction.

I. Make bends in raceway using large-radius preformed ells. Field bending shall be according to NFPA 70 minimum radii requirements. Use only equipment specifically designed for material and size involved.

J. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

K. Support conduit within 12 inches of enclosures to which attached.

L. Raceways Embedded in Slabs:

1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure raceways to reinforcement at maximum 10-foot intervals.
2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
3. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.
4. Change from ENT to GRC or IMC before rising above floor.

M. Stub-ups to Above Recessed Ceilings:

1. Use EMT, IMC, or RMC for raceways.
2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

N. 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.

O. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.

P. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.

Q. 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.

R. 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.

S. Surface Raceways:

1. Install surface raceway with a minimum 2-inchradius 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.

T. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces.

U. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where an underground service raceway enters a building or structure.
3. Conduit extending from interior to exterior of building.
4. Conduit extending into pressurized duct and equipment.
5. Conduit extending into pressurized zones that are automatically controlled to maintain different pressure set points.
6. Where otherwise required by NFPA 70.

V. 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.
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.

3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per degree F of temperature change for PVC conduits.
4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

W. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 36 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 subject to severe physical damage.
2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.

X. 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.

Y. 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 the box and cover plate or the supported equipment and box.

Z. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

AA. Locate boxes so that cover or plate will not span different building finishes.

BB. 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.

CC. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

DD. Set metal floor boxes level and flush with finished floor surface.

EE. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.3 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:

1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Section 312000 "Earth Moving" for pipe less than 6 inches in nominal diameter.
2. Install backfill as specified in Section 312000 "Earth Moving."
3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Section 312000 "Earth Moving."
4. Install manufactured duct elbows for stub-up 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. Underground Warning Tape: Comply with requirements in Section 260553 "Identification for Electrical Systems."

3.4 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.

B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.

C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch above finished grade.

D. Install handholes with bottom below frost line.

E. Field-cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.5 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 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.6 FIRESTOPPING

A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.7 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 260533

SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Labels.
2. Extruded insulating tubing.
3. Bands.
4. Tapes and stencils.
5. Tags.
6. Signs.
7. Cable ties.

B. Related Requirements:
1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this section.

1.2 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.

PART 2 - PRODUCTS

2.1 LABELS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
2. Listing Criteria: UL CCN PGDQ2 for components; including UL 969.

B. UL PGDQ2 - Vinyl Wraparound Labels: Preprinted, flexible labels laminated with clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing label ends.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Brady Corporation.
b. Champion America.
c. Grafoplast Wire Markers.

d. HellermannTyton.
e. LEM Products Inc.
f. Marking Services Inc.
g. Panduit Corp.
h. Seton Identification Products; a Brady Corporation company.
i. emedco.

C. UL PGDQ2 - Self-Adhesive Wraparound Labels: Preprinted, 3 mil thick, vinyl flexible label with acrylic pressure-sensitive adhesive.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. A'n D Cable Products.
b. Brady Corporation.
c. Brother International Corporation.
d. Grafoplast Wire Markers.
e. Ideal Industries, Inc.
f. LEM Products Inc.
g. Marking Services Inc.
h. Panduit Corp.
i. Seton Identification Products; a Brady Corporation company.
j. emedco.

2. Self-Lamination: Clear; UV-, weather-, and chemical-resistant; self-laminating, with protective shield over legend. Size labels such that clear shield overlaps entire printed legend.
3. Marker for Labels:

a. Permanent, waterproof, black ink marker recommended by tag manufacturer.
b. Machine-printed, permanent, waterproof, black ink recommended by printer manufacturer.

D. UL PGDQ2 - Self-Adhesive Labels: Vinyl, thermal, transfer-printed, 3 mil thick, multicolor, weather- and UV-resistant, pressure-sensitive adhesive labels, configured for intended use and location.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. A'n D Cable Products.
b. Brady Corporation.
c. Brother International Corporation.
d. Grafoplast Wire Markers.
e. HellermannTyton.
f. Ideal Industries, Inc.
g. LEM Products Inc.
h. Marking Services Inc.
i. Panduit Corp.
j. Seton Identification Products; a Brady Corporation company.
k. emedco.

2. Minimum Nominal Size:

a. 1-1/2 by 6 inch for raceway and conductors.
b. 3-1/2 by 5 inch for equipment.
c. As required by authorities having jurisdiction.

2.2 BANDS

A. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeves, with diameters sized to suit diameters and that stay in place by gripping action.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Brady Corporation.
b. HellermannTyton.
c. Marking Services Inc.
d. Panduit Corp.
e. Seton Identification Products; a Brady Corporation company.

B. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeves, 2 inch long, with diameters sized to suit diameters and that stay in place by gripping action.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Brady Corporation.
b. HellermannTyton.
c. Marking Services Inc.
d. Panduit Corp.

2.3 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.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Brady Corporation.
b. Carlton Industries, LP.
c. Champion America.
d. HellermannTyton.
e. Ideal Industries, Inc.
f. Marking Services Inc.
g. Panduit Corp.

B. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; not less than 3 mil thick by 1 to 2 inch wide; compounded for outdoor use.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Brady Corporation.

b. Carlton Industries, LP.
c. Marking Services Inc.
d. emedco.

C. Tape and Stencil: 4 inch wide black stripes on 10 inch centers placed diagonally over orange background and are 12 inch wide. Stop stripes at legends.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. HellermannTyton.
b. LEM Products Inc.
c. Marking Services Inc.
d. Pipemarker.com; Brimar Industries, Inc.
e. Seton Identification Products; a Brady Corporation company.

D. Floor Marking Tape: 2 inch wide, 5 mil pressure-sensitive vinyl tape, with yellow and black stripes and clear vinyl overlay.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Brady Corporation.
b. Carlton Industries, LP.
c. Seton Identification Products; a Brady Corporation company.

E. Underground-Line Warning Tape:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Brady Corporation.
b. Ideal Industries, Inc.
c. LEM Products Inc.
d. Marking Services Inc.
e. Pipemarker.com; Brimar Industries, Inc.
f. Reef Industries, Inc.
g. Seton Identification Products; a Brady Corporation company.

2. Tape:

a. Recommended by manufacturer for method of installation and suitable to identify and locate underground electrical and communications utility lines.
b. Printing on tape must be permanent and may not be damaged by burial operations.
c. Tape material and ink must be chemically inert and not be subject to degradation when exposed to acids, alkalis, and other destructive substances commonly found in soils.

3. Color and Printing:

a. Comply with APWA Uniform Color Code using NEMA Z535.1 safety colors.
b. Inscriptions for Red Tapes: "CAUTION BURIED ELECTRIC LINE BELOW".

c. Inscriptions for Orange Tapes: "CAUTION BURIED CATV LINE BELOW" "CAUTION BURIED TELEPHONE LINE BELOW" "CAUTION BURIED FIBER OPTIC LINE BELOW" "CAUTION BURIED COMMUNICATION LINE BELOW".

4. Reinforced Detectable Line-Warning Tape:

a. Reinforced, detectable three-layer laminate, consisting of printed pigmented woven scrim, solid aluminum-foil core, and clear protective film that allows inspection of continuity of conductive core; bright-colored, continuous-printed on one side with inscription of utility, compounded for direct-burial service.
b. Width: 3 inch.
c. Overall Thickness: 8 mil.
d. Foil Core Thickness: 0.35 mil.
e. Weight: 34 lb/1000 sq. ft.
f. Tensile in accordance with ASTM D882: 300 lbf and 12,500 psi.

F. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height must be 1 inch.

2.4 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.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Brady Corporation.
b. Carlton Industries, LP.
c. Marking Services Inc.
d. Seton Identification Products; a Brady Corporation company.
e. emedco.

B. Nonmetallic Preprinted Tags: Polyethylene tags, 0.023 inch thick, color-coded for phase and voltage level, with factory printed permanent designations; punched for use with self-locking cable tie fastener.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Brady Corporation.
b. Carlton Industries, LP.
c. Grafoplast Wire Markers.
d. LEM Products Inc.
e. Marking Services Inc.
f. Panduit Corp.
g. Seton Identification Products; a Brady Corporation company.
h. emedco.

C. Write-on Tags:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Brady Corporation.
    b. Carlton Industries, LP.
    c. LEM Products Inc.
    d. Pipemarker.com; Brimar Industries, Inc.
    e. Seton Identification Products; a Brady Corporation company.

2. Polyester Tags: 0.015 inch thick, with corrosion-resistant grommet and cable tie for attachment.
3. Marker for Tags:

    a. Permanent, waterproof, black ink marker recommended by tag manufacturer.
    b. Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

2.5 SIGNS

A. Baked-Enamel Signs:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Brady Corporation.
    b. Carlton Industries, LP.
    c. Champion America.
    d. Marking Services Inc.
    e. emedco.

2. Preprinted aluminum signs, high-intensity reflective, punched or drilled for fasteners, with colors, legend, and size required for application.
3. 1/4 inch grommets in corners for mounting.
4. Nominal Size: 7 by 10 inch.

B. Metal-Backed Butyrate Signs:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Brady Corporation.
    b. Champion America.
    c. Marking Services Inc.
    d. emedco.

2. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs, with 0.0396 inch galvanized-steel backing, punched and drilled for fasteners, and with colors, legend, and size required for application.
3. 1/4 inch grommets in corners for mounting.
4. Nominal Size: 10 by 14 inch.

C. Laminated Acrylic or Melamine Plastic Signs:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Brady Corporation.
   b. Carlton Industries, LP.
   c. Marking Services Inc.
   d. Seton Identification Products; a Brady Corporation company.
   e. emedco.

2. Engraved legend.
3. Thickness:

   a. For signs up to 20 sq. inch, minimum 1/16 inch thick.
   b. For signs larger than 20 sq. inch, 1/8 inch thick.
   c. Engraved legend with black letters on white face.
   d. Punched or drilled for mechanical fasteners with 1/4 inch grommets in corners for mounting.
   e. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.6 CABLE TIES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. HellermannTyton.
2. Ideal Industries, Inc.
3. Marking Services Inc.
4. Panduit Corp.

B. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
2. Listing Criteria: UL CCN ZODZ; including UL 1565 or UL 62275.

C. UL ZODZ - General-Purpose Cable Ties: Fungus inert, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.

1. Minimum Width: 3/16 inch.
2. Tensile Strength at 73 deg F in accordance with ASTM D638: 12,000 psi.
3. Temperature Range: Minus 40 to plus 185 deg F.
4. Color: Black, except where used for color-coding.

D. UL ZODZ - UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.

1. Minimum Width: 3/16 inch.

2. Tensile Strength at 73 deg F in accordance with ASTM D638: 12,000 psi.
3. Temperature Range: Minus 40 to plus 185 deg F.
4. Color: Black.

E. UL ZODZ - Plenum-Rated Cable Ties: Self-extinguishing, UV stabilized, one piece, and self-locking.

1. Minimum Width: 3/16 inch.
2. Tensile Strength at 73 deg F in accordance with ASTM D638: 7000 psi.
3. UL 94 Flame Rating: 94V-0.
4. Temperature Range: Minus 50 to plus 284 deg F.
5. Color: Black.

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 SELECTION OF COLORS AND IDENTIFICATION MARKINGS

A. Comply with 29 CFR 1910.144 for color identification of hazards, and the following:
1. Ceiling-mounted hangers, supports, cable trays, and raceways must be finished, painted, or suitably marked safety yellow where less than 8ft above finished floor.

B. Pipe and Conduit Labeling: Comply with ASME A13.1 and IEEE C2.

C. Color-Coding for Phase- and Voltage-Level Identification, 600 V or Less: Use colors listed below for ungrounded feeder and branch-circuit conductors.

1. Color must be factory applied.
2. Colors for 208Y/120 V Circuits:

a. Phase A: Black.
b. Phase B: Red.
c. Phase C: Blue.

3. Colors for 480Y/277 V Circuits:

a. Phase A: Brown.
b. Phase B: Orange.
c. Phase C: Yellow.

4. Color for Neutral (Grounded Conductor): White.
5. Color for Equipment Ground: Bare copper.
6. Color for Isolated Ground: Green with two or more yellow stripes.

D. Color-Coding Raceways, Cable Trays, Junction Boxes, and Conductors for Intrinsically-Safe Circuits: Light blue. When used to identify intrinsically-safe circuits, Article 504 of NFPA 70 requires that the color light blue not be used for any other purpose.

E. Color-Coding Instructional Signs: Self-adhesive labels, including color code for grounded and ungrounded conductors.

F. Accessible Fittings for Raceways: Identify cover of junction and pull box of the following systems with wiring system legend and system voltage. System legends must be as follows:

1. "EMERGENCY POWER."
2. "POWER."
3. "COMMUNICATIONS."

G. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, pull points, and locations of high visibility. Identify by system and circuit designation.

H. Locations of Underground Lines: Underground-line warning tape for power, lighting, communication, and control wiring and optical-fiber cable.

I. Vaults, Manholes, Handholes, and Pull and Junction Boxes, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use self-adhesive vinyl tape to identify phase.

1. Locate identification at changes in direction, at penetrations of walls and floors, at 50 ft maximum intervals in straight runs, and at 25 ft maximum intervals in congested areas.
2. Identify system voltage with black letters on orange field.

J. 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 raceway labels.

1. Locate identification at changes in direction, at penetrations of walls and floors, at 50 ft maximum intervals in straight runs, and at 25 ft maximum intervals in congested areas.
2. Identify system voltage with black letters on orange field.

K. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes, manholes, and handholes, use self-adhesive labels with conductor or cable designation, origin, and destination.

L. Control-Circuit Conductor Termination Identification: For identification at terminations, provide self-adhesive labels with conductor designation.

M. Conductors to Be Extended in Future: Attach marker tape to conductors and list source.

N. Auxiliary Electrical Systems Conductor Identification: Self-adhesive vinyl tape that is uniform and consistent with system used by manufacturer for factory-installed connections.

O. Faceplates: Label individual faceplates with self-adhesive labels. Place label at top of faceplate. Each faceplate to be labeled with its individual, sequential designation, composed of the following, in the order listed:

1. Wiring closet designation.

2. Colon.
3. Faceplate number.

P. Equipment Room Labeling:

1. Racks, Frames, and Enclosures: Identify front and rear of each with self-adhesive labels containing equipment designation.
2. Patch Panels: Label individual rows and outlets, starting at to left and working down, with self-adhesive labels.
3. Data Outlets: Label each outlet with a self-adhesive label indicating the following, in the order listed:

    a. Room number being served.
    b. Colon.
    c. Faceplate number.

Q. Backbone Cables: Label each cable with a self-adhesive wraparound label indicating the location of the far or other end of the backbone cable. Patch panel or punch down block where cable is terminated should be labeled identically.

R. Horizontal Cables: Label each cable with a self-adhesive wraparound label indicating the following, in the order listed:

1. Room number.
2. Colon.
3. Faceplate number.

S. Workspace Indication: Apply floor marking tape or tape and stencil to finished surfaces. Show working clearances in direction of access to live parts. Workspace must 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.

T. Equipment Identification Labels:
1. Include source panel with circuit numbers.
2. Include equipment name.
3. Indoor Equipment: Laminated acrylic or melamine plastic sign.
4. Outdoor Equipment: Laminated acrylic or melamine sign.
5. Equipment to Be Labeled:

    a. Panelboards: Typewritten directory of circuits in location provided by panelboard manufacturer. Panelboard identification must be in form of engraved, laminated acrylic or melamine label.
    b. Enclosures and electrical cabinets.
    c. Communications cabinets.
    d. Access doors and panels for concealed electrical items.
    e. Switchgear.
    f. Transformers: Label that includes tag designation indicated on Drawings for transformer, feeder, and panelboards or equipment supplied by secondary.
    g. Emergency system boxes and enclosures.
    h. Enclosed switches.
    i. Enclosed circuit breakers.
    j. Enclosed controllers.
    k. Variable-speed controllers.
    l. Push-button stations.

m. Power-transfer equipment.
n. Contactors.
o. Remote-controlled switches, dimmer modules, and control devices.
p. Battery-inverter units.
q. Power-generating units.
r. Monitoring and control equipment.
s. Computer room air conditioners.
t. Fire-alarm and suppression equipment.
u. Egress points.
v. Safety Switches (disconnects)
w. Motor Starters

3.3 SELECTION OF SIGNS AND HAZARD MARKINGS

A. Comply with 29 CFR 1910.145 for danger, caution, warning, and safety instruction signs.

B. Signs, labels, and tags required for personnel safety must comply with the following standards:

1. Safety Colors: NEMA Z535.1.
2. Facility Safety Signs: NEMA Z535.2.
3. Safety Symbols: NEMA Z535.3.
4. Product Safety Signs and Labels: NEMA Z535.4.
5. Safety Tags and Barricade Tapes for Temporary Hazards: NEMA Z535.5.

C. Electrical Hazard Warnings:

1. Arc-Flash Hazard Warning: Self-adhesive labels. Comply with NFPA 70E and Section 260574 "Overcurrent Protective Device Arc-Flash Study" requirements for arc-flash hazard warning labels.

2. Multiple Power Sources Warning Legend: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
3. OSHA Workspace Clearance Warning Legend: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 3 FEET MINIMUM."

D. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive labels.

1. Apply to exterior of door, cover, or other access.
2. 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.

E. Operating Instruction Signs: Laminated acrylic or melamine plastic signs.

F. Emergency Operating Instruction Signs: Laminated acrylic or melamine plastic signs with white legend on red background with minimum 3/8 inch high letters for emergency instructions at equipment used for power transfer.

3.4 INSTALLATION

A. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.

B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes typical for electrical equipment environments.

C. 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).

D. Fasteners for Labels and Signs: Self-tapping, stainless steel screws or stainless steel machine screws with nuts and flat and lock washers.

E. 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.

F. Install identifying devices before installing acoustical ceilings and similar concealment.

G. Verify identity of item before installing identification products.

H. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.

I. Apply identification devices to surfaces that require finish after completing finish work.

J. Install signs with approved legend to facilitate proper identification, operation, and maintenance of electrical systems and connected items.

K. System Identification for Raceways and Cables under 1000 V: Identification must completely encircle cable or conduit. Place identification of two-color markings in contact, side by side.

   1. Secure tight to surface of conductor, cable, or raceway.

L. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.

M. Emergency Operating Instruction Signs: Install instruction signs with white legend on red background with minimum 3/8 inch high letters for emergency instructions at equipment used for power transfer.

N. Elevated Components: Increase sizes of labels, signs, and letters to those appropriate for viewing from floor.

O. Vinyl Wraparound Labels:

   1. Secure tight to surface of raceway or cable at location with high visibility and accessibility.

2. Attach labels that are not self-adhesive type with clear vinyl tape, with adhesive appropriate to location and substrate.

P. Snap-Around Labels: Secure tight to surface at location with high visibility and accessibility.

Q. Self-Adhesive Wraparound Labels: Secure tight to surface at location with high visibility and accessibility.

R. Self-Adhesive Labels:

1. Install unique designation label that is consistent with wiring diagrams, schedules, and operation and maintenance manual.
2. Unless otherwise indicated, provide 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 inch high.

S. Snap-Around Color-Coding Bands: Secure tight to surface at location with high visibility and accessibility.

T. Heat-Shrink, Preprinted Tubes: Secure tight to surface at location with high visibility and accessibility.

U. Marker Tapes: Secure tight to surface at location with high visibility and accessibility.

V. Self-Adhesive Vinyl Tape: Secure tight to surface at location with high visibility and accessibility.

1. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for minimum distance of 6 inch where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding.

W. Tape and Stencil: Comply with requirements in painting Sections for surface preparation and paint application.

X. Floor Marking Tape: Apply stripes to finished surfaces following manufacturer's instructions.

Y. Underground Line Warning Tape:

1. During backfilling of trenches, install continuous underground-line warning tape directly above cable or raceway at 6 to 8 inch below finished grade. Use multiple tapes where width of multiple lines installed in common trench or concrete envelope exceeds 16 inch overall.
2. Limit use of underground-line warning tape to direct-buried cables.
3. Install underground-line warning tape for direct-buried cables and cables in raceways.

Z. Metal Tags:

1. Place in location with high visibility and accessibility.
2. Secure using UV-stabilized plenum-rated cable ties.

AA. Nonmetallic Preprinted Tags:

1. Place in location with high visibility and accessibility.
2. Secure using UV-stabilized plenum-rated cable ties.

BB. Write-on Tags:

1. Place in location with high visibility and accessibility.
2. Secure using UV-stabilized plenum-rated cable ties.

CC. Baked-Enamel Signs:

1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to location and substrate.
2. Unless otherwise indicated, provide single line of text with 1/2 inch high letters on minimum 1-1/2 inch high sign; where two lines of text are required, use signs minimum 2 inch high.

DD. Metal-Backed Butyrate Signs:

1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to location and substrate.
2. Unless otherwise indicated, provide single line of text with 1/2 inch high letters on 1-1/2 inch high sign; where two lines of text are required, use labels 2 inch high.

EE. Laminated Acrylic or Melamine Plastic Signs:

1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to location and substrate.
2. Unless otherwise indicated, provide single line of text with 1/2 inch high letters on 1-1/2 inch high sign; where two lines of text are required, use labels 2 inch high.

FF. Cable Ties: General purpose, for attaching tags, except as listed below:

1. Outdoors: UV-stabilized nylon.
2. In Spaces Handling Environmental Air: Plenum rated.

END OF SECTION 260553

SECTION 262813 - FUSES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Cartridge fuses rated 600 V ac and less for use in the following:
      a. Control circuits.
      b. Panelboards.
      c. Switchboards.
      d. Enclosed switches.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
   1. Bussmann; Eaton, Electrical Sector.
   2. Littelfuse, Inc.

2.2 CARTRIDGE FUSES

A. Characteristics: NEMA FU 1, current-limiting, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.
   1. Type RK-5: zero- to 600-A rating, 200 kAIC, time delay.
   2. Type J: 600-V, zero- to 600-A rating, 200 kAIC.
   3. Type L: 600-V, 601- to 6000-A rating, 200 kAIC.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with NEMA FU 1 for cartridge fuses.

D. Comply with NFPA 70.

E. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size and with system short-circuit current levels.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

3.2 IDENTIFICATION

A. Install labels complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems" and indicating fuse replacement information inside of door of each fused switch and adjacent to each fuse block, socket, and holder.

END OF SECTION 262813

SECTION 262816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fusible switches.
2. Nonfusible switches.
3. Molded-case circuit breakers (MCCBs).
4. Molded-case switches.
5. Enclosures.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include nameplate ratings, dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.

1. 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. Provide in PDF electronic format.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency.

B. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Accredited by NETA.

1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

1.6 WARRANTY

A. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace components that fail in materials or workmanship within specified warranty period.

1. Warranty Period: One year(s) from date of Final Completion.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single manufacturer.

B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.

D. Comply with NFPA 70.

2.2 FUSIBLE SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. ABB, Electrification Business.
2. Eaton.
3. Siemens Industry, Inc., Energy Management Division.
4. Square D; Schneider Electric USA.

B. Type HD, Heavy Duty:

1. Single throw.
2. Three pole.
3. 240 or 600-V ac.
4. 200 A and smaller.
5. UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate indicated fuses.
6. Lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.

2.3 NONFUSIBLE SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. ABB, Electrification Business.
2. Eaton.
3. Siemens Industry, Inc., Energy Management Division.
4. Square D; Schneider Electric USA.

B. Type HD, Heavy Duty, Three Pole, Single Throw, 240 or 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.

C. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.

2.4 MOLDED-CASE CIRCUIT BREAKERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. ABB, Electrification Business.
2. Eaton.
3. Siemens Industry, Inc., Energy Management Division.
4. Square D; Schneider Electric USA.

B. Circuit breakers shall be constructed using glass-reinforced insulating material. Current carrying components shall be completely isolated from the handle and the accessory mounting area.

C. Circuit breakers shall have a toggle operating mechanism with common tripping of all poles, which provides quick-make, quick-break contact action. The circuit-breaker handle shall be over center, be trip free, and reside in a tripped position between on and off to provide local trip indication. Circuit-breaker escutcheon shall be clearly marked on and off in addition to providing international I/O markings. Equip circuit breaker with a push-to-trip button, located on the face of the circuit breaker to mechanically operate the circuit-breaker tripping mechanism for maintenance and testing purposes.

D. The maximum ampere rating and UL, IEC, or other certification standards with applicable voltage systems and corresponding interrupting ratings shall be clearly marked on face of circuit breaker. Circuit breakers shall be 80 percent rated. Circuit breakers shall be fully rated for available fault current interruption.

E. MCCBs shall be equipped with a device for locking in the isolated position.

F. Lugs shall be suitable for 167 deg F rated wire.

G. Standards: Comply with UL 489 with interrupting capacity to comply with available fault currents.

H. Thermal-Magnetic Circuit Breakers: Inverse time-current thermal 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.

I. Adjustable, Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.

J. Electronic Trip Circuit Breakers: Field-replaceable rating plug, rms sensing, with the following field-adjustable settings:

1. Long- and short-time pickup levels.
2. Long- and short-time time adjustments.
3. Ground-fault pickup level, time delay, and I-squared t response.

K. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller, and let-through ratings less than NEMA FU 1, RK-5.

L. Features and Accessories:

1. Standard frame sizes, trip ratings, and number of poles.

2. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge lighting circuits.
3. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.
4. Auxiliary Contacts: Two SPDT switches with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.
5. Alarm Switch: One NC contact that operates only when circuit breaker has tripped.

2.5 ENCLOSURES

A. Enclosed Switches and Circuit Breakers: UL 489, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.

B. Enclosure Finish: The enclosure shall be finished with gray baked enamel paint, electrodeposited on cleaned, phosphatized steel (NEMA 250 Type 1), gray baked enamel paint, electrodeposited on cleaned, phosphatized galvannealed steel (NEMA 250 Types 3R, 12) or a brush finish on Type 304 stainless steel (NEMA 250 Type 4-4X stainless steel).

C. Conduit Entry: NEMA 250 Types 4, 4X, and 12 enclosures shall contain no knockouts.

D. Operating Mechanism: The circuit-breaker operating handle shall be externally operable with the operating mechanism being an integral part of the box, not the cover. The cover interlock mechanism shall have an externally operated override. The override shall not permanently disable the interlock mechanism, which shall return to the locked position once the override is released. The tool used to override the cover interlock mechanism shall not be required to enter the enclosure in order to override the interlock.

E. Enclosures designated as NEMA 250 Type 4, 4X stainless steel, 12, or 12K shall have a dual cover interlock mechanism to prevent unintentional opening of the enclosure cover when the circuit breaker is ON and to prevent turning the circuit breaker ON when the enclosure cover is open.

PART 3 - EXECUTION

3.1 ENCLOSURE ENVIRONMENTAL RATING APPLICATIONS

A. Enclosed Switches and Circuit Breakers: Provide enclosures at installed locations with the following environmental ratings.

1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
2. Outdoor Locations: NEMA 250, Type 3R.
3. Wash-Down Areas: NEMA 250, Type 4X.
4. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4X.
5. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.

3.2 INSTALLATION

A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.

C. Temporary Lifting Provisions: Remove temporary lifting of eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

D. Install fuses in fusible devices.

E. Comply with NFPA 70 and NECA 1.

3.3 IDENTIFICATION

A. Comply with requirements in Division 26 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. Tests and Inspections for Switches:

1. Visual and Mechanical Inspection:
   a. Inspect physical and mechanical condition.
   b. Inspect anchorage, alignment, grounding, and clearances.
   c. Verify that the unit is clean.
   d. Verify blade alignment, blade penetration, travel stops, and mechanical operation.
   e. Verify that fuse sizes and types match the Specifications and Drawings.
   f. Verify that each fuse has adequate mechanical support and contact integrity.
   g. Inspect bolted electrical connections for high resistance using one of the two following methods:
      1) Use a low-resistance ohmmeter.
         a) Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of the lowest value.
      2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data or NETA ATS Table 100.12.
         a) Bolt-torque levels shall be in accordance with manufacturer's published data. In the absence of manufacturer's published data, use NETA ATS Table 100.12.
   h. Verify that operation and sequencing of interlocking systems is as described in the Specifications and shown on the Drawings.
   i. Verify correct phase barrier installation.
   j. Verify lubrication of moving current-carrying parts and moving and sliding surfaces.

2. Electrical Tests:
   a. Perform resistance measurements through bolted connections with a low-resistance ohmmeter. Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.
   b. Measure contact resistance across each switchblade fuseholder. Drop values shall not exceed the high level of the manufacturer's published data. If manufacturer's published data are not available, investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.
   c. Perform insulation-resistance tests for one minute on each pole, phase-to-phase and phase-to-ground with switch closed, and across each open pole. Apply voltage in accordance with manufacturer's published data. In the absence of manufacturer's published data, use Table 100.1 from the NETA ATS. Investigate values of insulation resistance less than those published in Table 100.1 or as recommended in manufacturer's published data.
   d. Measure fuse resistance. Investigate fuse-resistance values that deviate from each other by more than 15 percent.
   e. Perform ground fault test according to NETA ATS 7.14 "Ground Fault Protection Systems, Low-Voltage."

B. Tests and Inspections for Molded Case Circuit Breakers:

1. Visual and Mechanical Inspection:
   a. Verify that equipment nameplate data are as described in the Specifications and shown on the Drawings.
   b. Inspect physical and mechanical condition.
   c. Inspect anchorage, alignment, grounding, and clearances.
   d. Verify that the unit is clean.
   e. Operate the circuit breaker to ensure smooth operation.
   f. Inspect bolted electrical connections for high resistance using one of the two following methods:
      1) Use a low-resistance ohmmeter.
         a) Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of the lowest value.
      2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data or NETA ATS Table 100.12.
         a) Bolt-torque levels shall be in accordance with manufacturer's published data. In the absence of manufacturer's published data, use NETA ATS Table 100.12.
   g. Inspect operating mechanism, contacts, and chutes in unsealed units.
   h. Perform adjustments for final protective device settings in accordance with the coordination study.

2. Electrical Tests:
   a. Perform resistance measurements through bolted connections with a low-resistance ohmmeter. Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.
   b. Perform insulation-resistance tests for one minute on each pole, phase-to-phase and phase-to-ground with circuit breaker closed, and across each open pole. Apply voltage in accordance with manufacturer's published data. In the absence of manufacturer's published data, use Table 100.1 from the NETA ATS. Investigate values of insulation resistance less than those published in Table 100.1 or as recommended in manufacturer's published data.
   c. Perform a contact/pole resistance test. Drop values shall not exceed the high level of the manufacturer's published data. If manufacturer's published data are not available, investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.
   d. Perform insulation resistance tests on all control wiring with respect to ground. Applied potential shall be 500-V dc for 300-V rated cable and 1000-V dc for 600-V rated cable. Test duration shall be one minute. For units with solid state components, follow manufacturer's recommendation. Insulation resistance values shall be no less than two megohms.
   e. Determine the following by primary current injection:
      1) Long-time pickup and delay. Pickup values shall be as specified. Trip characteristics shall not exceed manufacturer's published time-current characteristic tolerance band, including adjustment factors.
      2) Short-time pickup and delay. Short-time pickup values shall be as specified. Trip characteristics shall not exceed manufacturer's published time-current characteristic tolerance band, including adjustment factors.

3) Ground-fault pickup and time delay. Ground-fault pickup values shall be as specified. Trip characteristics shall not exceed manufacturer's published time-current characteristic tolerance band, including adjustment factors.
4) Instantaneous pickup. Instantaneous pickup values shall be as specified and within manufacturer's published tolerances.

f. Test functionality of the trip unit by means of primary current injection. Pickup values and trip characteristics shall be as specified and within manufacturer's published tolerances.
g. Perform minimum pickup voltage tests on shunt trip and close coils in accordance with manufacturer's published data. Minimum pickup voltage of the shunt trip and close coils shall be as indicated by manufacturer.
h. Verify correct operation of auxiliary features such as trip and pickup indicators; zone interlocking; electrical close and trip operation; trip-free, anti-pump function; and trip unit battery condition. Reset all trip logs and indicators. Investigate units that do not function as designed.
i. Verify operation of charging mechanism. Investigate units that do not function as designed.

3. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
4. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

C. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

1. Test procedures used.
2. Include identification of each enclosed switch and circuit breaker tested and describe test results.
3. List deficiencies detected, remedial action taken, and observations after remedial action.

END OF SECTION 262816

APPENDIX B

PROJECT DRAWINGS

LEWIS & CLARK COUNTY
MURRAY BUILDING HRV REPLACEMENT
1930 9TH AVE. HELENA, MT 59601

ACE JOB #: 24HL6004

PROJECT NOTES

1.) ALL WORK TO CONFORM WITH STANDARDS, CODES, AND REGULATIONS FOR APPROPRIATE CONSTRUCTION AND SEISMIC ZONE.

2.) WORK IS LIMITED TO WITHIN FIVE (5) FEET OF BUILDING PERIMETER.

3.) CONTRACTOR IS RESPONSIBLE FOR VERIFICATION OF ALL BUILDLING CONDITIONS PRIOR TO BEGINNING ANY WORK.

APPLICABLE CODES

2021 INTERNATIONAL FUEL GAS CODE (IFG)
2021 INTERNATIONAL BUILDING CODE (IBC)
2021 INTERNATIONAL MECHANICAL CODE (IMC)
2021 UNIFORM PLUMBING CODE (UPC)
2019 NATIONAL FIRE PREVENTION CODE (NFPA)
2020 NATIONAL ELECTRICAL CODE (NEC)

PROJECT OWNER

LEWIS & CLARK COUNTY
3402 COONEY DR.
HELENA, MT 59601
406-447-8035 OR 406-447-8299
CONTACT: AUDRA ZACERL OR MAC MCARLEY

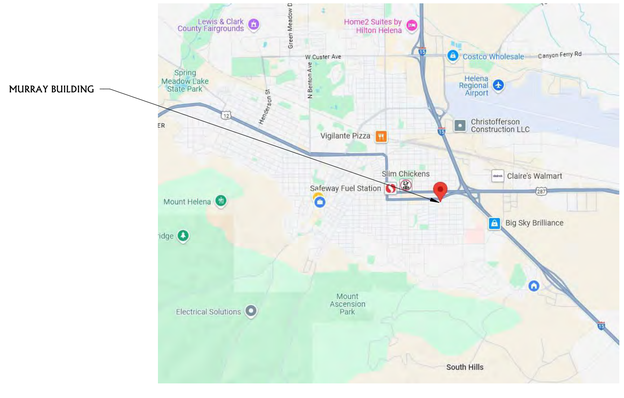
PROJECT ENGINEER

ASSOCIATED CONSTRUCTION ENGINEERING, INC.
3060 CABERNET DR. SUITE 3
HELENA, MT 59601
406-204-2400
CONTACT: RYAN GRAMM, RYANG@ACEMT.COM

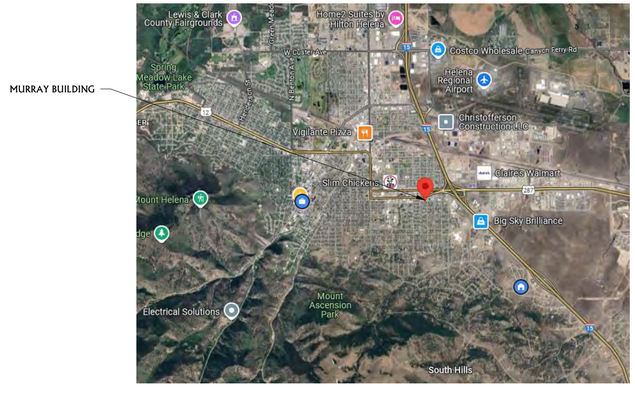
VICINITY MAP

PROJECT SHEET LIST

SHEET NUMBER	SHEET NAME
	PROJECT COVER SHEET
M0.0	MECHANICAL COVER SHEET
M1.2	MECHANICAL ROOF PLAN
M5.0	MECHANICAL REFERENCE I
M5.1	MECHANICAL REFERENCE II
M5.2	MECHANICAL REFERENCE III
E0.0	ELECTRICAL COVER SHEET
E1.2	ELECTRICAL DEMOLITION PLANS
E2.2	ELECTRICAL POWER REMODEL PLANS



LOCATION MAP



AERIAL VIEW

ACE INC
ASSOCIATED • CONSTRUCTION • ENGINEERING
3060 CABERNET DR SUITE 3 | HELENA, MT 59601
406-204-2400

HEAT RECOVERY VENTILATOR

PLAN CODE	MANUFACTURER	MODEL NUMBER	SUPPLY FAN			ENERGY RECOVERY SECTION (ENERGY RECOVERY WHEEL)								EXHAUST FAN SECTION			ELECTRICAL			
			CFM	ESP/TSP (IN W.C.)	MOTOR HP / BHP	WINTER DESIGN				SUMMER DESIGN				AIRFLOW (CFM)	ESP (IN. WC.)	MOTOR HP / BHP	VOLT	PH	MCA	MOCP
						OSA (°F, DB)	RAT (°F, DB/WB)	LAT (°F, DB/WB)	SENS. EFF.	OSA (°F, DB/WB)	RAT (°F, DB/WB)	LAT (°F, DB/WB)	SENS. EFF.							
HRV-1	DAIKIN	DPSC10B	4,625	1.5 / 4.3	7.0 / 5.4	-20.0 / -21.0	70 / 50	33.5 / 27.7	0.63	95 / 68	75 / 61	82.9 / 64.0	0.61	4,400	1.0	4.3 / 2.46	208	3	84.9	110

HEAT RECOVERY VENTILATOR - CONT'D

PLAN CODE	MANUFACTURER	MODEL NUMBER	DX COOLING					GAS-FIRED HEATING						FILTRATION			REMARKS
			TOTAL CAP. (MBH)	SENS. CAP. (MBH)	PERFORMANCE		REFRIG.	FUEL	INPUT (MBH)	OUTPUT (MBH)	PERFORMANCE		EFF.	EXHAUST	SUPPLY PRE-FILTER	SUPPLY FINAL FILTER	
					EAT (°F, DB/WB)	LAT (°F, DB/WB)					EAT (°F, DB/WB)	LAT (°F, DB/WB)					
HRV-1	DAIKIN	DPSC10B	127.3	127.3	82.9 / 64.0	56.4 / 53.1	R-32	NG	300	223.56	33.5	86.5	0.81	2" MERV 8	2" MERV 8	4" MERV 13	SEE NOTES

NOTES:
1. UNIT TO BE EQUIPPED WITH MOTORS CONTROLLERS, ECM MOTORS, AND FAN INTERLOCK. PROVIDE TOOL-LESS ACCESS DOORS.
2. PROVIDE UNIT WITH SINGLE POINT ELECTRICAL CONNECTION.
3. E.C. TO PROVIDE DISCONNECT.
4. PROVIDE WITH MANUFACTURERS REMOTE CONTROL PANEL. CONTROL PANEL TO BE INSTALLED IN JANITORS CLOSET IMMEDIATELY BELOW HRV. REFER TO SHEET M5.1 FOR ADDITIONAL INFORMATION.
5. PROVIDE ADAPTER CURB ALONG WITH MANUFACTURERS RECOMMENDED HOLD DOWN CLIPS TO ADAPT UNIT TO PREVIOUSLY INSTALLED CURB. EXISITNG EQUIPMENT IS A PREVIOUS GENERATION DAIKIN HRV.
6. SEE 1/M0.0 AND 2/M0.0 FOR CONDENSATE TRAP AND GAS CONNECTION REQUIREMENTS.
7. UNIT TO BE FACTORY EQUIPPED WITH THE FOLLOWING SENSORS: COIL LEAVING AIR TEMPERATURE, DISCHARGE AIR TEMPERATURE, RETURN AIR TEMPERATURE, OUTSIDE AIR TEMPERATURE, DIRTY FILTER SWITCH, SUPPLY AIR FAN PROVING SWITCH, BUILDING STATIC PRESSURE SENSOR, SUPPLY AND EXHAUST LEAVING WHEEL TEMPERATURE. ALL SENSORS SHALL BE VIEWABLE FROM UNIT'S REMOTE CONTROL PANEL.
8. PROVIDE WITH MANUFACTURERS UVC AIR FILTRATION DOWNSTREAM OF THE COOLING COIL.

TEST AND BALANCE NOTES

1. TEST AND BALANCE WORK IS TO BE IN ACCORDANCE WITH NEBB STANDARDS.
2. THE TEST AND BALANCE CONTRACTOR SHALL TAKE PRELIMINARY READING FROM THE EXISTING HRV TO DETERMINE BUILDING STATIC PRESSURE, SUPPLY AND EXHAUST AIRFLOWS AT THE OUTLET OF THE AHU. THESE VALUES SHALL BE USED TO SET THE NEW HRV SUPPLY FAN AND EXHAUST FAN SPEEDS.
3. CONTRACTOR SHALL PROVIDE TEST AND BALANCE SERVICES FOR EACH AIR HANDLING SYSTEM.
4. CONTRACTOR SHALL PROVIDE A FINAL REPORT INCLUDING ALL SYSTEM RESULTS. REPORT SHALL NOTE ANY NON-TYPICAL SYSTEM CHARECTERISTICS ENCOUTERED DURING THE TESTING PERIOD AND ANY MESURED VALUES EXCEEDING +/- 10% FROM SCHEDULED DESIGN PARAMATERS UNLESS OTHERWISE NOTED BELOW.
5. a. -0% TO +10% FOR EXHAUST TERMINALS SERVING NEGATIVE PRESSURE AREAS
   b. -10% TO + 0% FOR SUPPLY TERMINALS SERVING POSITIVE PRESSURE AREAS
   c. -5% TO +10% FOR TOTAL AIR HANDLING UNIT SUPPLY, RETURN, OR RELIEF FLOW
   d. -0% TO +10% FOR AIR HANDLING UNIT OUTDOOR AIR FLOW.
6. PROJECT ADD ALTERNATE: REBALANCE THE ENTIRE VENTILATION SYSTEM WITHIN THE BUILDING. SEE SHEET M5.0 THROUGH M5.2 FOR EXISTING VENTILATION OUTLET REQUIREMENTS.
7. SEE THE PROJECT SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS.

PROJECT ADD-ALTERNATE NOTES

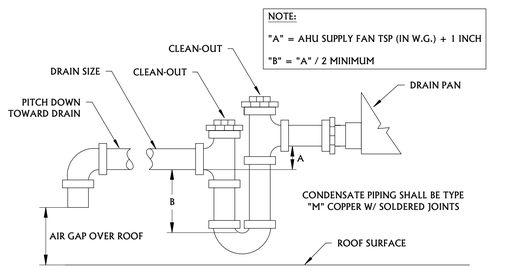
1. THIS PROJECT CONSISTS OF A BASE-BID WITH PROJECT ALTERNATES. THE CONTRACTOR SHALL PROVIDE LINE ITEM PRICING FOR THE BASE-BID AND SEPARATE LINE ITEM PRICING FOR EACH ALTERNATE AS NOTED BELOW.
2. BASE BID: THE PROJECT AS SHOWN IN THE DRAWINGS AND SPECIFICATIONS, LESS BALANCING THE OUTLETS FROM THE HRV WITHIN THE BUILDING. ONLY THE INLETS AND OUTLETS OF THE HRV SHALL BE BALANCED THE SCHEDULED VALUES.
3. ADD-ALTERNATE #1: THE HRV SHALL BE BALANCED TO THE SCHEDULED VALUES AND ALL ASSOCIATED OUTLETS WITHIN THE BUILDING INCLUDING BOTH GRD'S AND DUCT CONNECTIONS TO INDIVIDUAL FAN COILS. REFERENCE SHEETS M5.0, M5.1 AND M5.2 FOR ADDITIONAL INFORMATION.

SITE ELEVATION NOTES

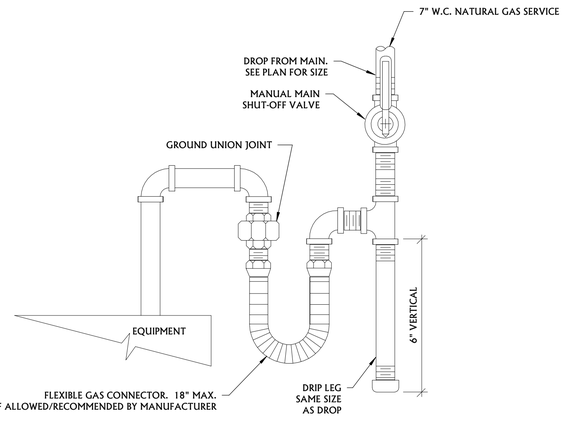
1. THE BUILDING SITE IS LOCATED IN HELENA, MT AND IS APPROXIMATELY AT 4,050 FEET ELEVATION ABOVE SEA LEVEL. ACCOUNT FOR THIS ELEVATION IN ALL EQUIPMENT SELECTIONS.

SEQUENCE OF OPERATIONS

1. THE HRV-1 FACTORY CONTROLLER WITH REMOTE INTERFACE SHALL BE CAPABLE OF 7-DAY, 24-HOUR PROGRAMMING. CONTROLLER SHALL BE EQUIPPED WITH VOLATILE MEMORY BACKUP TO ENSURE UNIT RE-ENABLES IN THE EVENT OF A POWER OUTAGE WITHOUT USER INTERVENTION.
2. HRV-1 SUPPLY AND EXHAUST FANS SHALL RUN CONTINUOUSLY DURING NORMALLY OCCUPIED HOURS, AND REMAIN OFF DURING ALL OTHER TIMES.
   A. THE HRV REMOTE CONTROL INTERFACE SHALL INCLUDE A USER OVERRIDE FOR UP TO 2-HOURS, AND ACCESS TO ALL SCHEDULES.
   B. DURING STARTUP, NORMALLY OCCUPIED HOURS SHALL BE COORDINATED WITH THE BUILDING OWNER.
3. HRV-1 TO BE CONFIGURED TO DISCHARGE NEUTRAL AIR TEMPERATURE:
   A. NEUTRAL AIR SHALL BE DEFINED AS 70°F WITH A +/- 2°F DEADBAND. DISCHARGE AIR TEMPERATURE SETPOINT SHALL BE FULLY ADJUSTABLE BY THE OWNER FROM THE REMOTE INTERFACE.
4. WHEN HRV-1 IS IN OPERATION, ON A RISE IN TEMPERATURE ABOVE THE DEADBAND TEMPERATURE, HRV-1 DX COOLING SECTION SHALL BE ENABLED AND MODULATE VIA THE THE FACTORY CONTROLS, AS REQUIRED TO MAINTAIN A NEUTRAL DISCHARGE AIR TEMPERATURE.
5. WHEN HRV-1 IS IN OPERATION, ON A FALL IN TEMPERATURE BELOW THE DEADBAND TEMPERATURE, HRV-1 GAS-FIRED HEATING SECTION SHALL BE ENABLED AND MODULATE VIA THE FACTORY CONTROLS, AS REQUIRED TO MAINTAIN THE NEUTRAL DISCHARGE AIR TEMPERATURE.
6. ALL FACTORY SAFETIES AND ALARMS SHALL BE VIEWABLE FROM THE MANUFACTURERS REMOTE INTERFACE.
7. THE MANUFACTURERS REMOTE INTERFACE SHALL INCLUDE A DIRTY FILTER ALARM WITH RESET.



1 AHU CONDENSATE DRAIN TRAP DETAIL
NOT TO SCALE



2 GAS CONNECTION DETAIL
NOT TO SCALE

MECHANICAL SYMBOLS LEGEND

AIR TERMINALS, EQUIPMENT & SPECIALTIES

- NEW EQUIPMENT
- EXISTING TO REMAIN
- EXISTING EQUIP TO BE REMOVED OR RELOCATED
- SUPPLY AIR TERMINAL (NEW, EXIST., DEMO.)
- RETURN AIR TERMINAL (NEW, EXIST., DEMO.)
- EXHAUST AIR TERMINAL (NEW, EXIST., DEMO.)
- LINEAR SLOT AIR TERMINAL
- PUMP
- P.O.D.C. - POINT OF DISCONNECTION
- P.O.C. - POINT OF CONNECTION

EQUIPMENT TAG: TYPE OF EQUIPMENT (EF) / EQUIPMENT NUMBER (REFER TO SCHEDULE)

DIFFUSER/GRILLE TAG (SD-1 / 220): AIR TERMINAL NUMBER / AIR TERMINAL CFM (REFER TO SCHEDULE)

- WALL LOUVER
- SIDEWALL AIR TERMINAL
- THERMOSTAT (T)
- SWITCH (S)

DUCTWORK & ACCESSORIES

- NEW DUCTWORK
- EXISTING DUCTWORK TO REMAIN
- EXISTING DUCTWORK TO BE REMOVED
- DUCT BREAK
- RISE IN DUCTWORK (UP)
- FALL IN DUCTWORK (DN)
- FIRE DAMPER (FD)
- SMOKE DAMPER (SD)
- FIRE/SMOKE DAMPER (F/SD)
- BACKDRAFT DAMPER (BDD)
- MANUAL VOLUME DAMPER (VD)
- MOTORIZED DAMPER
- 18x12 — INSIDE CLEAR DUCT SIZE: FIRST FIGURE INDICATED IS SIDE OF DUCT SHOWN
- DUCTWORK END CAP
- FLEXIBLE DUCTWORK
- SQUARE ELBOW UP SUPPLY/RETURN/EXH.
- SQUARE ELBOW DN SUPPLY/RETURN/EXH.
- ROUND ELBOW UP SUPPLY/RETURN/EXH.
- ROUND ELBOW DN SUPPLY/RETURN/EXH.
- SQUARE DIFFUSERS SUPPLY/RETURN/EXH.
- ROUND DIFFUSERS FULL / HALF
- INDICATED AIR FLOW SUPPLY / RETURN
- DUCT REDUCER

DUCTWORK SHADING

- SUPPLY AIR
- RETURN AIR
- EXHAUST AIR
- OUTSIDE AIR
- EXISTING
- DEMOLITION
- NEW

THIS IS A STANDARDIZED SYMBOLS LEGEND, ALL SYMBOLS SHOWN MAY NOT APPEAR ON OR WITHIN THIS SET OF CONTRACT DOCUMENTS.

SHEET LIST

ALBERTAN A. SADOWSKI
AARON B. SADOWSKI
No. 62688 PE
01/13/2025
REGISTERED PROFESSIONAL ENGINEER
STATE OF MONTANA

ACE | INC
ASSOCIATED CONSTRUCTION & ENGINEERING
2900 CAPITAL OFFICE PARK, SUITE B
HELENA, MT 59601 | 406-204-2400

LEWIS & CLARK COUNTY
MURRAY BUILDING HRV REPLACEMENT
1930 9TH AVE. HELENA, MT 59601

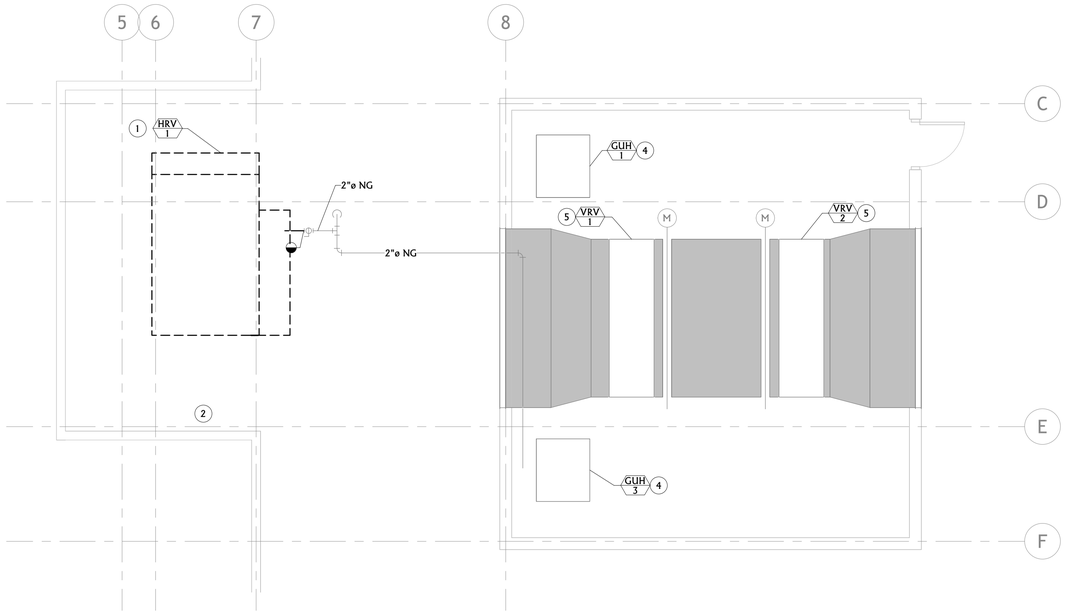
ISSUE DATES:

#	DATE	DESC.

JOB NO: 23HL5870
DATE: 01/13/2025

MECHANICAL COVER SHEET

M0.0



N

1 M1.2 ROOF DEMOLITION PLAN

1/4" = 1'-0"

MECHANICAL GENERAL DEMOLITION NOTES

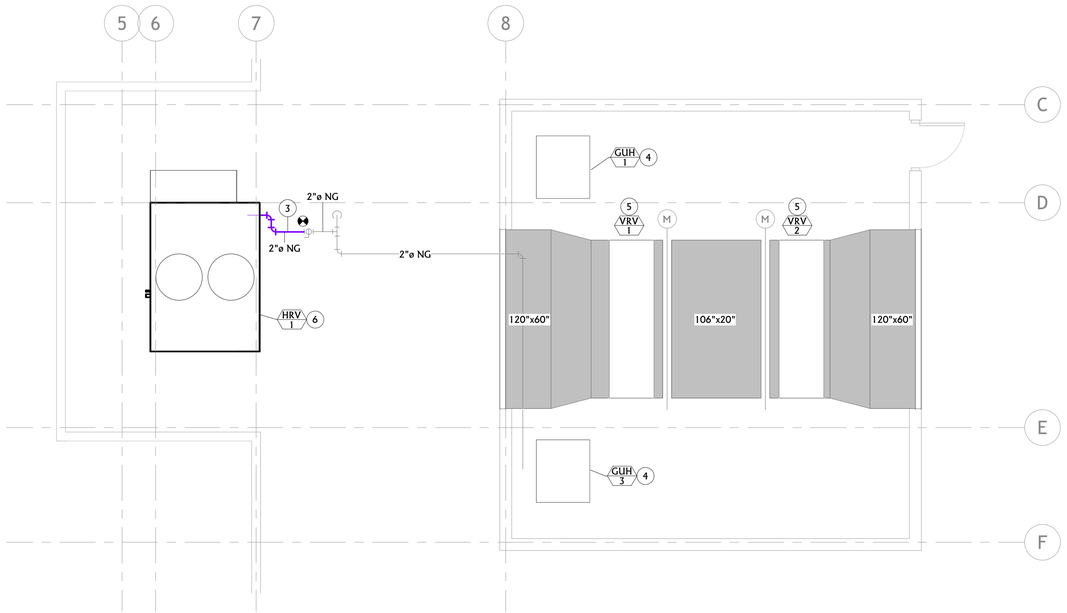
A	MECHANICAL CONTRACTOR SHALL CUT ALL FLOORS, WALLS, CEILINGS, AND ROOF AS REQUIRED TO PERFORM THE WORK DEPICTED IN THESE CONTRACT DOCUMENTS AND SPECIFICATIONS. GENERAL CONTRACTOR SHALL PATCH ALL ASSOCIATED FLOORS, WALLS, CEILINGS, AND ROOF AS REQUIRED TO THE SATISFACTION OF THE ARCHITECT/ENGINEER.
B	COORDINATE HVAC AND PLUMBING EQUIPMENT WITH ALL OTHER TRADES AS REQUIRED.
C	THE INFORMATION SHOWN ON THIS DRAWING WAS OBTAINED FROM EXISTING DRAWINGS AND FIELD OBSERVATIONS. FIELD VERIFY ALL EXISTING CONDITIONS AND PROVIDE DEMOLITION AS REQUIRED TO ACCOMMODATE EXISTING CONSTRUCTION.
D	NOTIFY THE OWNER OF ANY SYSTEM SHUT-DOWNS AND APPROXIMATE SHUT-DOWN TIME PRIOR TO COMMENCING WITH WORK.
E	CONTRACTOR SHALL REMOVE ALL DEMOLISHED MATERIALS FROM BUILDING, UNLESS SPECIFICALLY NOTED TO BE ABANDONED IN PLACE.
F	DRAWINGS SHOW GENERAL LOCATIONS OF MATERIALS TO BE REMOVED. IT SHALL BE THE CONTRACTORS RESPONSIBILITY TO DETERMINE THE EXTENT OF WORK REQUIRED FOR A COMPLETE SYSTEM REMOVAL.
G	OWNER HAS FIRST RIGHT OF REFUSAL FOR ALL EQUIPMENT/MATERIAL CALLED OUT TO BE REMOVED. CONTRACTOR SHALL PRESENT ALL DEMO'D EQUIPMENT/MATERIAL TO OWNER PRIOR TO REMOVING FROM SITE.
H	DEMO ALL T-STATS AND CONTROLS ASSOCIATED WITH DEMO'D MECHANICAL EQUIPMENT.

MECHANICAL GENERAL NOTES

A	MECHANICAL CONTRACTOR SHALL CUT ALL FLOORS, WALLS, CEILINGS, AND ROOF AS REQUIRED TO PERFORM THE WORK DEPICTED IN THESE CONTRACT DOCUMENTS AND SPECIFICATIONS. GENERAL CONTRACTOR SHALL PATCH ALL ASSOCIATED FLOORS, WALLS, CEILINGS, AND ROOF AS REQUIRED TO THE SATISFACTION OF THE ARCHITECT/ENGINEER.
B	COORDINATE HVAC AND PLUMBING EQUIPMENT WITH ALL OTHER TRADES AS REQUIRED.
C	MAINTAIN CODE REQUIRED CLEARANCES FROM ELECTRICAL PANELS.
D	CONTRACTOR SHALL COORDINATE PIPE ROUTING WITH THE DUCT, STRUCTURAL, PLUMBING AND FIRE PROTECTION SYSTEMS PRIOR TO INSTALLING. DUCTWORK SHALL HAVE THE ROUTING PRIORITY. PROVIDE OFFSETS IN PIPING AS REQUIRED.
E	CONTRACTOR SHALL REFER TO MECHANICAL DETAILS FOR ADDITIONAL WORK REQUIREMENTS.

MECHANICAL KEYNOTES

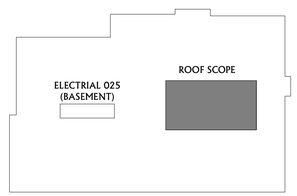
1	REMOVE EXISTING HRV AND ALL ACCESSORIES. DEMOLISH GAS PIPING BACK TO ISOLATION VALVE AND PREPARE FOR CONNECTION TO NEW.
2	EXISTING ROOFTOP UNIT CURB, TO REMAIN. PREPARE FOR INSTALLATION OF NEW EQUIPMENT ON EXISTING CURB.
3	CONNECT TO EXISTING NATURAL GAS ISOLATION VALVE. EXTEND PIPING FULL SIZE TO HRV GAS CONNECTION. PROVIDE NEW DRIP LEG, AND REDUCE TO HRV CONNECTION SIZE AT UNIT. SEE DETAIL 2/M0.0 FOR ADDITIONAL GAS CONNECTION REQUIREMENTS.
4	EXISTING GAS FIRED UNIT HEATER IN PENTHOUSE TO REMAIN.
5	EXISTING VRV CONDENSING UNITS TO REMAIN.
6	HEAT RECOVERY AIR HANDLING UNIT, HRV-1. SEE SCHEDULE ON SHEET M0.0 FOR ADDITIONAL INFORMATION. PLACE UNIT ON EXISTING CURB WITH NEW GASKETING MATERIAL. CONNECT UNIT TO EXISTING DUCTWORK AND REPLACE EXISTING FLEXIBLE CONNECTIONS AS REQUIRED.



N

2 M1.2 ROOF MECHANICAL PLAN

1/4" = 1'-0"



N

KEYPLAN

AARON B. SADOWSKI
No. 62689 PE
01/13/2025
REGISTERED PROFESSIONAL ENGINEER
STATE OF MONTANA

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1930 9TH AVE. HELENA, MT 59601

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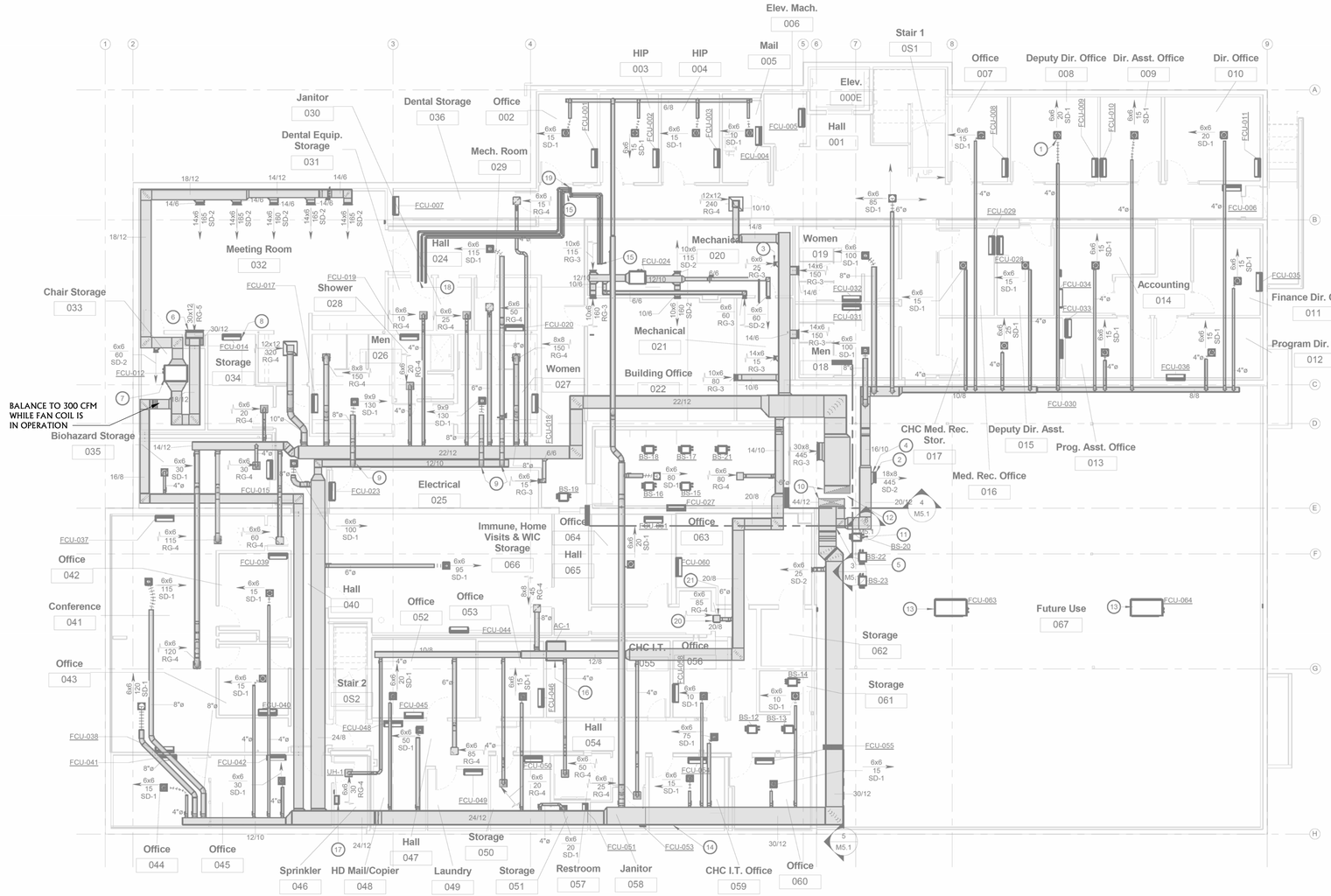
JOB NO: 23HL5870
DATE: 11/07/24

MECHANICAL ROOF PLAN

M1.2



1 BASEMENT PLAN

AS-BUILT DRAWINGS ARE FOR REFERENCE ONLY

1. THE AS-BUILT DRAWINGS SHOWN ON THIS SHEET ARE FOR REFERENCE ONLY, AND ALL NOTES REFLECT EXISTING CONDITIONS FOR CONTRACTORS REFERENCE ONLY. NO CONSTRUCTION OR MODIFICATIONS TO THE SYSTEM SHALL TAKE PLACE BASED ON THESE REFERENCE DRAWINGS.
2. THE AIR BALANCING NOTES INDICATED ON THESE DRAWINGS REFERENCE TO ADD-ALTERNATE #1. SEE COVER SHEET FOR ADDITIONAL INFORMATION. AIR BALANCING VALUES ARE BASED OFF AS-BUILT DRAWINGS AND DO NOT MODIFY EXISTING CONDITIONS.

GENERAL NOTES:

A. SEE EQUIPMENT SCHEDULES ON DRAWINGS M7.1 AND M7.2.
B. SEE EQUIPMENT INSTALLATION DETAILS ON DRAWING M6.1.
C. SEE REFRIGERANT PIPING SCHEMATICS ON DRAWINGS M6.3 AND M6.4.
D. SEE CONTROLS SEQUENCE AND THERMOSTAT INFORMATION ON DRAWING M8.1.
E. AREAS WITH LIMITED CEILING SPACE AVALIABLE SHALL UTILIZE THE SHALLOW SUPPLY OR RETURN CONNECTION DETAIL AS SHOWN ON DRAWING M6.1.
F. PROVIDE REMOTE DAMPER ACUATORS FOR ANY BALANCING DAMPER LOCATED ABOVE A HARD LID CEILING. SEE SPECIFICATIONS.

FLAG NOTES: ○

1 SD-1 LOUVERED FACE SUPPLY DIFFUSER, TYPICAL
2 SD-2 SIDEWALL SUPPLY DIFFUSER, TYPICAL.
3 RG-3 SIDEWALL RETURN GRILLE, TYPICAL. GRILLE TO BE INSTALLED WITH BLADES POINTING UP.
4 45 DEGREE DUCT TAKE-OFF. SEE DETAIL ON DRAWING M6.1, TYPICAL.
5 30-14 DUCT SPLIT. SEE DETAIL ON M6.1.
6 RG-5 SIDEWALL RETURN GRILLE. MOUNT BOTTOM OF GRILLE AT 6" AFF WITH BLADES POINTING DOWN.
7 FCU-# CONCEALED DUCTED FAN COIL UNIT, TYPICAL. TRANSITION DUCTWORK TO UNIT OPENINGS AS REQUIRED. UNIT TO BE MOUNTED AS HIGH AS POSSIBLE.
8 FCU-# WALL MOUNTED FAN COIL UNIT, TYPICAL. UNIT TO BE MOUNTED AS HIGH AS POSSIBLE.
9 PROVIDE BRANCH DUCT TAP WITHOUT DAMPER. DAMPER TO BE LOCATED AS SHOWN. PROVIDE REMOTE DAMPER ACTUATOR WITHIN HARD LID CEILING.
10 DUCTWORK UP TO FIRST FLOOR. SEE CONTINUATION ON DRAWING M2.2.
11 BS-# BRANCH SELECTOR BOX. BOX TO BE MOUNTED AS HIGH AS POSSIBLE.
12 LOCATION OF MAIN CHASE UP TO FIRST FLOOR. ROUTE REFRIGERANT PIPING AS REQUIRED UP CHASE TO FIRST FLOOR AND TO HEAT PUMP UNITS ON THE ROOF AS REQUIRED.
13 TERMINATE UNIT SUPPLY AND RETURN AIR OPENINGS WITH 1/2" WIRE MESH.
14 ROUTE DUCTWORK WITHIN ARCHITECTURAL SOFFIT AS NEEDED.
15 ROUTE 3" CPVC FLUE AND COMBUSTION AIR AND CONNECT TO DOMESTIC WATER HEATER AS REQUIRED. SEE DRAWING M2.2 FOR CONTINUATION TO FIRST FLOOR.
16 AC-1 ROOM AIR CONDITIONING UNIT. UNIT TO BE MOUNTED ON THE FLOOR AS SHOWN. UNIT SHALL HAVE A FRONT RETURN AIR OPENING AND A DISCHARGE PLENUM. ROUTE AND SIZE REFRIGERANT LINES TO CONDENSING UNIT CU-1 ON THE ROOF. CONTRACTOR TO COORDINATE ROUTING OF REFRIGERANT LINES WITHIN ARCHITECTURAL CHASE.
17 UH-1 MOUNT UNIT HEATER AS HIGH AS POSSIBLE. MOUNT REMOTE THERMOSTAT AT 48" AFF NEAR LIGHTSWITCH.
18 ROUTE ONE 2" PVC VENT LINE AND CONNECT TO EXISTING AIR / WATER SEPARATOR. THE SECOND 2" PVC VENT LINE SHALL BE CAPPED JUST INSIDE THE ROOM FOR FUTURE USE. THE THIRD 2" PVC VENT LINE SHALL BE ROUTED TO AND/OR CONNECTED TO THE AIR COMPRESSOR AS REQUIRED. SEE DRAWING M6.7 FOR ADDITIONAL INFORMATION.
19 ROUTE VENTS UP ARCHITECTURAL CHASE. SEE DRAWING M2.2 FOR CONTINUATION TO FIRST FLOOR.
20 RG-4 PERFORATED FACE RETURN / EXHAUST GRILLE, TYPICAL.
21 SEE SHALLOW CONNECTION DETAIL, TYPICAL. SEE DETAIL ON DRAWING M6.1.

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ARCHITECT SEAL:

PROJECT:
Cooperative Health Center Renovation

PROJECT NUMBER:
SMA #1226, Bjerke #12-1162

PROJECT LOCATION:
1930 9th Ave.
Helena, MT 59601

PREPARED FOR:
CHC, Lewis & Clark County

LOGO:
Caring for our Community
Cooperative Health Center

CONSULTANT:
MKK CONSULTING ENGINEERS, INC.
50 years and counting!

REVISIONS:

TEAM:
DRAWN BY: CMD
CHECKED BY: KGP

TITLE:
BASEMENT HVAC PLAN

BIM FILE PATH:
C:\Users\cdrake\Documents\0019-M-Central-R14_cdrake.rvt

PHASE:
CONSTRUCTION DOCUMENTS

DATE:
10.29.2013

PROJECT NUMBER:
SMA #1226, Bjerke #12-1162

SHEET NO.:

LEWIS & CLARK COUNTY
MURRAY BUILDING HRV REPLACEMENT
1930 9TH AVE. HELENA, MT 59601

ISSUE DATES:

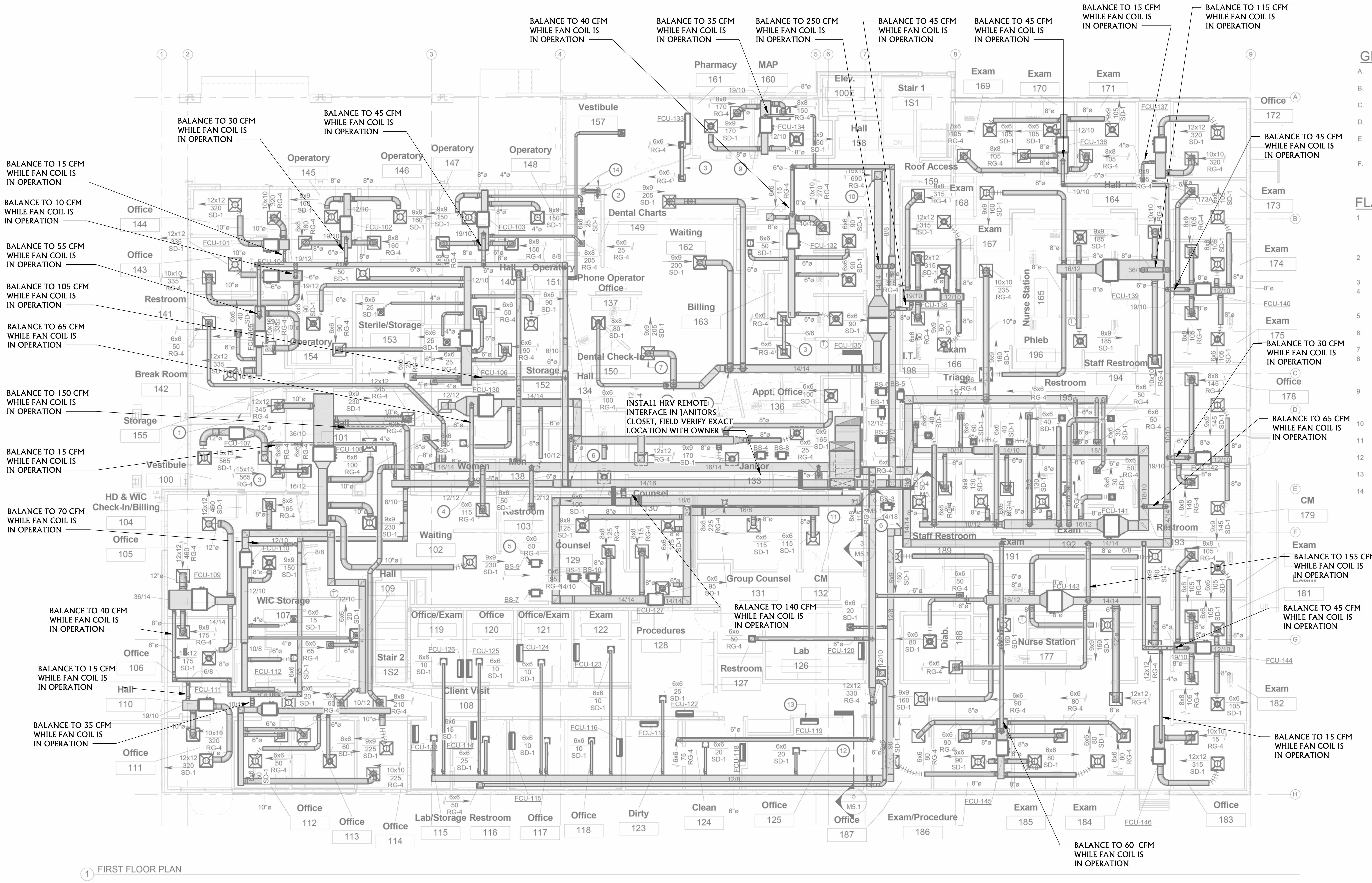
#	DATE	DESC.

JOB NO: 23HL5870
DATE: 11/07/24

MECHANICAL REFERENCE I

M5.0

Plot Date: 10/29/2013 12:13:21 PM



GENERAL NOTES:

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B. SEE EQUIPMENT INSTALLATION DETAILS ON DRAWING M6.1.
C. SEE REFRIGERANT PIPING SCHEMATICS ON DRAWINGS M6.3 AND M6.4.
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E. AREAS WITH LIMITED CEILING SPACE AVALIABLE SHALL UTILIZE THE SHALLOW SUPPLY OR RETURN CONNECTION DETAIL AS SHOWN ON DRAWING M6.1.
F. PROVIDE REMOTE DAMPER ACUATORS FOR ANY BALANCING DAMPER LOCATED ABOVE A HARD LID CEILING. SEE SPECIFICATIONS.

FLAG NOTES: ○

1 PROVIDE A "DRYERBOX" MODEL 425. PROVIDE DRYER VENT AS REQUIRED FROM DRYER VENT BOX TO A MINIMUM OF 24" ABOVE THE ROOF AND TERMINATE AS REQUIRED WITH AN APPROVED DRYER VENT ROOF TERMINATION.
2 TERMINATE 3" CPVC FLUE AND COMBUSTION AIR WITH A CONCENTRIC ROOF TERMINATION. SEE DRAWING M2.1 FOR CONTINUATION.
3 LINED TRANSFER AIR DUCT.
4 ROUND DUCT BRANCH TAP OFF THE TOP OF THE MAIN DUCT. BRANCH DUCTWORK TO BE ROUTED UP INTO JOIST SPACE AS SHOWN, TYPICAL.
5 BS-# BRANCH SELECTOR BOX. BOX TO BE MOUNTED AS HIGH AS POSSIBLE.
6 45 DEGREE DUCT TAKE-OFF. SEE DETAIL ON DRAWING M6.1, TYPICAL.
7 SD-1 LOUVERED FACE SUPPLY DIFFUSER, TYPICAL
8 ROUND DUCT TAKE-OFF. TYPICAL OF ALL HORIZONTAL AND VERTICAL ROUND BRANCH TAPS UNLESS OTHERWISE NOTED. SEE DETAIL ON DRAWING M6.1.
9 FCU-# CONCEALED DUCTED FAN COIL UNIT, TYPICAL. TRANSITION DUCTWORK TO UNIT OPENINGS AS REQUIRED. UNIT TO BE MOUNTED AS HIGH AS POSSIBLE.
10 RG-4 PERFORATED FACE RETURN / EXHAUST GRILLE, TYPICAL.
11 DUCTWORK DOWN TO BASEMENT. SEE CONTINUATION ON DRAWING M2.1.
12 SEE SHALLOW CONNECTION DETAIL, TYPICAL. SEE DETAIL ON DRAWING M6.1.
13 FCU-# WALL MOUNTED FAN COIL UNIT, TYPICAL. UNIT TO BE MOUNTED AS HIGH AS POSSIBLE.
14 DENTAL VENT LINES. SEE DRAWING M2.3 FOR CONTINUATION TO THE ROOF OR DRAWING M2.1 FOR CONTINUATION TO THE BASEMENT.

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ARCHITECT SEAL:

PROJECT: Cooperative Health Center Renovation

PROJECT NUMBER: SMA #1226, Bjerke #12-1162

PROJECT LOCATION: 1930 9th Ave. Helena, MT 59601

PREPARED FOR: CHC, Lewis & Clark County

LOGO: Caring for our Community — Cooperative Health Center

CONSULTANT:

MKK CONSULTING ENGINEERS, INC.
50 years and counting!

REVISIONS:

TEAM: DRAWN BY: CMD CHECKED BY: RGP

TITLE: FIRST FLOOR HVAC PLAN

PHASE: CONSTRUCTION DOCUMENTS
DATE: 10.29.2013
PROJECT NUMBER: SMA #1226, Bjerke #12-1162

SHEET NO:

AARON B. SADOWSKI
No. 62689 PE
01/13/2025
PROFESSIONAL ENGINEER

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1930 9TH AVE. HELENA, MT 59601

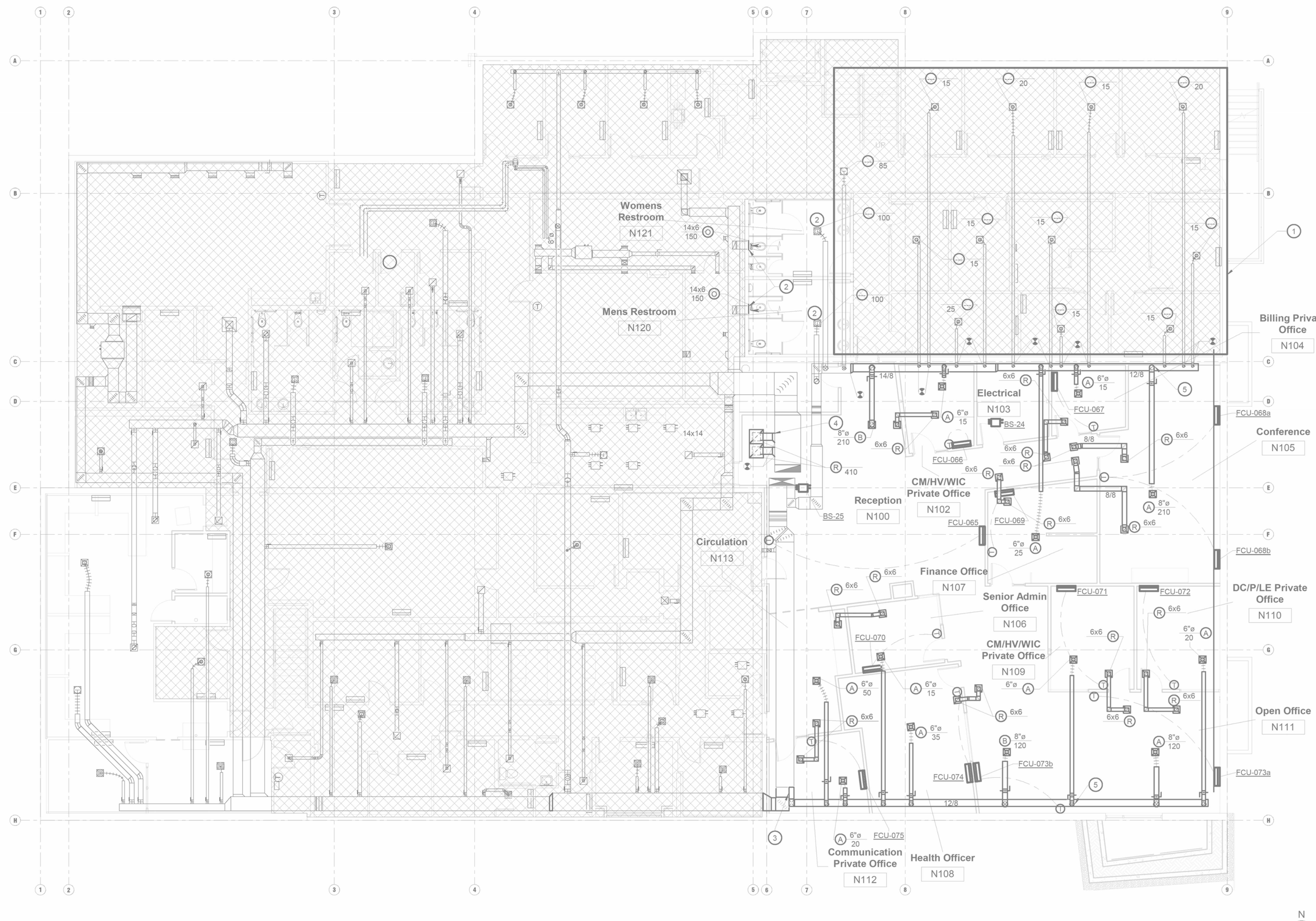
ISSUE DATES:

#	DATE	DESC.

JOB NO: 23HL5870
DATE: 11/07/24

MECHANICAL REFERENCE II

M5.1



1 BASEMENT PLAN

GENERAL NOTES:

A. SEE THE M6 SERIES OF DRAWINGS FOR INSTALLATION DETAILS.

B. SEE THE M7 SERIES OF DRAWINGS FOR EQUIPMENT SCHEDULES

C. INSTALL DUCTWORK PER SMACNA STANDARDS.

D. SHALLOW DIFFUSER/GRILLE CONNECTIONS ARE TO BE USED AS NEEDED. SEE DETAILS ON THE M6 SERIES OF DRAWINGS.

E. THERMOSTATS TO BE INSTALLED AT 48" AFF.

F. REBALANCE THE AIRFLOW FOR THE AIR HANDLING UNIT BASED ON THE NEW AIRFLOWS SHOWN. TOTAL CFM CHANGE FOR THE UNIT SHALL BE AN ADDITIONAL 430 CFM FOR SUPPULY AND 390 CFM FOR EXHAUST.

G. THIS CONTRACTOR SHALL RE-SECURE ALL EXISTING DUCT WRAP WITHIN THE AREA OF WORK AS PART OF THIS PROJECT. ANY DUCT MISSING INSULATION SHALL BE WRAPPED AS PART OF THIS PROJECT. ALL DUCT WRAP SHALL BE 1.5".

H. CONTRACTOR SHALL PREFORM AND DOCUMENT THE REFERGERANT PIPING PRESSURE AND VACUUM TESTING AS INDICATED WITHIN THE SPECIFICATIONS WITH THE ENGINEER, GENERAL CONTRACTOR, MECHANICAL CONTRACTOR, AND AN OWNER'S REPRESENTATIVE IN ATTENDANCE FOR THE START AND FINISH OF THE TEST.

I. MECHANICAL CONTRACT SHALL RETURN AT THE 11 MONTH POINT IN THE WARRENTY TO TIGHTEN ALL REFERGERANT PIPING FITTINGS ADDED AS PART OF THE PROJECT.

FLAG NOTES:

1 EXISTING DIFFUSERS WITHIN THIS AREA ARE TO BE BALANCED TO THE CFMS INDICATED.

2 ADD DIFFUSER AND FLEX DUCTWORK AS REQUIRED.

3 22-8 DUCT SPLIT. SEE DETAIL ON DRAWING M6.1 FOR MORE INFORMATION.

4 45 DEGREE DUCT TAKE-OFF. SEE DETAILS FOR MORE INFORMATION.

5 ROUND DUCT TAKE-OFF. SEE DETAILS FOR MORE INFORMATION, TYPICAL.

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SMA ARCHITECTS

MURRAY BUILDING REMODEL

1732

1930 9th Ave.
Helena, MT 59601

MKK CONSULTING ENGINEERS, INC.
Mechanical, Electrical & Energy Consultants

No.	Date	Revision Description

BASEMENT HVAC PLAN

100% CD Submittal
09/22/2017
1732

ARRON B. SADOWSKI
No. 62689 PE
01/13/2025
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LEWIS & CLARK COUNTY MURRAY BUILDING HRV REPLACEMENT

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MECHANICAL REFERENCE III

M5.2

Switchboard: (E) SDP

Location: Electrical 025
Supply From: (E) MDP
Mounting: Surface
Enclosure: Type 1

Volts: 120/208 Wye
Phases: 3
Wires: 4

A.I.C. Rating: 65,000
Mains Type: MCB
Mains Rating: 700 A
Buss Rating 800 A

Notes:
EXISTING SWITCHBOARD IS A GE AV-LINE SWITCHBOARD.

CKT	Circuit Description	# of Poles	Frame Size	Trip Rating	Load	Remarks
1	(E) FACP	1	20 A	20 A	0 VA	
2	(E) SPARE	3	30 A	30 A	0 VA	
3	(E) SPARE	3	30 A	30 A	0 VA	
4	(E) PANEL B	3	100 A	100 A	0 VA	
5	(E) PANEL F	3	60 A	60 A	0 VA	
6	(E) SPARE	3	60 A	60 A	0 VA	
7	(E) PANEL D	3	100 A	100 A	0 VA	
8	(R) ELEVATOR	3	100 A	100 A	0 VA	SEE NOTES BELOW.
9	(N) HRV	3	200 A	110 A	27415 VA	SEE NOTES BELOW.
10	(E) PANEL H	3	200 A	200 A	0 VA	
11	(E) PANEL P	3	400 A	300 A	0 VA	
12	(E) SPACE	3	--	--	--	
				Total Conn. Load:	27415 VA	
				Total Amps:	76 A	

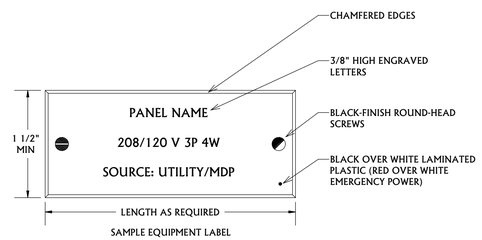
Legend:

Load Classification	Connected Load	Demand Factor	Estimated Demand	Panel Totals	
Motor	27415 VA	125.00%	34269 VA		
Power	0 VA	0.00%	0 VA	**Total Conn. Load:**	27415 VA
				Total Est. Demand:	34269 VA
				Total Conn.:	76 A
				Total Est. Demand:	95 A

Notes:
RELOCATE CONDUCTORS SERVING EXISTING ELEVATOR TO SWITCH PREVIOUSLY SERVING DEMOED HRV. PROVIDE NEW 100A FUSES. PROVIDE NEW POWER CONNECTION FOR NEW HRV FROM SWITCH PREVIOUSLY SERVING ELEVATOR. PROVIDE UPDATED CIRCUIT LABELS.

MECHANICAL EQUIPMENT CONNECTION SCHEDULE

CALLOUT	ELECTRICAL DATA	FLA	MCA	MOCP	WIRE SIZE (Cu)'	DISCONNECT PROVIDED BY	DISCONNECT INSTALLED BY
(N) HRV	208 V/3-27415 VA	76 A	85 A	110 A	#1	EC	EC



1 EQUIPMENT IDENTIFICATION LABEL DETAIL
NOT TO SCALE

ELECTRICAL LEGEND

POWER DEVICES

$	SINGLE POLE SWITCH, SUBSCRIPT INDICATES TYPE: 2 2-POLE 3 3-WAY 4 4-WAY D DIMMER K KEYED LV LOW VOLTAGE MC MOMENTARY CONTAC OS OCCUPANCY SENSOR P PILOT LIGHT T TIMER - 1 HOUR TIMER, MOTOR RATED FOR EXHAUST FANS
	DUPLEX RECEPTACLE SUBSCRIPT INDICATES TYPE: AC ABOVE COUNTER GFCI GROUND FAULT CIRCUIT INTERRUPTER IG ISOLATED GROUND TR TAMPER RESISTANT U USB WP WEATHERPROOF WR WEATHER-RESISTANT FILLED CENTER INDICATES GFCI DEVICE
	DOUBLE DUPLEX RECEPTACLE, SUBSCRIPT ABOVE INDICATE TYPE
	DUPLEX RECEPTACLE IN FLOOR BOX
	DOUBLE DUPLEX RECEPTACLE IN FLOOR BOX
	SIMPLEX RECEPTACLE
	DUPLEX RECEPTACLE, CEILING MOUNTED. DEVICE AND COVER SHALL MATCH CEILING FINISH
	SWITCHED DUPLEX RECEPTACLE, BOX INDICATES DEVICE LOCATED IN FLOOR BOX
	208V SINGLE PHASE RECEPTACLE, CONFIGURATION NOTED ON PLANS
	208V THREE PHASE RECEPTACLE, CONFIGURATION NOTED ON PLANS
	SIMPLEX RECEPTACLE IN FLOOR BOX
	MUSHROOM HEAD PUSH BUTTON
PC	PHOTO CELL
C	WALL MOUNTED CLOCK HANGER/ POWER RECEPTACLE
OS	CORNER WALL MOUNTED OCCUPANCY SENSOR
OS_1	CEILING MOUNTED OCCUPANCY SENSOR, STYLE 1
OS_2	CEILING MOUNTED OCCUPANCY SENSOR, STYLE 2
OS_3	CEILING MOUNTED OCCUPANCY SENSOR, STYLE 3
PP PP	OCCUPANCY SENSOR POWER PACK, BOX INDICATES WALL MOUNTING
	SPECIAL PURPOSE CONNECTION, BRACKET INDICATES WALL MOUNTING, BOX INDICATES FLOOR MOUNTING
	JUNCTION BOX, BRACKET INDICATES WALL MOUNTING, BOX INDICATES FLOOR MOUNTING
M	MOTOR CONNECTION
R	RELAY
	NON-FUSED DISCONNECT SWITCH
	FUSED DISCONNECT SWITCH
	COMBINATION STARTER/DISCONNECT SWITCH
	CONTACTOR
S_M	MANUAL MOTOR STARTER
AS	AQUASTAT BY PLUMBING CONTRACTOR, WIRED BY EC.
VFD	VARIABLE FREQUENCY DRIVE
CO2	CO2 DETECTOR BY MC, ROUGH-IN BY EC
T	THERMOSTAT BY MC, ROUGH-IN BY EC
	PAD MOUNTED UTILITY TRANSFORMER
	ELECTRICAL PANEL - SEE PANEL SCHEDULES FOR MOUNTING CONFIGURATION

MISCELLANEOUS LEGEND

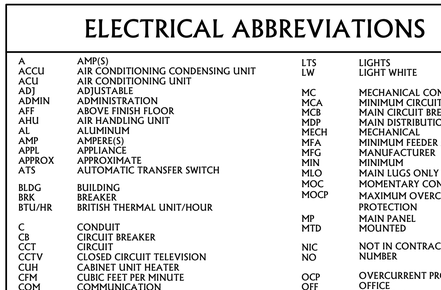
W/	WITH	AFF	ABOVE FINISHED FLOOR
AC	ABOVE COUNTER	AFG	ABOVE FINISHED GRADE
EC	ELECTRICAL CONTRACTOR	WM	WIRE MOLD
(E)	EXISTING	GC	GENERAL CONTRACTOR
(R)	RELOCATED	GND	GROUND
(N)	NEW DEVICE	UG	UNDER GROUND
C	CONDUIT	BOD	BOTTOM OF DEVICE
BFG	BELOW FINISHED GRADE	TOD	TOP OF DEVICE
UC	UNDER COUNTER	COD	CENTER OF DEVICE
WP	WEATHER PROOF	BOF	BOTTOM OF FIXTURE
MC	MECHANICAL CONTRACTOR	PC	PLUMBING CONTRACTOR

1	REFER TO ELECTRICAL NOTES
	HOMERUN TO ELECTRICAL PANEL
	NUMBER OF HASH MARKS INDICATES NUMBER OF CURRENT CARRYING CONDUCTORS. NO MARKS INDICATES TWO. GROUNDING CONDUCTOR NOT SHOWN BUT SHALL BE INCLUDED IN ALL CONDUITS.
	NORMAL CIRCUIT CONCEALED IN WALL OR EXPOSED
	UNDERGROUND OR BURIED CIRCUIT

ELECTRICAL ABBREVIATIONS

A	AMP(S)
ACCU	AIR CONDITIONING CONDENSING UNIT
ACU	AIR CONDITIONING UNIT
ADJ	ADJUSTABLE
ADMIN	ADMINISTRATION
AFF	ABOVE FINISH FLOOR
AHU	AIR HANDLING UNIT
AL	ALUMINUM
AMP	AMPERE(S)
APPL	APPLIANCE
APPROX	APPROXIMATE
ATS	AUTOMATIC TRANSFER SWITCH
BLDG	BUILDING
BRK	BREAKER
BTU/HR	BRITISH THERMAL UNIT/HOUR
C	CONDUIT
CB	CIRCUIT BREAKER
CCT	CIRCUIT
CCTV	CLOSED CIRCUIT TELEVISION
CUH	CABINET UNIT HEATER
CFM	CUBIC FEET PER MINUTE
COM	COMMUNICATION
COMM	COMMISSARY
COMP	COMPRESSOR
COND	CONDENSER
CONTR	CONTRACTOR
CU	COPPER
CTV	CABLE TELEVISION
CW	COOL WHITE
CWP	COLD WATER PUMP
DIA	DIAMETER
DISC	DISCONNECT
DPS	DOOR POWER SUPPLY
DWG	DRAWING
EC	ELECTRICAL CONTRACTOR
EF	EXHAUST FAN
ELEC	ELECTRIC
EMD	ESTIMATED MAXIMUM DEMAND
EMER	EMERGENCY
ENGR	ENGINEER
ETC	ETCETERA
EWC	ELECTRIC WATER COOLER
EXT	EXTERIOR
FA	FIRE ALARM
FAC	FACILITY
FACP	FIRE ALARM CONTROL PANEL
FIX	FIXTURE
FLA	FULL LOAD AMPS
FT	FOOT
GC	GENERAL CONTRACTOR
GFCI	GROUND FAULT CIRCUIT INTERRUPTER
GFI	GROUND FAULT INTERRUPTER
HP	HORSEPOWER
HPS	HIGH PRESSURE SODIUM
HID	HIGH INTENSITY DISCHARGE
HT	HEIGHT
HTRS	HEATERS
HW	HOT WATER
HWH	HOT WATER HEATER
HWP	HOT WATER PUMP
HZ	HERTZ
INC	INCORPORATED
J-BOX	JUNCTION BOX
KHZ	KILOHERTZ
KIT	KITCHEN
KVA	KILIVOLT AMPERE(S)
KW	KILOWATT(S)
LTS	LIGHTS
LW	LIGHT WHITE
MC	MECHANICAL CONTRACTOR
MCA	MINIMUM CIRCUIT AMPS
MCB	MAIN CIRCUIT BREAKER
MDP	MAIN DISTRIBUTION PANEL
MECH	MECHANICAL
MFA	MINIMUM FEEDER AMPACITY
MFG	MANUFACTURER
MIN	MINIMUM
MLO	MAIN LUGS ONLY
MOC	MOMENTARY CONTACT
MOCP	MAXIMUM OVERCURRENT PROTECTION
MP	MAIN PANEL
MTD	MOUNTED
NIC	NOT IN CONTRACT
NO	NUMBER
OCP	OVERCURRENT PROTECTION
OFF	OFFICE
OH	OVERHEAD
P	PHASE
PNL	PANEL
PREP	PREPARATION
PROD	PRODUCE
P/I	PROVIDE & INSTALL
RA	REMOTE ANNUNCIATOR
RAF	RETURN AIR FAN
RECP	RECEPTACLE
RECPTS	RECEPTACLES
REF	REFRIGERATOR
REFR	REFRIGERANT
REQD	REQUIRED
RM	ROOM
RMS	ROOM(S)
RR	RESTROOMS
RS	RAPID START
SDP	SUB DISTRIBUTION PANEL
SER	SERVICE
SF	SUPPLY FAN
SHT	SHEET
SN	SOLID NEUTRAL
SP	SWITCH, PILOT
SPECS	SPECIFICATIONS
SPST	SWITCH, SINGLE POLE-SINGLE THROW
STD	STANDARD
STL	STEEL
STOR	STORAGE
SW	SWITCH
TBD	TELEPHONE BACK BOARD
TV	TELEVISION
TYP	TYPICAL
UG	UNDERGROUND
UGE	UNDERGROUND ELECTRICAL
UGT	UNDERGROUND TELEPHONE
UH	UNIT HEATER
V	VOLT(S)
VA	VOLT AMPERES
VEST	VESTIBULE
W	WIRE
W	WATT(S)
W/	WITH
WM	WATT MISER
XFMR	TRANSFORMER

INTERIOR MOUNTING HEIGHTS



ELECTRICAL SHEET LIST

JOHN PATRICK KNOLL
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1/13/2025
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MURRAY BUILDING HRV REPLACEMENT
1930 9TH AVE. HELENA, MT 59601

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JOB NO: 24HL6004
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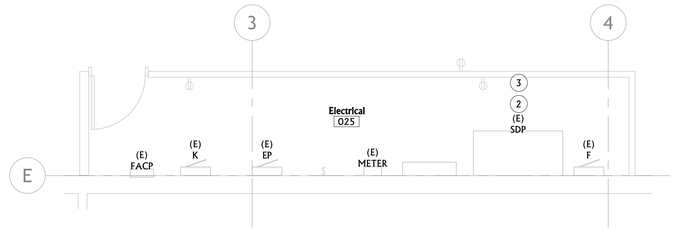
ELECTRICAL COVER SHEET

E0.0



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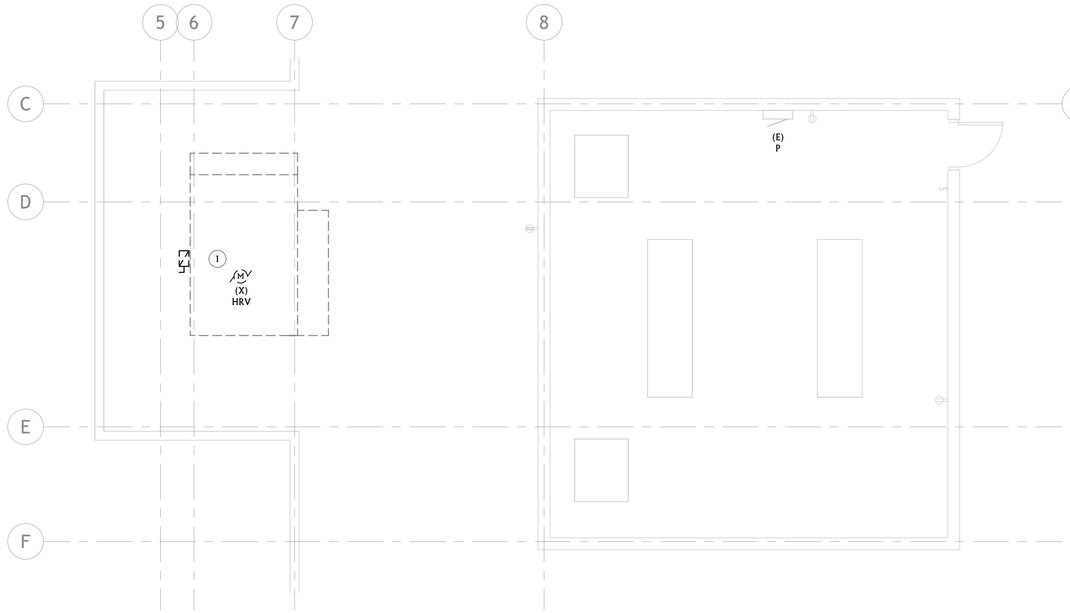
2 E1.2

BASEMENT ELECTRICAL ROOM DEMOLITION PLAN

1/4" = 1'-0"



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1 E1.2

ROOF DEMOLITION PLAN

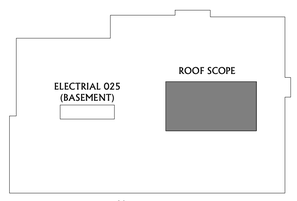
1/4" = 1'-0"

ELECTRICAL GENERAL DEMOLITION NOTES

A	ALL DASHED ITEMS ON DEMOLITION PLANS ARE TO BE REMOVED UNLESS NOTED OTHERWISE. DEVICES SHOWN ARE BASED ON EXISTING PLANS AND LIMITED VISUAL FIELD OBSERVATIONS AND ARE ONLY INTENDED TO CONVEY SCOPE. DEMO OR MODIFY ALL EXISTING ELECTRICAL INSTALLATIONS ARE REQUIRED TO SUPPORT PROJECT. FIELD VERIFY ALL CONDITIONS PRIOR TO BIDDING.
B	ALL ITEMS DENOTED WITH AN (R) ARE TO BE RELOCATED OR REMOVED AND REINSTALLED. ALL SHADED ITEMS ARE EXISTING TO REMAIN. ALL ITEMS DENOTED WITH AN (E) ARE EXISTING TO REMAIN.
C	EXISTING CONDUITS STUBBED THROUGH THE FLOOR THAT ARE NOT REUSED OR ARE ABANDONED SHALL BE CUT AT THE FLOOR SURFACE, GROUND FLUSH AND FILLED WITH GROUT. FLOOR FINISH SHALL MATCH THAT OF EXISTING.
D	REMOVE ALL CONDUCTORS, CABLING AND RACEWAYS BACK TO SOURCE OR TO NEARSEST JUNCTION UNNAFFECTED BY DEMOLITION AND REMODEL WORK, UNLESS OTHERWISE NOTED. NO EXISTING WIRING MAY BE REUSED IN THE NEW ELECTRICAL WORK. PROVIDE NEW CONDUCTORS IN EXISTING RACEWAYS THAT ARE FEASIBLE TO RE-USE. USE EXISTING BACK BOXES WITH NEW DEVICES IN APPROPRIATE AREAS.
E	SOME DEVICES AND SYSTEMS THAT ARE NOT REMOVED MAY BE AFFECTED BY DEMOLITION AND CONSTRUCTION. PROVIDE ALL LABOR AND MATERIALS REQUIRED TO MAINTAIN OR RESTORE CONTINUITY AND FUNCTION OF ALL EXISTING DEVICES AND SYSTEMS THAT ARE NOT REMOVED BUT ARE AFFECTED BY DEMOLITION OR CONSTRUCTION WORK.
F	DISCONNECT AND REMOVE ALL ELECTRICAL FROM MECHANICAL EQUIPMENT SHOWN TO BE DEMOLISHED. SEE MECHANICAL DRAWINGS FOR ADDITIONAL INFORMATION.
G	ALL WORK SHALL BE PERFORMED IN STRICT ACCORDANCE WITH NEC, STATE AND LOCAL BUILDING CODE.
H	ANY WORK THAT REQUIRES POWER DISRUPTIONS SHALL BY SCHEDULED AND APPROVED BY THE OWNER. ALL WORK SHALL BE PERFORMED WITH NO DISRUPTION OF THE OWNERS'S BUSINESS.
I	OWNER HAS FIRST RIGHT OF REFUSAL FOR ALL REMOVED EQUIPMENT AND MATERIALS. PRESENT ALL REMOVED EQUIPMENT AND MATERIALS TO OWNER, REMOVE ALL UNCLAIMED MATERIALS FROM PROJECT SITE AND DISPOSE OF IT IN ACCORANCE WITH ALL APPLICABLE REGULATIONS.
J	PROVIDE UPDATED, TYPEWRITTEN DIRECTORIES FOR ALL EXISTING PANELS AFFECTED BY DEMOLITION WORK. LABEL ALL CIRCUIT BREAKERS THAT HAVE THEIR ENTIRE LOAD REMOVED AS 'SPARE'.

ELECTRICAL KEYNOTES

1	DISCONNECT EXISTING ELECTRICAL SERVING HEAT RECOVERY VENTILATOR TO BE DEMOED. DEMO CONDUIT, CONDUCTORS AND DISCONNECT BACK TO SOURCE PANEL.
2	DISCONNECT EXISTING CONDUCTORS SERVING ELEVATOR FROM FUSED SWITCH. PREPARE CONDUCTORS FOR RECONNECTION TO DIFFERENT FUSED SWITCH. SEE REMODEL PLAN FOR ADDITIONAL INFORMATION.
3	DISCONNECT AND DEMO CONDUCTORS AND FUSES SERVING HRV TO BE DEMOED. RETAIN FUSED SWITCH FOR REUSE. SEE REMODEL PLAN FOR ADDITIONAL INFORMATION.



KEYPLAN

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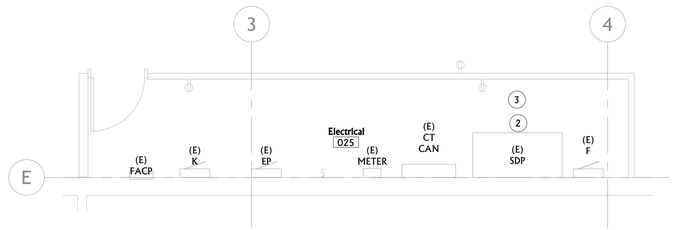
ELECTRICAL DEMOLITION PLANS

E1.2

ELECTRICAL POWER GENERAL NOTES	
A	REFER TO MECHANICAL PLANS FOR ADDITIONAL INFORMATION ON DEVICE LOCATIONS, DIMENSIONS, ETC. CAREFULLY EXAMINE MECHANICAL FLOOR PLANS, CEILING PLANS, ETC. FOR INFORMATION THAT AFFECTS ELECTRICAL WORK. NOTIFY ENGINEER IMMEDIATELY OF ANY DISCREPANCIES BETWEEN MECHANICAL AND ELECTRICAL PLANS.
B	ALL DARK ITEMS ARE NEW, UNLESS NOTED OTHERWISE. ALL SHADED ITEMS ARE EXISTING TO REMAIN.
C	ALL ITEMS DENOTED WITH AN (R) ARE RELOCATED OR REINSTALLED. ALL ITEMS DENOTED WITH AN (E) ARE EXISTING TO REMAIN.

ELECTRICAL KEYNOTES	
1	PROVIDE POWER CONNECTION AND DISCONNECT FOR NEW HRV UNIT. PROVIDE NEW CONDUIT AND CONDUCTORS. COORDINATE LOCATION AND REQUIREMENTS WITH MC AND MECHANICAL PLANS.
2	RECONNECT CONDUCTORS SERVING ELEVATOR TO SWITCH IN (E) SDP THAT PREVIOUSLY SERVED DEMOED HRV. PROVIDE NEW 100A RK-1 OR CLASS J FUSE KIT IN EXISTING SWITCH. COORDINATE FINAL FUSE TYPE WITH ENGINEER IF NEEDED. EXTEND/MODIFY CONDUCTORS AS NECESSARY.
3	PROVIDE POWER CONNECTION FOR NEW HRV FROM SWITCH IN (E) SDP THAT PREVIOUSLY SERVED ELEVATOR. PROVIDE NEW RK-1 OR CLASS J FUSE KIT IN EXISTING SWITCH. COORDINATE FINAL FUSE TYPE WITH ENGINEER IF NEEDED. SEE MECHANICAL EQUIPMENT CONNECTION SCHEDULE FOR MOCP SIZE.
4	PROVIDE (1) 3/4"C FROM NEW HRV UNIT TO JANITORS CLOSET BELOW FOR REMOTE HRV INTERFACE WIRING. WIRING PROVIDED BY OTHERS. COORDINATE LOCATION AND ROUTING WITH MC AND MECHANICAL PLANS.



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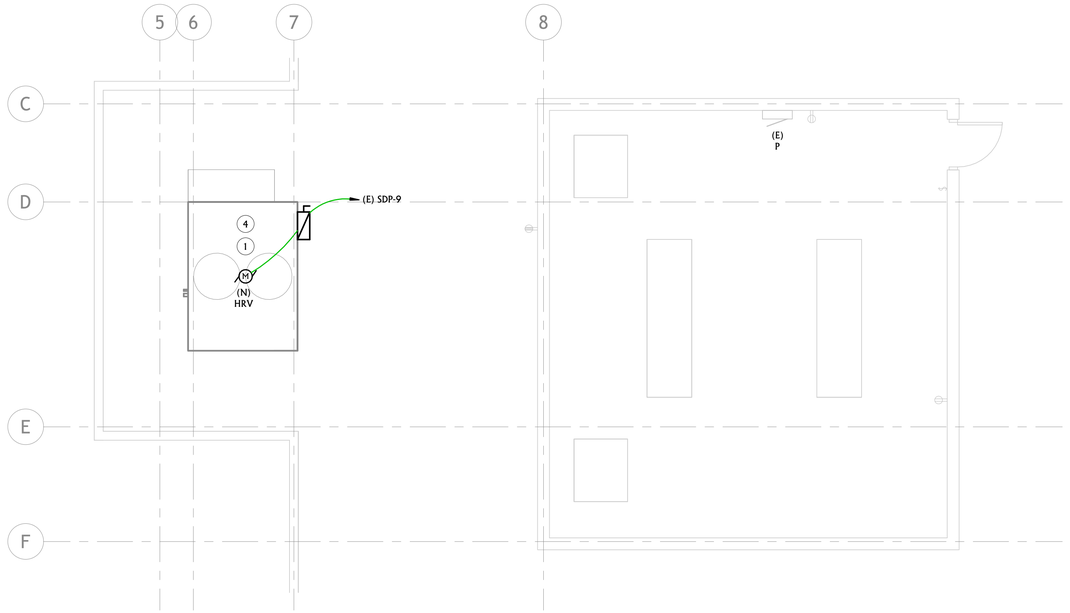
1
E2.2

BASEMENT ELECTRICAL ROOM POWER REMODEL PLAN

1/4" = 1'-0"

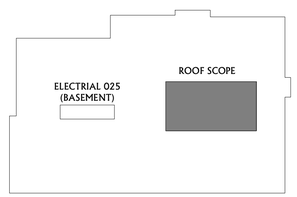


N

2
E2.2

ROOF POWER REMODEL PLAN

1/4" = 1'-0"



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ELECTRICAL POWER REMODEL PLANS

E2.2