



PROJECT MANUAL

FOR
DOUGLAS COUNTY SCHOOL DISTRICT
2025 BOILER REPLACEMENT

VARIOUS SITES

January 31, 2025

FOR

DOUGLAS COUNTY SCHOOL DISTRICT
1126 Airport Road, Building E-1
Minden, Nevada 89423



**Douglas County
School District**

PROJECT MANUAL VARIOUS SITES

PROJECT LOCATIONS:

MINDEN ELEMENTARY SCHOOL
1170 Baler Street
Minden, Nevada 89423

CC MENELEY ELEMENTARY SCHOOL
1446 Muir Drive
Gardnerville, Nevada 89460

PAU WA LU MIDDLE SCHOOL
701 Long Valley Road
Gardnerville, Nevada 89460

GEORGE WHITTELL HIGH SCHOOL
240 Warrior Way
Zephyr Cove, Nevada 89449

GENE SCARSELLI ELEMENTARY SCHOOL
699 Long Valley Road
Gardnerville, Nevada 89460

PINION HILLS ELEMENTARY SCHOOL
1479 Stephanie Way
Minden, Nevada 89423

OWNER

DOUGLAS COUNTY SCHOOL DISTRICT
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Minden, Nevada 89423
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Director
Phone: (775) 782-5134

MECHANICAL ENGINEER

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MECHANICAL ENGINEERING CONSULTANT
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ELECTRICAL ENGINEER

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SECTION 01 31 00 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
 - 1. Project meetings.
 - 2. Requests for Interpretation (RFIs).
- B. See Division 01 Section "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.

1.2 DEFINITIONS

- A. RFI: Request from Contractor seeking interpretation or clarification of the Contract Documents.

1.3 SUBMITTALS

- A. No construction is to commence prior to approval of all submittals.

1.4 COORDINATION

- A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different sections that depend on each other for proper installation, connection, and operation.
 - 1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
 - 2. Coordinate installation of different components with other contractors to ensure maximum accessibility for required maintenance, service, and repair.
 - 3. Make adequate provisions to accommodate items scheduled for later installation.
 - 4. Where availability of space is limited, coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair of all components, including mechanical and electrical.
- B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
 - 1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.
- C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
 - 1. Preparation of Contractor's Construction Schedule.
 - 2. Delivery and processing of submittals.
 - 3. Progress meetings.
 - 4. Preinstallation conferences.
 - 5. Project closeout activities.
 - 6. Startup and adjustment of systems.
 - 7. Project closeout activities.

1.5 PROJECT MEETINGS

- A. General: Schedule and conduct meetings and conferences at Project site, unless otherwise indicated.

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1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Engineer of scheduled meeting dates and times.
 2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
 3. Minutes: Record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Engineer, within three days of the meeting.
- B. Preconstruction Conference: Schedule a preconstruction conference before starting construction, at a time convenient to Owner and Engineer, but no later than 15 days after execution of the Agreement. Hold the conference at Project site or another convenient location. Conduct the meeting to review responsibilities and personnel assignments.
1. Attendees: Authorized representatives of Owner, Engineer, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
 2. Agenda: Discuss items of significance that could affect progress, including the following:
 - a. Tentative construction schedule.
 - b. Phasing.
 - c. Critical work sequencing and long-lead items.
 - d. Designation of key personnel and their duties.
 - e. Procedures for processing field decisions and Change Orders.
 - f. Procedures for RFIs.
 - g. Procedures for testing and inspecting.
 - h. Procedures for processing Applications for Payment.
 - i. Distribution of the Contract Documents.
 - j. Submittal procedures.
 - k. Preparation of Record Documents.
 - l. Use of the premises.
 - m. Work restrictions.
 - n. Owner's occupancy requirements.
 - o. Construction waste management and recycling.
 - p. Parking availability.
 - q. Office, work, and storage areas.
 - r. Equipment deliveries and priorities.
 - s. Progress cleaning.
 - t. Working hours.
 3. Minutes: Record and distribute meeting minutes.
- C. Progress Meetings: Conduct progress meetings at weekly intervals. Coordinate dates of meetings with preparation of payment requests.
1. Attendees: In addition to representatives of Owner and Engineer, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
 2. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
 - a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's Construction Schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
 - 1) Review schedule for next period.
 - b. Review present and future needs of each entity present, including the following:
 - 1) Interface requirements.
 - 2) Sequence of operations.

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- 3) Status of submittals.
 - 4) Deliveries.
 - 5) Off-site fabrication.
 - 6) Access.
 - 7) Site utilization.
 - 8) Work hours.
 - 9) Hazards and risks.
 - 10) Progress cleaning.
 - 11) Quality and work standards.
 - 12) Status of correction of deficient items.
 - 13) Field observations.
 - 14) RFIs.
 - 15) Pending changes.
3. Minutes: Record the meeting minutes.
 4. Reporting: Distribute minutes of the meeting to each party present and to parties who should have been present.
 - a. Schedule Updating: Revise Contractor's Construction Schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

1.6 REQUESTS FOR INTERPRETATION (RFIs)

- A. Procedure: Immediately on discovery of the need for interpretation of the Contract Documents, and if not possible to request interpretation at Project meeting, prepare and submit an RFI in the form specified.
 1. RFIs shall originate with Contractor. RFIs submitted by entities other than Contractor will be returned with no response.
 2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.
- B. Content of the RFI: Include a detailed, legible description of item needing interpretation and the following:
 1. Project name.
 2. Date.
 3. Name of Contractor.
 4. Name of Engineer and Construction Manager.
 5. RFI number, numbered sequentially.
 6. Specification Section number and title and related paragraphs, as appropriate.
 7. Drawing number and detail references, as appropriate.
 8. Field dimensions and conditions, as appropriate.
 9. Contractor's suggested solution(s). If Contractor's solution(s) impact the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
 10. Contractor's signature.
 11. Attachments: Include drawings, descriptions, measurements, photos, Product Data, Shop Drawings, and other information necessary to fully describe items needing interpretation.
- C. Hard-Copy RFIs: CSI Form 13.2A.
 1. Identify each page of attachments with the RFI number and sequential page number.
- D. Engineer's Action: Engineer will review each RFI, determine action required, and return it. Allow seven working days for Engineer's response for each RFI. RFIs received after 1:00 p.m. will be considered as received the following working day.
 1. The following RFIs will be returned without action:
 - a. Requests for approval of submittals.
 - b. Requests for approval of substitutions.
 - c. Requests for coordination information already indicated in the Contract Documents.
 - d. Requests for adjustments in the Contract Time or the Contract Sum.
 - e. Requests for interpretation of Engineer's actions on submittals.

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- f. Incomplete RFIs or RFIs with numerous errors.
- 2. Engineer's action may include a request for additional information, in which case Engineer's time for response will start again.
- E. On receipt of Engineer's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Engineer within seven days if Contractor disagrees with response.
- F. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly. Use CSI Log Form 13.2B.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 Construction

- A. Anytime a sub contractor is present at job site, the prime contractor shall be on site.

END OF SECTION 01 31 00

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SECTION 01 33 00 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.
- B. See Division 01 Section "Closeout Procedures" for submitting warranties.
- C. See Division 01 Section "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.

1.2 DEFINITIONS

- A. Action Submittals: Written and graphic information that requires Engineer's responsive action.
- B. Informational Submittals: Written information that does not require Engineer's responsive action. Submittals may be rejected for not complying with requirements.

1.3 COMMENCEMENT

- A. No construction shall start prior to approval of all submittals.

1.4 SUBMITTAL PROCEDURES

- A. 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. Coordinate transmittal of different types of submittals for related parts of the work so processing will not be delayed because of need to review submittals concurrently for coordination.
 - a. Engineer reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- B. Electronic submittals shall be in Adobe PDF format.
- C. Substituted items shall be submitted with manufacturer's descriptive data and must show equality to item specified. Information on substituted items must be complete, including, but not limited to: design, construction materials, and construction quality. Engineer will not research information required to compare equipment. Engineer reserves the right to require specified item.
- D. Contractor has two chances (one submittal and one resubmittal) to substitute a piece of equipment from specified equipment. If piece of equipment is still unacceptable to engineer, contractor to provide specified equipment.
- E. Submit manufacturer's descriptive data within ten (10) working days after award of the contract. Materials and fixtures shall not be ordered prior to submittal approval. Allow ten (10) working days after receipt of submittals in the engineer's office before reviewed submittals will be returned.
- F. Upon completion of the project, and prior to final acceptance payment, submit one (1) set of as-built drawings and three sets of operating and maintenance instructions (bound in 3-ring binders).
- G. Resubmittal Review: Allow 10 working days for review of each resubmittal.
- H. Identification: Place a permanent label or title block on each submittal for identification.
 - 1. Indicate name of firm or entity that prepared each submittal on label or title block.
 - 2. Provide a space approximately 6 by 8 inches on label or beside title block to record Contractor's review and approval markings and action taken by Engineer.
 - 3. Include the following information on label for processing and recording action taken:

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- a. Project name.
 - b. Date.
 - c. Name and address of Engineer.
 - d. Name and address of Contractor.
 - e. Name and address of subcontractor.
 - f. Name and address of supplier.
 - g. Name of manufacturer.
 - h. Submittal number or other unique identifier, including revision identifier.
 - 1) Submittal number shall use Specification Section number followed by a decimal point and then a sequential number (e.g., 06 10 00.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., 06 10 00.01.A).
 - i. Number and title of appropriate Specification Section.
 - j. Drawing number and detail references, as appropriate.
 - k. Location(s) where product is to be installed, as appropriate.
 - l. Other necessary identification.
- I. Deviations: Highlight, encircle, or otherwise specifically identify deviations from the Contract Documents on submittals.
- J. Additional Copies: Unless additional copies are required for final submittal, and unless Engineer observes noncompliance with provisions in the Contract Documents, initial submittal may serve as final submittal.
- 1. Additional copies submitted for maintenance manuals will be marked with action taken and will be returned.
- K. Transmittal: Package each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Engineer will return submittals, without review, received from sources other than Contractor.
- 1. Transmittal Form: Use AIA Document G810.
- L. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
- 1. Note date and content of previous submittal.
 - 2. Note date and content of revision in label or title block and clearly indicate extent of revision.
- M. 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.

PART 2 - PRODUCTS

2.1 ACTION SUBMITTALS

- A. General: Prepare and submit Action Submittals required by individual Specification Sections.
- B. 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 printed data are not suitable 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 written recommendations.
 - b. Manufacturer's product specifications.
 - c. Manufacturer's installation instructions.
 - d. Manufacturer's catalog cuts.
 - e. Wiring diagrams showing factory-installed wiring.
 - f. Printed performance curves.
 - g. Operational range diagrams.
 - h. Compliance with specified referenced standards.
 - i. Testing by recognized testing agency.

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4. Number of Copies: Submit one electronic copy of Product Data. Engineer will mark up and return one electronic copy as a Project Record Document.
- C. 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. Dimensions.
 - b. Identification of products.
 - c. Fabrication and installation drawings.
 - d. Roughing-in and setting diagrams.
 - e. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring.
 - f. Shopwork manufacturing instructions.
 - g. Templates and patterns.
 - h. Schedules.
 - i. Notation of coordination requirements.
 - j. Notation of dimensions established by field measurement.
 - k. Relationship to adjoining construction clearly indicated.
 - l. Seal and signature of professional engineer if specified.
 - m. Wiring Diagrams: Differentiate between manufacturer-installed and field-installed wiring.
 2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches but no larger than 30 by 40 inches.
 3. Number of Copies: Submit electronic copy of each submittal. Engineer will return one copy.
- D. Product Schedule or List: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location.
 1. Number of Copies: Submit electronic copy of product schedule or list.
- E. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design.
 1. Number of Copies: Submit electronic copy of subcontractor list.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

- A. 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. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, 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.

3.2 ENGINEER'S ACTION

- A. General: Engineer will not review submittals that do not bear Contractor's approval stamp and will return them without action.
- B. Action Submittals: Engineer will review each submittal, make marks to indicate corrections or modifications required, and return it. Engineer will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action taken, as follows:
- C. Partial submittals are not acceptable, will be considered nonresponsive, and will be returned without review.
- D. Submittals not required by the Contract Documents may not be reviewed and may be discarded.

END OF SECTION 01 33 00

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SECTION 01 40 00 – QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Quality assurance and control of installation.
- B. Tolerances.
- C. Manufacturers' field services and reports.
- D. Testing and inspections.

1.2 RELATED SECTIONS

- A. Section 01 33 00 - Submittals.
- B. Individual Specification Sections.

1.3 QUALITY ASSURANCE/CONTROL OF INSTALLATION

- A. Monitor quality control over suppliers, manufacturers, Products, services, site conditions, and workmanship, to produce Work of specified quality.
- B. Comply fully with manufacturers' instructions, including each step-in sequence.
- C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect/Engineer before proceeding.
- D. Comply with specified standards as a minimum quality for the Work except when more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
- E. Perform work by persons qualified to produce workmanship of specified quality.

1.4 TOLERANCES

- A. Monitor tolerance control of installed products to produce acceptable work. Do not permit tolerances to accumulate.
- B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Engineer before proceeding.
- C. Adjust products to appropriate dimensions; position before securing products in place.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION (Not Used)

END OF SECTION 01 40 00

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SECTION 01 60 00 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; product substitutions; and comparable products.
- B. See Division 01 Section "Closeout Procedures" for submitting warranties for Contract closeout.
- C. See Division 23 Sections for specific requirements for warranties on products and installations specified to be warranted.

1.2 DEFINITIONS

- A. Products: Items purchased for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
 - 1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature, that is current as of date of the Contract Documents.
 - 2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
 - 3. Comparable Product: Product that is demonstrated and approved through submittal process, or where indicated as a product substitution, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.
- B. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.
- C. Basis-of-Design Product Specification: Where a specific manufacturer's product is named and accompanied by the words "basis of design," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of other named manufacturers.

1.3 SUBMITTALS

- A. Substitution Requests: Submit electronic copy of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
 - 1. Substitution Request Form: Use CSI Form 13.1A.
 - 2. Documentation: Show compliance with requirements for substitutions and the following, as
 - a. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by Owner and separate contractors, that will be necessary to accommodate proposed substitution.
 - b. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
 - c. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
 - d. Samples, where applicable or requested.
 - e. List of similar installations for completed projects with project names and addresses and names and addresses of engineers and owners.

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- B. Comparable Product Requests: Submit electronic copy of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
 - 1. Engineer's Action: If necessary, Engineer will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Engineer will notify Contractor of approval or rejection of proposed comparable product request within 10 working days of receipt of request, or 7 working days of receipt of additional information or documentation, whichever is later.
- C. Basis-of-Design Product Specification Submittal: Comply with requirements in Division 01 Section "Submittal Procedures." Show compliance with requirements.

1.4 QUALITY ASSURANCE

- A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, product selected shall be compatible with products previously selected, even if previously selected products were also options.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft. Comply with manufacturer's written instructions.
- B. Delivery and Handling:
 - 1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
 - 2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
 - 3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
 - 4. Inspect products on delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected.
- C. Storage:
 - 1. Store materials in a manner that will not endanger Project structure.
 - 2. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
 - 3. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
 - 4. Protect stored products from damage and liquids from freezing.

1.6 PRODUCT WARRANTIES

- A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
 - 1. Manufacturer's Warranty: Preprinted written warranty published by individual manufacturer for a product and specifically endorsed by manufacturer to Owner.
 - 2. Special Warranty: Written warranty required by or incorporated into the Contract Documents, either to extend time limit provided by manufacturer's warranty or to provide more rights for Owner.
- B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution. Submit a draft for approval before final execution.
 - 1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
 - 2. Specified Form: When specified forms are included with the Specifications, prepare a written document using appropriate form properly executed.

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3. Refer to Divisions 2 through 16 Sections for specific content requirements and particular requirements for submitting special warranties.
- C. Submittal Time: Comply with requirements in Division 01 Section "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

- A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise indicated, that are new at time of installation.
1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
 2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
 3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
 4. Where products are accompanied by the term "as selected," Engineer will make selection.
 5. Descriptive, performance, and reference standard requirements in the Specifications establish "salient characteristics" of products.

2.2 PRODUCT SUBSTITUTIONS

- A. Timing: Engineer will consider requests for substitution if received within 10 working days after the Notice of Award. Requests received after that time may be considered or rejected at discretion of Engineer.
- B. Conditions: Engineer will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Engineer will return requests without action, except to record noncompliance with these requirements:
1. Requested substitution does not require extensive revisions to the Contract Documents.
 2. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 3. Substitution request is fully documented and properly submitted.
 4. Requested substitution will not adversely affect Contractor's Construction Schedule.
 5. Requested substitution is compatible with other portions of the Work.
 6. Requested substitution has been coordinated with other portions of the Work.
 7. Requested substitution provides specified warranty.

2.3 COMPARABLE PRODUCTS

- A. Conditions: Engineer will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Engineer will return requests without action, except to record noncompliance with these requirements:
1. Evidence that the proposed product does not require extensive revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
 2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
 3. Evidence that proposed product provides specified warranty.
 4. List of similar installations for completed projects with project names and addresses and names and addresses of engineers and owners, if requested.

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 60 00

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SECTION 01 63 01 - SUBSTITUTIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for handling requests for substitutions made after award of the contract.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Division 1 Section "References" specifies the applicability of industry standards to products specified.
 - 2. Division 1 Section "Submittals" specifies requirements for submitting the Contractor's Construction Schedule and the Submittal Schedule.

1.3 DEFINITIONS

- A. Definitions in this Article do not change or modify the meaning of other terms used in the Contract Documents.
- B. Substitutions: Changes in products, materials, equipment, and methods of construction required by the Contract Documents proposed by the Contractor after award of the Contract are considered to be requests for substitutions. The following are not considered to be requests for substitutions:
 - 1. Substitutions requested during the bidding period, and accepted by Addendum prior to award of the Contract, are included in the Contract Documents and are not subject to requirements specified in this Section for substitutions.
 - 2. Revisions to the Contract Documents requested by the Owner or Engineer.
 - 3. Specified options of products and construction methods included in the Contract Documents.
 - 4. The Contractor's determination of and compliance with governing regulations and orders issued by governing authorities.

- 1.4 Contractor has 2 chances (initial submittals and 1 revised submittal) for a substitution. If submittals are not to the satisfaction of the Engineer, Contractor to provide specified material at no additional cost to Owner.

1.5 SUBMITTALS

- A. Substitution Request Submittal: The Engineer will consider requests for substitution if received within 30 days after commencement of the Work. Requests received more than 30 days after commencement of the Work may be considered or rejected at the discretion of the Engineer.
 - 1. Submit electronic copy of each request for substitution for consideration. Submit requests in the form and according to procedures required for change-order proposals.
 - 2. Identify the product or the fabrication for installation method to be replaced in each request. Include related Specification Section and Drawing numbers.
 - 3. Provide complete documentation showing compliance with the requirements for substitutions, and the following information, as appropriate:
 - a. Coordination information, including a list of changes or modifications needed to other parts of Work and to construction performed by the Owner and separate contractors, that will be necessary to accommodate the proposed substitution.
 - b. A detailed comparison of significant qualities of the proposed substitution with those of the Work specified. Significant qualities may include elements, such as performance, weight, size, durability, and visual effect.

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- c. Product Data, including Drawings and descriptions of products and fabrication and installation procedures.
 - d. Samples, where applicable or requested.
 - e. A statement indicating the substitution's effect on the Contractor's Construction Schedule compared to the schedule without approval of the substitution. Indicate the effect of the proposed substitution on overall Contract Time.
 - f. Cost information, including a proposal of the net change, if any in the Contract Sum.
 - g. The Contractor's certification that the proposed substitution conforms to requirements in the Contract Documents in every respect and is appropriate for the applications indicated.
 - h. The Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of the failure of the substitution to perform adequately.
4. Engineer's Action: If necessary, the Engineer will request additional information or documentation for evaluation within one week of receipt of a request for substitution. The Engineer will notify the Contractor of acceptance or rejection of the substitution within 2 weeks of receipt of the request, or one week of receipt of additional information or documentation, whichever is later. Acceptance will be in the form of a change order.
 - a. Use the product specified if the Engineer cannot make a decision on the use of a proposed substitute within the time allocated.
 5. Any changes to the electrical, mechanical, structural, or architectural will be the burden of the Contractor.
- B. Contractor shall submit shop drawings to Engineer of all these changes during submittal process.

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

- A. Conditions: The Engineer will receive and consider the Contractor's request for substitution when one or more of the following conditions are satisfied, as determined by the Engineer. If the following conditions are not satisfied, the Engineer will return the requests without action except to record noncompliance with these requirements.
1. Extensive revisions to the Contract Documents are not required.
 2. Proposed changes are in keeping with the general intent of the Contract Documents.
 3. The request is timely, fully documented, and properly submitted.
 4. The specified product or method of construction cannot be provided with the Contract Time. The Engineer will not consider the request if the product or method cannot be provided as a result of failure to pursue the Work promptly or coordinate activities properly.
 5. The request is directly related to an "or-equal" clause or similar language in the Contract Documents.
 6. The requested substitution offers the Owner a substantial advantage, in cost, time, energy conservation, or other considerations, after deducting additional responsibilities the Owner must assume. The Owner's additional responsibilities may include compensation to the Engineer for redesign and evaluation services, increased cost of other construction by the Owner, and similar considerations.
 7. The specified product or method of construction cannot receive necessary approval by a governing authority, and the requested substitution can be approved.
 8. The specified product or method of construction cannot be provided in a manner that is compatible with other materials and where the Contractor certifies that the substitution will overcome the incompatibility.
 9. The specified product or method of construction cannot be coordinated with other materials and where the Contractor certifies that the proposed substitution can be coordinated.
 10. The specified product or method of construction cannot provide a warranty required by the Contract Documents and where the Contractor certifies that the proposed substitution provides the required warranty.

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- B. The Contractor's submittal and the Engineer's acceptance of Shop Drawings, Product Data, or Samples for construction activities not complying with the Contract Documents do not constitute an acceptable or valid request for substitution, nor do they constitute approval.
- C. Listed manufacturers are subject to compliance to the specified product on the drawings. Electrical, dimensions, weights and options shall not require re-engineering by the design team.
- D. Substituted product shall not increase cost to owner or design team

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 01 63 01

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SECTION 01 73 00 - EXECUTION

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes general procedural requirements governing execution of the Work including, but not limited to, the following:
 - 1. Construction layout.
 - 2. General installation of products.
 - 3. Progress cleaning.
 - 4. Starting and adjusting.
 - 5. Protection of installed construction.
 - 6. Correction of the Work.
- B. See Division 01 Section "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.
- C. No construction shall start prior to approval of all submittals.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Existing Conditions: The existence and location of site improvements, utilities, and other construction indicated as existing are not guaranteed. Before beginning work, investigate and verify the existence and location of mechanical and electrical systems and other construction affecting the Work.
 - 1. Before construction, verify the location and points of connection of utility services.
- B. Existing Utilities: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities and other construction affecting the Work.
 - 1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; and underground electrical services.
 - 2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.
- C. Acceptance of Conditions: Examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
 - 1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
 - 2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
 - 3. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Existing Utility Information: Furnish information to Owner that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.
- B. 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

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construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

- C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- D. 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. Include a detailed description of problem encountered, together with recommendations for changing the Contract Documents. Submit requests on CSI Form 13.2A, "Request for Interpretation."

3.3 INSTALLATION

- A. General: 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.
- 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 the best possible results. 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.
- E. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.
- F. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.
- G. Anchors and Fasteners: Provide anchors and fasteners as required to anchor each component securely in place, accurately located and aligned with other portions of the Work.
 - 1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Engineer.
 - 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.
- H. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.
- I. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.4 PROGRESS CLEANING

- A. General: Clean Project site and work areas daily, including common areas. Coordinate progress cleaning for joint-use areas where more than one installer has worked. 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 materials more than 7 days during normal weather or 3 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, according to regulations.

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- 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 according to 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 in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
- G. Waste Disposal: Burying or burning waste materials on-site will not be permitted. Washing waste materials down sewers or into waterways will not be permitted.
- 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 assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.5 STARTING AND ADJUSTING

- A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
- B. Adjust operating components for proper operation without binding. Adjust equipment for proper operation.
- 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: If a factory-authorized service representative is required to inspect field-assembled components and equipment installation, comply with qualification requirements in Division 01 Section "Quality Requirements."

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

3.7 CORRECTION OF THE WORK

- A. Repair or remove and replace defective construction. 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. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.

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- C. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.
- D. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION 01 73 00

SECTION 01 73 29 - CUTTING AND PATCHING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes procedural requirements for cutting and patching.
- B. See Divisions 23 Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.

1.2 QUALITY ASSURANCE

- A. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio.
- B. 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.
- C. Miscellaneous Elements: Do not cut and patch miscellaneous elements or related 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.
- D. Visual Requirements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in Engineer's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

1.3 WARRANTY

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

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Comply with requirements specified in other Sections.
- B. In-Place Materials: Use materials 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 match the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.
 - 1. Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with in-place finishes or primers.
 - 2. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. 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.

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- B. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.
- C. 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 minimize interruption to occupied areas.

3.3 PERFORMANCE

- 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. 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 as small as possible, neatly to 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. 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.
 - 4. Proceed with patching after construction operations requiring cutting are complete.
- C. 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 possible. Provide materials and comply with installation requirements of the existing building.
 - 1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate 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.
 - 3. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
- D. Cleaning: Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.
- E. Roof patching: Contractor is responsible for keeping existing foam roof weather tight. Contractor to patch and repair any damages to roof caused by construction of this project. Patch and repair shall be per roofing manufacturer's instructions.

END OF SECTION 01 73 29

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SECTION 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes administrative and procedural requirements for the following:
 - 1. Disposing of nonhazardous demolition and construction waste.

1.2 DEFINITIONS

- A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.
- B. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.
- C. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.
- D. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

- 3.1 All existing equipment and control sensors and equipment shall be offered to the owner and shall be delivered to owner on site. All equipment becomes property of the contractor and shall be removed from site.

3.2 PLAN IMPLEMENTATION

- A. General: Implement waste management plan as approved by Owner. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.

3.3 DISPOSAL OF WASTE

- A. General: Remove waste materials from Project site and legally dispose of them in a landfill acceptable to authorities having jurisdiction.
 - 1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
 - 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
- B. Burning: Do not burn waste materials.
- C. Disposal: Transport waste materials and dispose of at designated spoil areas on Owner's property.
- D. Disposal: Transport waste materials off Owner's property and legally dispose of them.

END OF SECTION 01 74 19

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SECTION 01 77 00 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
 - 1. Inspection procedures.
 - 2. Warranties.
 - 3. Final cleaning.
- B. See Division 01 Section "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
- C. See Divisions 23 Sections for specific closeout and special cleaning requirements for the Work in those Sections.

1.2 SUBSTANTIAL COMPLETION

- A. Preliminary Procedures: Before requesting inspection for determining date of Substantial Completion, complete the following. List items below that are incomplete in request.
 - 1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
 - 2. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
 - 3. Obtain and submit releases permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
 - 4. Prepare and submit Project Record Documents, operation and maintenance manuals, and similar final record information.
 - 5. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.
 - 6. Complete startup testing of systems.
 - 7. Submit test/adjust/balance records.
 - 8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
 - 9. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
 - 10. Complete final cleaning requirements, including touchup painting.
 - 11. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.
- B. Inspection: Submit a written request for inspection for Substantial Completion. On receipt of request, Engineer will either proceed with inspection or notify Contractor of unfulfilled requirements. Engineer will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Engineer, that must be completed or corrected before certificate will be issued.
 - 1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
 - 2. Results of completed inspection will form the basis of requirements for Final Completion.

1.3 FINAL COMPLETION

- A. Preliminary Procedures: Before requesting final inspection for determining date of Final Completion, complete the following:
 - 1. Submit certified copy of Engineer's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Engineer. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
 - 2. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
 - 3. Submit pest-control final inspection report and warranty.

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4. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.
- B. Inspection: Submit a written request for final inspection for acceptance. On receipt of request, Engineer will either proceed with inspection or notify Contractor of unfulfilled requirements. Engineer 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. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.4 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

- A. Preparation: Submit electronic copy of list. Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.
 1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor.
 2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.

1.5 WARRANTIES

- A. Submittal Time: Submit written warranties on request of Engineer for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated.
- B. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.
 1. Bind warranties and bonds in heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
 2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
 3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
- C. Provide additional copies of each warranty to include in operation and maintenance manuals.

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. General: Provide 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 portion of Project:

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- a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
 - b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
 - c. Remove tools, construction equipment, machinery, and surplus material from Project site.
 - d. 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.
 - e. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
 - f. Sweep concrete floors broom clean in unoccupied spaces.
 - g. Remove labels that are not permanent.
 - h. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.
 - 1) Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.
 - i. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
 - j. Replace parts subject to unusual operating conditions.
 - k. Leave Project clean and ready for occupancy.
- C. Comply with safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from Project site and dispose of lawfully.

END OF SECTION 01 77 00

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SECTION 01 78 23 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
 - 1. Operation manuals for systems, subsystems, and equipment.
 - 2. Maintenance manuals for the care and maintenance of systems and equipment.
- B. See Divisions 23 Sections for specific operation and maintenance manual requirements for the Work in those Sections.

1.2 SUBMITTALS

- A. Manual: Submit one copy of each manual in final form at least 10 days before final inspection. Engineer will return copy with comments within 10 days after final inspection.
 - 1. Correct or modify each manual to comply with Engineer's comments. Submit 3 copies of each corrected manual within 10 days of receipt of Engineer's comments.

PART 2 - PRODUCTS

2.1 MANUALS, GENERAL

- A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain a title page, table of contents, and manual contents.
- B. Title Page: Enclose title page in transparent plastic sleeve. Include the following information:
 - 1. Subject matter included in manual.
 - 2. Name and address of Project.
 - 3. Name and address of Owner.
 - 4. Date of submittal.
 - 5. Name, address, and telephone number of Contractor.
 - 6. Name and address of Engineer.
 - 7. Cross-reference to related systems in other operation and maintenance manuals.
- C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
- D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.
 - 1. Provide a final review copy to engineer prior to final submittal to owner.
 - 2. Final submittal to owner shall include all of the engineer's comments.
 - 3. Provide owner with (2) USB thumb drives of the manuals.
 - a. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents. Indicate volume number for multiple-volume sets.

2.2 OPERATION MANUALS

- A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and equipment descriptions, operating standards, operating procedures, operating logs, wiring and control diagrams, and license requirements.
- B. Descriptions: Include the following:
 - 1. Product name and model number.

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2. Manufacturer's name.
 3. Equipment identification with serial number of each component.
 4. Equipment function.
 5. Operating characteristics.
 6. Limiting conditions.
 7. Performance curves.
 8. Engineering data and tests.
 9. Complete nomenclature and number of replacement parts.
- C. Operating Procedures: Include start-up, break-in, and control procedures; stopping and normal shutdown instructions; routine, normal, seasonal, and weekend operating instructions; and required sequences for electric or electronic systems.
- D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

2.3 PRODUCT MAINTENANCE MANUAL

- A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.
- B. Source Information: List each product included in manual, identified by product name, and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.
- C. Product Information: Include the following, as applicable:
1. Product name and model number.
 2. Manufacturer's name.
 3. Color, pattern, and texture.
 4. Material and chemical composition.
 5. Reordering information for specially manufactured products.
- D. Maintenance Procedures: Include manufacturer's written recommendations and inspection procedures, types of cleaning agents, methods of cleaning, schedule for cleaning and maintenance, and repair instructions.
- E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.
- F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

2.4 SYSTEMS AND EQUIPMENT MAINTENANCE MANUAL

- A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.
- B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name, and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.
- C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including maintenance instructions, drawings and diagrams for maintenance, nomenclature of parts and components, and recommended spare parts for each component part or piece of equipment:
- D. Maintenance Procedures: Include test and inspection instructions, troubleshooting guide, disassembly instructions, and adjusting instructions that detail essential maintenance procedures:

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- E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
- F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.
- G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.
- H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

2.5 TEST AND BALANCE REPORT

- A. Include final copy of Test and Balance Report.

2.6 MANUFACTURER'S START UP REPORT

- A. Include all manufacturer's start up report.

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

- A. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.
- B. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.
- C. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.
- D. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
- E. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in Record Drawings to ensure correct illustration of completed installation.
 - 1. Do not use original Project Record Documents as part of operation and maintenance manuals.
- F. Comply with Division 01 Section "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION 01 78 23

SECTION 01 78 39 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes administrative and procedural requirements for Project Record Documents, including the following:
 - 1. Record Drawings.
 - 2. Record Specifications.
 - 3. Record Product Data.
- B. See Divisions 23 Sections for specific requirements for Project Record Documents of the Work in those Sections.

1.2 SUBMITTALS

- A. Record Drawings: Comply with the following:
 - 1. Number of Copies: Submit one set of marked-up Record Prints.
- B. Record Specifications: Submit one copy of Project's Specifications, including addenda and contract modifications.
- C. Record Product Data: Submit one copy of each Product Data submittal.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

- A. Record Prints: Maintain one set of blue- or black-line white prints of the Contract Drawings and Shop Drawings.
 - 1. Preparation: Mark Record Prints to show the actual installation where installation varies from that shown originally.
 - a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
 - b. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.
 - 2. Mark the Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. If Shop Drawings are marked, show cross-reference on the Contract Drawings.
 - 3. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
 - 4. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.
 - 5. If any substitutions are made from scheduled products, Contractor is to mark schedules to reflect what was installed.
 - 6. Mark to be in Red pen.
 - 7. Submit Record Drawings to Engineer.

2.2 MISCELLANEOUS RECORD SUBMITTALS

- A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

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PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

- A. Recording: Maintain one copy of each submittal during the construction period for Project Record Document purposes. Post changes and modifications to Project Record Documents as they occur; do not wait until the end of Project.
- B. Maintenance of Record Documents and Samples: Store Record Documents and Samples in the field office apart from the Contract Documents used for construction. Do not use Project Record Documents for construction purposes. Maintain Record Documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to Project Record Documents for Engineer's reference during normal working hours.

END OF SECTION 01 78 39

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SECTION 01 79 00 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:
 - 1. Demonstration of operation of systems, subsystems, and equipment.
 - 2. Training in operation and maintenance of systems, subsystems, and equipment.
- B. See Divisions 23 Sections for specific requirements for demonstration and training for products in those Sections.

1.2 SUBMITTALS

- A. Instruction Program: Submit two copies of outline of instructional program for demonstration and training, including a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.

1.3 QUALITY ASSURANCE

- A. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Engineer.

PART 2 - PRODUCTS

2.1 INSTRUCTION PROGRAM

- A. Program Structure: Develop an instruction program that includes individual training modules for each system and equipment not part of a system, as required by individual Specification Sections.
- B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following:
 - 1. Basis of System Design, Operational Requirements, and Criteria: Include system and equipment descriptions, operating standards, regulatory requirements, equipment function, operating characteristics, limiting conditions, and performance curves.
 - 2. Documentation: Review emergency, operations, and maintenance manuals; Project Record Documents; identification systems; warranties and bonds; and maintenance service agreements.
 - 3. Emergencies: Include instructions on stopping; shutdown instructions; operating instructions for conditions outside normal operating limits; instructions on meaning of warnings, trouble indications, and error messages; and required sequences for electric or electronic systems.
 - 4. Operations: Include startup, break-in, control, and safety procedures; stopping and normal shutdown instructions; routine, normal, seasonal, and weekend operating instructions; operating procedures for emergencies and equipment failure; and required sequences for electric or electronic systems.
 - 5. Adjustments: Include alignments and checking, noise, vibration, economy, and efficiency adjustments.
 - 6. Troubleshooting: Include diagnostic instructions and test and inspection procedures.
 - 7. Maintenance: Include inspection procedures, types of cleaning agents, methods of cleaning, procedures for preventive and routine maintenance, and instruction on use of special tools.
 - 8. Repairs: Include diagnosis, repair, and disassembly instructions; instructions for identifying parts; and review of spare parts needed for operation and maintenance.

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PART 3 - EXECUTION

3.1 INSTRUCTION

- A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.
- B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
 - 1. Owner will furnish an instructor to describe Owner's operational philosophy.
- C. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
 - 1. Schedule training with Owner with at least seven days advance notice.

END OF SECTION 01 79 00

SECTION 22 05 00 - COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Piping materials and installation instructions common to most piping systems.
 - 2. Dielectric fittings.
 - 3. Equipment installation requirements common to equipment sections.

1.2 DEFINITIONS

- A. Finished Spaces: Spaces other than plumbing and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and plumbing equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

1.3 SUBMITTALS

- A. Welding certificates.
- B. Company welding procedures.
- C. See section 01 33 00 for submittal requirements.

1.4 QUALITY ASSURANCE

- A. Electrical Characteristics for Plumbing Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.
- B. Reference Building Codes and Standards:
 - 1. IBC – 2018 International Building Code
 - 2. UMC – 2018 Uniform Mechanical Code
 - 3. UPC – 2018 Uniform Plumbing Code
 - 4. IFC – 2018 International Fire Code
 - 5. NFPA – National Fire Protection Association
 - 6. NEC – National Electrical Code
 - 7. Nevada State Regulatory Agencies
 - 8. ANSI – American National Standards Institute
 - 9. SMACNA – Sheet Metal and Air Conditioning Contractors National Association
 - 10. ASME – American Society of Mechanical Engineers
 - 11. UL – Underwriters Laboratory
 - 12. 2018 – International Energy Conservation Code

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PART 2 - NOT USED

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.
- B. Install equipment level and plumb, parallel, and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- C. Install plumbing equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
- D. Install equipment to allow right of way for piping installed at required slope.

END OF SECTION 22 05 00

SECTION 22 05 19 - METERS AND GAGES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Bimetallic-actuated thermometers.
 - 2. Thermowells.
 - 3. Dial-type pressure gages.
 - 4. Gage attachments.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

1.3 INFORMATIONAL SUBMITTALS

- A. Product certificates.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 BIMETALLIC-ACTUATED THERMOMETERS

- A. following:
 - 1. Miljoco Corporation.
 - 2. Trerice, H. O. Co.
 - 3. Weiss Instruments, Inc.
 - 4. Or approved equal.
- B. Standard: ASME B40.200.
- C. Case: sealed type(s); stainless steel with 5-inch minimum diameter.
- D. Dial: Nonreflective aluminum with permanently etched scale markings and scales in deg F.
- E. Connector Type(s): Union joint, adjustable angle and rigid, bottom, with unified-inch screw threads.
- F. Connector Size: 1/2 inch, with ASME B1.1 screw threads.
- G. Stem: 0.25 or 0.375 inch in diameter; stainless steel.
- H. Window: Glass.
- I. Ring: Stainless steel.
- J. Element: Bimetal coil.
- K. Pointer: Dark-colored metal.
- L. Accuracy: Plus, or minus 1 percent of scale range.
- M. NSF-61 compliant.

2.2 THERMOWELLS

- A. Thermowells:
 - 1. Standard: ASME B40.200.
 - 2. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.

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3. Material for Use with Copper Tubing: CNR or CUNI.
4. Material for Use with Steel Piping: CRES.
5. Type: Stepped shank unless straight or tapered shank is indicated.
6. External Threads: NPS 1/2, NPS 3/4, or NPS 1, ASME B1.20.1 pipe threads.
7. Internal Threads: 1/2, 3/4, and 1 inch, with ASME B1.1 screw threads.
8. Bore: Diameter required to match thermometer bulb or stem.
9. Insertion Length: Length required to match thermometer bulb or stem.
10. Lagging Extension: Include on thermowells for insulated piping and tubing.
11. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.
12. NSF-61 Compliant

- B. Heat-Transfer Medium: Mixture of graphite and glycerin.

2.3 PRESSURE GAGES

A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Miljoco Corporation.
 - b. Terice, H. O. Co.
 - c. Weiss Instruments, Inc.
 - d. Or approved equal.
2. Standard: ASME B40.100.
3. Case: Sealed type(s); cast aluminum or drawn steel; 4-1/2-inch minimum diameter.
4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
5. Pressure Connection: Brass, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
6. Movement: Mechanical, with link to pressure element and connection to pointer.
7. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi.
8. Pointer: Dark-colored metal.
9. Window: Glass.
10. Ring: Metal.
11. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.
12. NSF-61 compliant.

2.4 GAGE ATTACHMENTS

- A. Snubbers: ASME B40.100, brass; with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and porous-metal-type surge-dampening device. Include extension for use on insulated piping.
- B. Siphons: Loop-shaped section of brass pipe with NPS 1/4 or NPS 1/2 pipe threads.
- C. Valves: Brass or stainless-steel needle, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install thermowells with socket extending one-third of pipe diameter and in vertical position in piping tees.
- B. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.
- C. Install thermowells with extension on insulated piping.
- D. Fill thermowells with heat-transfer medium.
- E. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.

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- F. Install remote-mounted thermometer bulbs in thermowells and install cases on panels; connect cases with tubing and support tubing to prevent kinks. Use minimum tubing length.
- G. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.
- H. Install remote-mounted pressure gages on panel.
- I. Install valve and snubber in piping for each pressure gage for fluids.
- J. Install thermometers in the following locations:
 - 1. Inlet and outlet of each water heater.
 - 2. Inlets and outlets of each domestic water heat exchanger.
 - 3. Inlet and outlet of each domestic hot-water storage tank.
 - 4. Inlet and outlet of each remote domestic water chiller.
- K. Install pressure gages in the following locations:
 - 1. Building water service entrance into building.
 - 2. Inlet and outlet of each pressure-reducing valve.
 - 3. Suction and discharge of each domestic water pump.
- L. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.
- M. Adjust faces of meters and gages to proper angle for best visibility.

3.2 THERMOMETER SCHEDULE

- A. Thermometers at inlet and outlet of each domestic water heater shall be the following:
Sealed, bimetallic-actuated type.
- B. Thermometers at inlets and outlets of each domestic water heat exchanger shall be the following:
 - 1. Sealed, bimetallic-actuated type.
- C. Thermometers at inlet and outlet of each domestic hot-water storage tank shall be the following:
Sealed, bimetallic-actuated type.
- D. Thermometer stems shall be of length to match thermowell insertion length.

3.3 THERMOMETER SCALE-RANGE SCHEDULE

- A. Scale Range for Domestic Cold-Water Piping: 0 to 150 deg F.

3.4 PRESSURE-GAGE SCHEDULE

- A. Pressure gages at inlet and outlet of each water pressure-reducing valve shall be the following:
Sealed, direct-mounted, metal case.
- B. Pressure gages at inlet and outside of gas pressure regulators shall be the following, discharge of each domestic water pump shall be the following:
Sealed, direct-mounted, metal case.

3.5 PRESSURE-GAGE SCALE-RANGE SCHEDULE

- A. Scale Range for gas pressure regulator: 0 to 10 psi.
- B. Scale Range for Domestic Water Piping: 0 to 160 psi.

END OF SECTION 22 05 19

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SECTION 22 05 23.12 - BALL VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Bronze ball valves.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of valve.
1. Certification that products comply with NSF 61 Annex G and NSF 372.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
- B. ASME Compliance:
1. ASME B1.20.1 for threads for threaded end valves.
 2. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
 3. ASME B16.18 for solder-joint connections.
 4. ASME B31.9 for building services piping valves.
- C. NSF Compliance: NSF 61 Annex G and NSF 372 for valve materials for potable-water service.
- D. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.
- E. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- F. Valve Sizes: Same as upstream piping unless otherwise indicated.
- G. Valve Actuator Types:
1. Handlever: For quarter-turn valves smaller than NPS 4.
- H. Valves in Insulated Piping:
1. Include 2-inch stem extensions.
 2. Extended operating handles of nonthermal-conductive material and protective sleeves that allow operation of valves without breaking vapor seals or disturbing insulation.
 3. Memory stops that are fully adjustable after insulation is applied.

2.2 BRONZE BALL VALVES

- A. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.
- B. Two-Piece, Bronze Ball Valves with Full Port and Bronze or Brass Trim:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Milwaukee Valve.
 - b. NIBCO INC.
 - c. Red-White Valve Corporation.
 - d. Watts; a Watts Water Technologies company.
 2. Description:
 - a. Standard: MSS SP-110.
 - b. CWP Rating: 400 psig.
 - c. Body Design: Two-piece.
 - d. Body Material: Bronze.

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- e. Ends: Threaded and soldered.
- f. Seats: PTFE.
- g. Stem: Stainless steel.
- h. Ball: Stainless steel.
- i. Port: Full.

PART 3 - EXECUTION

3.1 VALVE INSTALLATION

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves in horizontal piping with stem at or above center of pipe.
- D. Install valves in position to allow full stem movement.

3.2 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. If valves with specified CWP ratings are unavailable, the same types of valves with higher CWP ratings may be substituted.
- B. Select valves with the following end connections:
 - 1. For Copper Tubing, NPS 4 and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.

3.3 DOMESTIC WATER VALVE SCHEDULE

- A. Pipe NPS 4 and Smaller:
 - 1. Bronze Valves: May be provided with solder-joint ends instead of threaded ends.
- B. Ball valves at expansion tanks shall be Bronze Ball Valves with lockable handles.

3.4 COMPRESSED AIR VALVE SCHEDULE

- A. Pipe NPS 4 and Smaller:
 - 1. Bronze Valves: May be provided with solder-joint ends instead of threaded ends.

END OF SECTION 22 05 23.12

SECTION 22 05 29 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Metal pipe hangers and supports.
 - 2. Trapeze pipe hangers.
 - 3. Thermal-hanger shield inserts.
 - 4. Fastener systems.
 - 5. Pipe positioning systems.
 - 6. Equipment supports.

1.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified State of Nevada Professional Engineer, using performance requirements and design criteria indicated.
- B. Structural Performance: Hangers and supports for plumbing piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Signed and sealed by a qualified State of Nevada Professional Engineer. Show fabrication and installation details and include calculations for the following; include Product Data for components:
 - 1. Trapeze pipe hangers.
 - 2. Equipment supports.
- C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

- A. Welding certificates.

1.5 QUALITY ASSURANCE

- A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

- A. Carbon-Steel Pipe Hangers and Supports:
 - 1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
 - 2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
 - 3. Nonmetallic Coatings: Plastic coating, jacket, or liner.

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- 4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
- 5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
- B. Stainless-Steel Pipe Hangers and Supports:
 - 1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
 - 2. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
 - 3. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.
- C. Copper Pipe Hangers:
 - 1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
 - 2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.

2.2 TRAPEZE PIPE HANGERS

- A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.3 THERMAL-HANGER SHIELD INSERTS

- A. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength and vapor barrier.
- B. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength.
- C. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- D. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- E. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.4 FASTENER SYSTEMS

- A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.5 PIPE POSITIONING SYSTEMS

- A. Description: IAPMO PS 42, positioning system of metal brackets, clips, and straps for positioning piping in pipe spaces; for plumbing fixtures in commercial applications.

2.6 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.7 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.
- B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
 - 1. Properties: Nonstaining, noncorrosive, and nongaseous.
 - 2. Design Mix: 5000-psi, 28-day compressive strength.

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PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
- B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
 - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
 - 2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
- C. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- D. Fastener System Installation:
 - 1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
 - 2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- E. Pipe Positioning-System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture.
- F. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- G. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- H. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- I. Install lateral bracing with pipe hangers and supports to prevent swaying.
- J. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- K. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- L. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- M. Insulated Piping:
 - 1. Attach clamps and spacers to piping.
 - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
 - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
 - c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
 - 2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
 - 3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

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- a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
4. Shield Dimensions for Pipe: Not less than the following:
 - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
 - b. NPS 4: 12 inches long and 0.06 inch thick.
 - c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
 - d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
 - e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.
5. Pipes NPS 8 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.2 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make bearing surface smooth.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.3 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:
 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 2. Obtain fusion without undercut or overlap.
 3. Remove welding flux immediately.
 4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.4 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 3/4 inches.

3.5 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use carbon-steel pipe hangers and supports and metal trapeze pipe hangers and attachments for general service applications.
- F. Use stainless-steel pipe hangers and stainless-steel attachments for stainless-steel piping and tubing.
- G. Use copper-plated pipe hangers and copper attachments for copper piping and tubing.

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- H. Use padded hangers for piping that is subject to scratching.
- I. Use thermal-hanger shield inserts for insulated piping and tubing.
- J. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
 - 2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F, pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.
 - 3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
 - 4. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
 - 5. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
 - 6. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
 - 7. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
 - 8. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction might occur.
 - 9. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
- K. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
 - 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.
- L. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
 - 2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
- M. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
 - 2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
 - 3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
 - 4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
 - 5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
 - 6. C-Clamps (MSS Type 23): For structural shapes.
 - 7. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:
 - a. Light (MSS Type 31): 750 lb.
 - b. Medium (MSS Type 32): 1500 lb.
 - c. Heavy (MSS Type 33): 3000 lb.
 - 8. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
 - 9. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
- N. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

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1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
 2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
 3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
- O. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
 2. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
 3. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
- P. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- Q. Use powder-actuated fasteners instead of building attachments where required in concrete construction.
- R. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION 22 05 29

SECTION 22 05 48-VIBRATION AND SEISMIC CONTROLS FOR PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Seismic bracing for plumbing systems (equipment, piping, and conduit) and mechanical systems (flue, combustion air, ducting, and equipment) shall comply with all applicable requirements of the 2018 International Building Code (IBC) including all applicable provisions of the American Society of Civil Engineers (ASCE) Minimum Design Loads for Buildings and Other Structures (ASCE Standard 7-16). Basic seismic design criteria for each project shall be as listed on the structural drawings for that project.
- B. Compliance with the applicable seismic bracing requirements shall be accomplished utilizing the most current version of one of the following design manuals (no exceptions):
 - 1. International Seismic Application Technology (ISAT) Design Manual
 - 2. Mason Industries Seismic Restraint Design Manual
 - 3. Kinetics Noise Control Seismic Design Manual
 - 4. Vibro-Acoustics Seismic Design Manual
- C. A complete bound copy of the applicable design manual shall be provided to the Owner at the beginning of the construction period for use/reference during the course of the project.
- D. Component Importance Factors (Ip) for all plumbing equipment, piping, and conduit shall be determined and assigned in accordance with ASCE Standard 7-16 Section 13.1.3.

1.2 SUBMITTALS

- A. The Contractor shall provide the required number of seismic shop drawing submittal sets for review and approval by the Owner. Submittals shall include a comprehensive set of shop drawings clearly depicting the seismic bracing requirements for all plumbing equipment, piping, and conduit. Any equipment that does not require seismic bracing shall be specifically identified in the submittal, and the reason for exemption shall be provided.
- B. Submittals shall be fully coordinated with the structural drawings and shall include all applicable structural attachment details. Seismic bracing shop drawings shall include all vertical support anchorage loads and all seismic bracing anchorage loads. Each specific load shall be indicated and the structural element that the support is attached to shall be clearly depicted/identified. Seismic bracing submittals shall be stamped and signed by a mechanical, structural, or civil engineer licensed in the State of Nevada.
- C. Seismic shop drawing submittals will be reviewed by both the mechanical engineer and the structural engineer.

1.3 INFORMATIONAL SUBMITTALS

- A. Welding certificates.
- B. Field quality-control reports.

1.4 QUALITY ASSURANCE

- A. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.
- B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- C. An authorized representative of the seismic bracing system manufacturer shall visit the job site during the construction period to confirm that the seismic bracing installation complies with the shop drawings, with all applicable code requirements, and with the seismic bracing system manufacturer's written

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installation requirements and associated details. A minimum of three site visits shall be provided, with the first visit scheduled just prior to installation of the first seismic braces, the second visit at the approximate midpoint of construction, and the third visit when the seismic bracing installation is complete (and prior to installation of ceilings).

- D. A written report shall be issued within one week of each site visit summarizing the observations made during the site visit and listing all required corrective actions and/or deficiencies.
- E. Site visits shall be coordinated with the Owner and shall be scheduled in writing a minimum of two weeks prior to the proposed site visit date.
- F. After all equipment installation is complete and all seismic bracing has been verified, the authorized representative that conducted the field verification shall issue a letter certifying that the installation is complete and that the installation complies with the specified requirements.

1.5 SPECIAL INSPECTION

- A. Special inspections will be arranged and paid for by the Owner when and if required by 2018 IBC Section 1704. When special inspection is required for a system or item of equipment the Contractor shall be available on site during each special inspection to facilitate the on-site review process.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Wind-Restraint Loading:
 - 1. Basic Wind Speed: 140 mph.
 - 2. Building Classification Category: III.
 - 3. Minimum 10 lb./sq. ft. multiplied by maximum area of HVAC component projected on vertical plane normal to wind direction, and 45 degrees either side of normal.
- B. Seismic-Restraint Loading:
 - 1. Site Class as Defined in the IBC: D.
 - 2. Assigned Seismic Risk as Defined in the IBC: III.
 - a. Component Importance Factor: 1.0.
 - b. Component Response Modification Factor: 6.0 for air-side units and ducts of sheet metal; wet-side components: 2.5.
 - c. Component Amplification Factor: 2.5 for air-side components and 1.0 for wet-side components.
 - 3. Design Spectral Response Acceleration Parameter at Short Periods (0.2 Second): 1.577g.
 - 4. Design Spectral Response Acceleration Parameter at 1-Second Period: 0.841g.

2.2 SEISMIC RESTRAINTS

- A. Compliance with the applicable seismic bracing requirements shall be accomplished utilizing the most current version of one of the following design manuals (no exceptions):
 - 1. International Seismic Application Technology (ISAT) Design Manual
 - 2. Mason Industries Seismic Restraint Design Manual
 - 3. Kinetics Noise Control Seismic Design Manual
 - 4. Vibro-Acoustics Seismic Design Manual

PART 3 - EXECUTION

3.1 APPLICATIONS

- A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by an agency acceptable to authorities having jurisdiction.
- B. Hanger-Rod Stiffeners: Install hanger-rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.

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- C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength is adequate to carry present and future static and seismic loads within specified loading limits.

3.2 VIBRATION CONTROL AND SEISMIC-RESTRAINT DEVICE INSTALLATION

- A. Installation of vibration isolators must not cause any change of position of equipment, piping resulting in stresses or misalignment.
- B. Equipment Restraints:
 - 1. Install seismic snubbers on HVAC equipment mounted on vibration isolators. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.
 - 2. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch.
 - 3. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction that provides required submittals for component.
- C. Piping Restraints:
 - 1. Comply with requirements in MSS SP-127.
 - 2. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.
 - 3. Brace a change of direction longer than 12 feet.
- D. Install cables so they do not bend across edges of adjacent equipment or building structure.
- E. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction that provides required submittals for component.
- F. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.
- G. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.
- H. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.
- I. Drilled-in Anchors:
 - 1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
 - 2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
 - 3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
 - 4. Set anchors to manufacturer's recommended torque, using a torque wrench.
 - 5. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.3 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

- A. Install flexible connections in piping where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment. Comply with requirements in Section 23 21 13 "Hydronic Piping" for piping flexible connections.

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

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- B. Perform tests and inspections.
- C. Tests and Inspections:
 - 1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
 - 2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless post connection testing has been approved), and with at least seven days' advance notice.
 - 3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
 - 4. Test to 90 percent of rated proof load of device.
 - 5. Measure isolator restraint clearance.
 - 6. Measure isolator deflection.
 - 7. Verify snubber minimum clearances.
- D. Remove and replace malfunctioning units and retest as specified above.
- E. Prepare test and inspection reports.

3.5 ADJUSTING

- A. Adjust isolators after piping system is at operating weight.
- B. Adjust limit stops on restrained-spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

END OF SECTION 22 05 48

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SECTION 22 05 53 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Equipment labels.
 2. Warning signs and labels.
 3. Pipe labels.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

- A. Metal Labels for Equipment:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Brimar Industries, Inc.
 - b. Craftmark Pipe Markers.
 - c. LEM Products Inc.
 - d. Marking Services, Inc.
 2. Material and Thickness: anodized aluminum, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
 3. Letter Color: White.
 4. Background Color: Black.
 5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
 6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
 7. Fasteners: Stainless-steel rivets.
 8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- B. Plastic Labels for Equipment:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Brimar Industries, Inc.
 - b. Craftmark Pipe Markers.
 - c. LEM Products Inc.
 - d. Marking Services, Inc.
 2. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8-inch-thick, and having predrilled holes for attachment hardware.
 3. Letter Color: White.
 4. Background Color: Black.
 5. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
 6. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
 7. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
 8. Fasteners: Stainless-steel rivets.
 9. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

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- C. Label Content: Include equipment's Drawing designation or unique equipment number, drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.
- D. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number, and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Brimar Industries, Inc.
 - 2. Craftmark Pipe Markers.
 - 3. LEM Products Inc.
 - 4. Marking Services Inc.
- B. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
- C. Letter Color: White.
- D. Background Color: Red.
- E. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
- F. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- G. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
- H. Fasteners: Stainless-steel rivets.
- I. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- J. Label Content: Include caution and warning information plus emergency notification instructions.

2.3 PIPE LABELS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Brimar Industries, Inc.
 - 2. Craftmark Pipe Markers.
 - 3. LEM Products Inc.
 - 4. Marking Services Inc.
- B. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction according to ASME A13.1.
- C. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.
- D. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- E. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings; also include pipe size and an arrow indicating flow direction.
 - 1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
 - 2. Lettering Size: Size letters according to ASME A13.1 for piping.

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PART 3 - EXECUTION

3.1 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

3.2 PIPE LABEL INSTALLATION

- A. Pipe Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
 - 1. Near each valve and control device.
 - 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
 - 3. Near penetrations and on both sides of through walls, floors, ceilings, and inaccessible enclosures.
 - 4. At access doors, manholes, and similar access points that permit view of concealed piping.
 - 5. Near major equipment items and other points of origination and termination.
 - 6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
 - 7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.
- B. Pipe Label Color Schedule:
 - 1. Domestic Water Piping: White letters on a blue background with white flow arrows.
 - 2. Natural Gas Piping: Black letters on yellow background.

END OF SECTION 22 05 53

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SECTION 22 07 19 PLUMBING PIPING INSULATION

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes insulating the following plumbing piping services:
1. Domestic cold-water piping.
 2. Domestic hot-water piping.
 3. Domestic recirculating hot-water piping.
 4. Domestic tempered-water piping.
 5. Domestic recirculating, tempered-water piping.

1.2 ACTION SUBMITTALS

- A. See Section 01 33 00 for submittal requirements.
- B. Product Data: For each type of product indicated.

1.3 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.4 QUALITY ASSURANCE

- A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E84 by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

PART 2 PRODUCTS

2.1 INSULATION MATERIALS

- A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Mineral-Fiber, Preformed Pipe Insulation:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Johns Manville; a Berkshire Hathaway company.
 - b. Knauf Insulation.
 - c. Owens Corning.
 2. Type I, 850 Deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C547, Type I, Grade A, with factory-applied ASJ-SSL. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

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- G. Flexible Closed Cell Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Aeroflex USA, Inc.
 - b. Armacell LLC.
 - c. K-Flex USA.
 2. Insulation shall be an EPDM-rubber based insulation that is UV resistant. Insulation shall not require supplemental vapor retarder protection. Insulation shall have an acrylic adhesive seal on the inside of the longitudinal joint and an EPDM flap that is self-sealing.

2.2 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
- B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Childers Brand; H. B. Fuller Construction Products.
 - b. Eagle Bridges - Marathon Industries.
 2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- C. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Childers Brand; H. B. Fuller Construction Products.
 - b. Eagle Bridges - Marathon Industries.
 - c. Foster Brand; H. B. Fuller Construction Products.
 2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- D. PVC Jacket Adhesive: Compatible with PVC jacket
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Dow Corning Corporation.
 - b. Johns Manville; a Berkshire Hathaway company.
 - c. P.I.C. Plastics, Inc.
 - d. Speedline Corporation.
 2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.3 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

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1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Aeroflex USA, Inc.
 - b. Armacell LLC.
 - c. K-Flex USA.
 2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
 4. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 5. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- B. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Childers Brand; H. B. Fuller Construction Products.
 - b. Eagle Bridges - Marathon Industries.
 - c. Foster Brand; H. B. Fuller Construction Products.
 - d. Knauf Insulation.
 2. Water-Vapor Permeance: ASTM F1249, 1.8 perms at 0.0625-inch dry film thickness.
 3. Service Temperature Range: Minus 20 to plus 180 deg F.
 4. Solids Content: 60 percent by volume and 66 percent by weight.
 5. Color: White.

2.4 SEALANTS

- A. Joint Sealants:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Childers Brand; H. B. Fuller Construction Products.
 - b. Eagle Bridges - Marathon Industries.
 - c. Foster Brand; H. B. Fuller Construction Products.
 2. Materials shall be compatible with insulation materials, jackets, and substrates.
 3. Permanently flexible, elastomeric sealant.
 4. Service Temperature Range: Minus 100 to plus 300 deg F.
 5. Color: White or gray.
 6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 7. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- B. FSK and Metal Jacket Flashing Sealants:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Childers Brand; H. B. Fuller Construction Products.
 - b. Eagle Bridges - Marathon Industries.
 - c. Foster Brand; H. B. Fuller Construction Products.
 2. Materials shall be compatible with insulation materials, jackets, and substrates.
 3. Fire- and water-resistant, flexible, elastomeric sealant.
 4. Service Temperature Range: Minus 40 to plus 250 deg F.
 5. Color: Aluminum.
 6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

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7. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. ASJ Flashing Sealants, and Vinyl and PVC Jacket Flashing Sealants:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Childers Brand; H. B. Fuller Construction Products.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: White.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Flexible Elastomeric Insulation Sealants:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Aeroflex USA, Inc.
 - b. Armacell LLC.
 - c. K-Flex USA.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.5 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C1136, Type I.
3. Vinyl Jacket: White vinyl with a permeance of 1.3 perms when tested according to ASTM E96/E96M, Procedure A, and complying with NFPA 90A and NFPA 90B.

2.6 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C921, Type I, unless otherwise indicated.

B. Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Johns Manville; a Berkshire Hathaway company.
 - b. P.I.C. Plastics, Inc.
 - c. Proto Corporation.
 - d. Speedline Corporation.
2. Adhesive: As recommended by jacket material manufacturer.
3. Color: White.
4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricated.

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- a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.
- C. Aluminum embossed jacket, 0.016" thick
 - 1. Adhesive: As recommended by jacket material manufacturer.
 - 2. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricated.
 - a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

2.7 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C1136
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Avery Dennison Corporation, Specialty Tapes Division.
 - b. Compac Corporation.
 - c. Ideal Tape Co., Inc., an American Biltrite Company.
 - d. Knauf Insulation.
 - e. Venture Tape.
 - 2. Width: 3 inches.
 - 3. Thickness: 11.5 mils.
 - 4. Adhesion: 90 ounces force/inch in width.
 - 5. Elongation: 2 percent.
 - 6. Tensile Strength: 40 lbf/inch in width.
 - 7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
- B. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Compac Corporation.
 - b. Ideal Tape Co., Inc., an American Biltrite Company.
 - c. Venture Tape.
 - 2. Width: 2 inches.
 - 3. Thickness: 6 mils.
 - 4. Adhesion: 64 ounces force/inch in width.
 - 5. Elongation: 500 percent.
 - 6. Tensile Strength: 18 lbf/inch in width.

2.8 SECUREMENTS

- A. Aluminum Bands: ASTM B209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020-inch-thick, 1/2-inch-wide with wing seal or closed seal.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ITW Insulation Systems; Illinois Tool Works, Inc.
 - b. RPR Products, Inc.
- B. Staples: Outward-clinching insulation staples, nominal 3/4-inch-wide, stainless steel, or Monel.
- C. Wire: 0.080-inch nickel-copper alloy.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. C & F Wire.

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PART 3 EXECUTION

3.1 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
- C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.2 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 1. Install insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
 - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
 - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
 - 1. Draw jacket tight and smooth.
 - 2. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.

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3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.
 - a. For below-ambient services, apply vapor-barrier mastic over staples.
 4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- P. For above-ambient services, do not install insulation to the following:
1. Vibration-control devices.
 2. Testing agency labels and stamps.
 3. Nameplates and data plates.
 4. Cleanouts.

3.3 PENETRATIONS

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
1. Seal penetrations with flashing sealant.
 2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
 4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.
- C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
1. Seal penetrations with flashing sealant.
 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
 4. Seal jacket to wall flashing with flashing sealant.
- D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
1. Comply with requirements in Section 078400 - Firestopping for firestopping and fire-resistive joint sealers.
- F. Insulation Installation at Floor Penetrations:
1. Pipe: Install insulation continuously through floor penetrations.
 2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078400 - Firestopping.

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3.4 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
 2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
 3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
 4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
 5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
 6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
 7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
 8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
 9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

3.5 INSTALLATION OF MINERAL-FIBER PREFORMED PIPE INSULATION

- A. Insulation Installation on Straight Pipes and Tubes:
1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
 2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
 3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
 4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.
- B. Insulation Installation on Pipe Flanges:

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1. Install preformed pipe insulation to outer diameter of pipe flange.
 2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
 4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.
- C. Insulation Installation on Pipe Fittings and Elbows:
1. Install preformed sections of same material as straight segments of pipe insulation when available.
 2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.
- D. Insulation Installation on Valves and Pipe Specialties:
1. Install preformed sections of same material as straight segments of pipe insulation when available.
 2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
 3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 4. Install insulation to flanges as specified for flange insulation application.

3.6 FIELD-APPLIED JACKET INSTALLATION

- A. Where FSK jackets are indicated, install as follows:
1. Draw jacket material smooth and tight.
 2. Install lap or joint strips with same material as jacket.
 3. Secure jacket to insulation with manufacturer's recommended adhesive.
 4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch-wide joint strips at end joints.
 5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.
- B. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints. Seal with manufacturer's recommended adhesive.
1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.
- C. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.7 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
1. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.
- C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.8 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

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- B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
 - 1. Drainage piping located in crawl spaces.
 - 2. Underground piping.
 - 3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.9 INDOOR PIPING INSULATION SCHEDULE

- A. Domestic Cold Water: Insulation shall be the following:
 - 1. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch thick.
- B. Domestic Hot and Recirculated Hot Water: Insulation shall be the following:
 - 1. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
- C. Domestic Tempered and Recirculated Tempered water: Insulation shall be the following:
 - 1. Mineral-Fiber, preformed pipe insulation, Type 1: 1-inch thick.

3.10 INDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. If more than one material is listed, selection from materials listed is Contractor's option.
- C. Piping, Concealed:
 - 1. None.
- D. Piping, Exposed in the office area:
 - 1. PVC: 30 mils thick.

END OF SECTION 22 07 19

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SECTION 22 11 16 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes under-building-slab and aboveground domestic water pipes, tubes, and fittings inside buildings.

1.2 ACTION SUBMITTALS

- A. Product Data: For transition fittings and dielectric fittings.

1.3 INFORMATIONAL SUBMITTALS

- A. System purging and disinfecting activities report.
- B. Field quality-control reports.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.
- B. Potable-water piping and components shall comply with NSF 14 and NSF 61 Annex G. Plastic piping components shall be marked with "NSF-pw."

2.2 COPPER TUBE AND FITTINGS

- A. Hard Copper Tube: ASTM B 88, Type L water tube, drawn temper.
- B. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings.
- C. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
- D. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.
- E. Copper Unions:
 - 1. MSS SP-123.
 - 2. Cast-copper-alloy, hexagonal-stock body.
 - 3. Ball-and-socket, metal-to-metal seating surfaces.
 - 4. Solder-joint or threaded ends.

2.3 PIPING JOINING MATERIALS

- A. Pipe-Flange Gasket Materials:
 - 1. AWWA C110/A21.10, rubber, flat face, 1/8-inch-thick or ASME B16.21, nonmetallic and asbestos free unless otherwise indicated.
 - 2. Full-face or ring type unless otherwise indicated.
- B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
- C. Solder Filler Metals: ASTM B 32, lead-free alloys.
- D. Flux: ASTM B 813, water flushable.
- E. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

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2.4 TRANSITION FITTINGS

- A. General Requirements:
 - 1. Same size as pipes to be joined.
 - 2. Pressure rating at least equal to pipes to be joined.
 - 3. End connections compatible with pipes to be joined.
- B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

2.5 DIELECTRIC FITTINGS

- A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
- B. Dielectric Unions:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. HART Industrial Unions, LLC.
 - b. Watts.
 - c. Wilkins.
 - d. Zurn Industries, LLC.
 - 2. Standard: ASSE 1079.
 - 3. Pressure Rating: 150 psig.
 - 4. End Connections: Solder-joint copper alloy and threaded ferrous.
- C. Dielectric Flanges:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Watts.
 - b. Wilkins.
 - c. Zurn Industries, LLC.
 - 2. Standard: ASSE 1079.
 - 3. Factory-fabricated, bolted, companion-flange assembly.
 - 4. Pressure Rating: 150 psig.
 - 5. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.
- D. Dielectric-Flange Insulating Kits:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Advance Products & Systems, Inc.
 - b. Calpico, Inc.
 - c. Central Plastics Company.
 - d. Pipeline Seal and Insulator, Inc.
 - 2. Nonconducting materials for field assembly of companion flanges.
 - 3. Pressure Rating: 150 psig.
 - 4. Gasket: Neoprene or phenolic.
 - 5. Bolt Sleeves: Phenolic or polyethylene.
 - 6. Washers: Phenolic with steel backing washers.
- E. Dielectric Nipples:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Grinnell Mechanical Products.
 - b. Precision Plumbing Products.
 - c. Victaulic Company.
 - 2. Standard: IAPMO PS 66.
 - 3. Electroplated steel nipple complying with ASTM F 1545.
 - 4. Pressure Rating and Temperature: 300 psig at 225 deg F.

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- 5. End Connections: Male threaded or grooved.
- 6. Lining: Inert and noncorrosive, propylene.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.
- B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."
- C. Install ductile-iron piping under building slab with restrained joints according to AWWA C600 and AWWA M41.
- D. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve inside the building at each domestic water-service entrance. Comply with requirements for pressure gages in Section 22 05 19 "Meters and Gages for Plumbing Piping" and with requirements for drain valves and strainers in Section 22 11 19 "Domestic Water Piping Specialties."
- E. Install shutoff valve immediately upstream of each dielectric fitting.
- F. Install water-pressure-reducing valves downstream from shutoff valves. Comply with requirements for pressure-reducing valves in Section 22 11 19 "Domestic Water Piping Specialties."
- G. Install domestic water piping level and plumb.
- H. Rough-in domestic water piping for water-meter installation according to utility company's requirements.
- I. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
- J. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- K. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
- L. Install piping to permit valve servicing.
- M. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.
- N. Install piping free of sags and bends.
- O. Install fittings for changes in direction and branch connections.
- P. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.

3.2 JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

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- D. Brazed Joints for Copper Tubing: Comply with CDA's "Copper Tube Handbook," "Brazed Joints" chapter.
- E. Soldered Joints for Copper Tubing: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."
- F. Pressure-Sealed Joints for Copper Tubing: Join copper tube and pressure-seal fittings with tools recommended by fitting manufacturer.
- G. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.
- H. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

3.3 TRANSITION FITTING INSTALLATION

- A. Install transition couplings at joints of dissimilar piping.

3.4 DIELECTRIC FITTING INSTALLATION

- A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
- B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric couplings or nipples.

3.5 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for seismic-restraint devices in Section 22 05 48 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- B. Comply with requirements for pipe hanger, support products, and installation in Section 22 05 29 "Hangers and Supports for Plumbing Piping and Equipment."
 - 1. Vertical Piping: MSS Type 8 or 42, clamps.
 - 2. Individual, Straight, Horizontal Piping Runs:
 - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
 - c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.
 - 3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
 - 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- C. Support vertical piping and tubing at base and at each floor.
- D. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.
- E. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 3/4 and Smaller: 60 inches with 3/8-inch rod.
 - 2. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.
 - 3. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
 - 4. NPS 2-1/2: 108 inches with 1/2-inch rod.
 - 5. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
 - 6. NPS 6: 10 feet with 5/8-inch rod.
 - 7. NPS 8: 10 feet with 3/4-inch rod.
- F. Install supports for vertical copper tubing every 10 feet.
- G. Install supports for vertical steel piping every 15 feet.
- H. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer's written instructions.

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3.6 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.
- C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.

3.7 IDENTIFICATION

- A. Identify system components. Comply with requirements for identification materials and installation in Section 22 05 53 "Identification for Plumbing Piping and Equipment."
- B. Label pressure piping with system operating pressure.

3.8 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Piping Inspections:
 - a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
 - b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
 - 1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.
 - 2) Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.
 - c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections, and arrange for reinspection.
 - d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
 - 2. Piping Tests:
 - a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
 - b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
 - c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
 - d. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
 - e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
 - f. Prepare reports for tests and for corrective action required.
- B. Domestic water piping will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

3.9 ADJUSTING

- A. Perform the following adjustments before operation:
 - 1. Close drain valves, hydrants, and hose bibbs.
 - 2. Open shutoff valves to fully open position.
 - 3. Open throttling valves to proper setting.
 - 4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.

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- a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide hot-water flow in each branch.
- b. Adjust calibrated balancing valves to flows indicated.
5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
7. Remove filter cartridges from housings and verify that cartridges are as specified for application were used and are clean and ready for use.
8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.10 CLEANING

- A. Clean and disinfect potable domestic water piping as follows:
 1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
 2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:
 - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
 - b. Fill and isolate system according to either of the following:
 - 1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
 - 2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.
 - c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
 - d. Repeat procedures if biological examination shows contamination.
 - e. Submit water samples in sterile bottles to authorities having jurisdiction.
- B. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.
- C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.11 PIPING SCHEDULE

- A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
- B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.
- C. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.
- D. Aboveground domestic water piping, NPS 1-1/2 and smaller, shall be the following:
 1. Hard copper tube, ASTM B 88, Type L; wrought-copper, solder-joint fittings; and soldered joints.

END OF SECTION 22 11 16

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SECTION 22 11 17 - DRAIN PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes equipment drain pipes, tubes, and fittings inside buildings.

1.2 ACTION SUBMITTALS

- A. Product Data: For transition fittings and dielectric fittings.

1.3 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 COPPER TUBE AND FITTINGS

- A. Hard Copper Tube: ASTM B 88, Type M water tube, drawn temper.
- B. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
- C. Copper Unions:
 - 1. MSS SP-123.
 - 2. Cast-copper-alloy, hexagonal-stock body.
 - 3. Ball-and-socket, metal-to-metal seating surfaces.
 - 4. Solder-joint or threaded ends.

2.3 CPVC PIPING.

- A. CPVC Pipe:
 - 1. CPVC Socket Fittings: ASTM F 438 for Schedule 40.
- B. CPVC Piping System: ASTM D 2846/D 2846M, SDR 11, pipe and socket fittings.
- C. CPVC Tubing System: ASTM D 2846/D 2846M, SDR 11, tube and socket fittings.

2.4 PIPING JOINING MATERIALS

- A. Solder Filler Metals: ASTM B 32, lead-free alloys.
- B. Flux: ASTM B 813, water flushable.
- C. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.
- D. Solvent Cements for Joining CPVC Piping and Tubing:
 - 1. CPVC solvent cement shall have a VOC content of 490 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 2. Adhesive primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 3. Solvent cement and adhesive primer shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

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2.5 TRANSITION FITTINGS

- A. General Requirements:
 - 1. Same size as pipes to be joined.
 - 2. Pressure rating at least equal to pipes to be joined.
 - 3. End connections compatible with pipes to be joined.
- B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
- C. Plastic-to-Metal Transition Fittings:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Colonial Engineering, Inc.
 - b. NIBCO INC.
 - c. Spears Manufacturing Company.
 - 2. Description:
 - a. CPVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions.
 - b. One end with threaded brass insert and one solvent-cement-socket or threaded end.

2.6 DIELECTRIC FITTINGS

- A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
- B. Dielectric Unions:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. HART Industrial Unions, LLC.
 - b. Watts.
 - c. Wilkins.
 - d. Zurn Industries, LLC.
 - 2. Standard: ASSE 1079.
 - 3. Pressure Rating: 150 psig.
 - 4. End Connections: Solder-joint copper alloy and threaded ferrous.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.
- B. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
- E. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.
- F. Install piping free of sags and bends.
- G. Install fittings for changes in direction and branch connections.
- H. Install unions in copper and CPUC tubing at final connection to each piece of equipment, machine, and specialty.

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3.2 JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- C. Soldered Joints for Copper Tubing: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."
- D. Joint Construction for Solvent-Cemented Plastic Piping: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 - 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements. Apply primer.
 - 2. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
- E. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

3.3 TRANSITION FITTING INSTALLATION

- A. Install transition couplings at joints of dissimilar piping.

3.4 DIELECTRIC FITTING INSTALLATION

- A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
- B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric couplings or nipples.

3.5 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for seismic-restraint devices in Section 22 05 48 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- B. Comply with requirements for pipe hanger, support products, and installation in Section 22 05 29 "Hangers and Supports for Plumbing Piping and Equipment."
 - 1. Vertical Piping: MSS Type 8 or 42, clamps.
 - 2. Individual, Straight, Horizontal Piping Runs:
 - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
 - c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.
 - 3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
 - 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- C. Support vertical piping and tubing at base and at each floor.
- D. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.
- E. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 3/4 and Smaller: 60 inches with 3/8-inch rod.
 - 2. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.
 - 3. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
- F. Install supports for vertical copper tubing every 10 feet.
- G. Install vinyl-coated hangers for CPVC piping with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1 and Smaller: 36 inches with 3/8-inch rod.
 - 2. NPS 1-1/4 to NPS 2: 48 inches with 3/8-inch rod.

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- H. Install supports for vertical CPVC piping every 60 inches for NPS 1 and smaller, and every 72 inches for NPS 1-1/4 and larger.
- I. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer's written instructions.

3.6 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.

3.7 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Piping Inspections:
 - a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
 - b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
 - 1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.
 - 2) Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.
 - c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections, and arrange for reinspection.
 - d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
 - 2. Piping Tests:
 - a. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
 - b. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
 - c. Prepare reports for tests and for corrective action required.
- B. Prepare test and inspection reports.

3.8 CLEANING

- A. Clean and flush piping of all debris, use a filter at the end of discharge so debris do not go into drains.

3.9 PIPING SCHEDULE

- A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
- B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.
- C. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.
- D. Boiler condensate drain piping to and from the neutralizer shall be the following:
 - 1. CPVC, Schedule 40, plastic pipe and fittings and solvent-welded joints
- E. Water Heater condensate drain piping to and from the neutralizer shall be the following:
 - 1. CPVC, Schedule 40, plastic pipe and fittings and solvent-welded joints
- F. Equipment drain for mechanical equipment shall have a trap per manufacturer's instructions and be the following:
 - 1. Hard copper tube, ASTM B 88, Type M; wrought copper, solder-joint fittings, and soldered joints.

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END OF SECTION 22 11 17

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SECTION 22 11 19 - DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Backflow preventers.
 - 2. Water pressure-reducing valves.
 - 3. Strainers.
 - 4. Drain valves.
- B. Related Requirements:
 - 1. Section 22 05 19 "Meters and Gages for Plumbing Piping" for thermometers, pressure gages, and flow meters in domestic water piping.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PIPING SPECIALTIES

- A. Potable-water piping and components shall comply with NSF 61 Annex G and NSF 14. Mark "NSF-pw" on plastic piping components.

2.2 PERFORMANCE REQUIREMENTS

- A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig unless otherwise indicated.

2.3 BACKFLOW PREVENTERS

- A. Reduced-Pressure-Principle Backflow Preventers:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Apollo.
 - b. Wilkins
 - c. Watts
 - 2. Standard: ASSE 1013.
 - 3. Operation: Continuous-pressure applications.
 - 4. Pressure Loss: 12 psig maximum, through middle third of flow range.
 - 5. Body: Bronze for NPS 2 and smaller; steel with interior lining that complies with AWWA C550 or that is FDA approved or stainless steel for NPS 2-1/2 and larger.
 - 6. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
 - 7. Configuration: Designed for horizontal, straight-through or vertical flow.
 - 8. Accessories:
 - a. Valves NPS 2 and Smaller: Ball type with threaded ends on inlet and outlet.
 - b. Valves NPS 2-1/2 and Larger: Outside-screw and yoke-gate type with flanged ends on inlet and outlet.

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- c. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.

2.4 WATER PRESSURE-REDUCING VALVES

A. Water Regulators:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Apollo.
 - b. Wilkins
 - c. Watts
2. Standard: ASSE 1003.
3. Pressure Rating: Initial working pressure of 150 psig.
4. Body: Bronze for NPS 2 and smaller; cast iron with interior lining that complies with AWWA C550 or that is FDA approved for NPS 2-1/2 and NPS 3.
5. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and NPS 3.

2.5 STRAINERS FOR DOMESTIC WATER PIPING

A. Y-Pattern Strainers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Watts; a Watts Water Technologies company.
 - b. Zurn Industries, LLC.
 - c. Apollo.
2. Pressure Rating: 125 psig minimum unless otherwise indicated.
3. Body: Bronze for NPS 2 and smaller; cast iron with interior lining that complies with AWWA C550 or that is FDA approved, epoxy coated and for NPS 2-1/2 and larger.
4. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
5. Screen: Stainless steel with round perforations unless otherwise indicated.
6. Perforation Size:
 - a. Strainers NPS 2 and Smaller: 0.020 inch.
 - b. Strainers NPS 2-1/2 to NPS 4: 0.045 inch.
 - c. Strainers NPS 5 and Larger: 0.10 inch.
7. Drain: Factory-installed, hose-end drain valve.

2.6 DRAIN VALVES

A. Ball-Valve-Type, Hose-End Drain Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Crane; Crane Energy Flow Solutions.
 - b. Hammond Valve.
 - c. Red-White Valve Corporation.
 - d. Watts; a Watts Water Technologies company.
2. Standard: MSS SP-110 for standard-port, two-piece ball valves.
3. Pressure Rating: 400-psig minimum CWP.
4. Size: NPS 3/4.
5. Body: Copper alloy.
6. Ball: Chrome-plated brass.
7. Seats and Seals: Replaceable.
8. Handle: Vinyl-covered steel.
9. Inlet: Threaded or solder joint.
10. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

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PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.
 - 1. Locate backflow preventers in same room as connected equipment or system.
 - 2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe-to-floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are unacceptable for this application.
 - 3. Do not install bypass piping around backflow preventers.
- B. Install water regulators with inlet and outlet shutoff valves and balancing valves. Install pressure gages on inlet and outlet.
- C. Install Y-pattern strainers for water on supply side of each control valve, water pressure-reducing valve, solenoid valve, and pump.

3.2 CONNECTIONS

- A. Comply with requirements for ground equipment in Section 26 05 26 "Grounding and Bonding for Electrical Systems."
- B. Fire-retardant-treated-wood blocking is specified in Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables" for electrical connections.

3.3 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Test each reduced-pressure-principle backflow preventer and double-check, backflow-prevention assembly according to authorities having jurisdiction and the device's reference standard.
- B. Domestic water piping specialties will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

3.4 ADJUSTING

- A. Set field-adjustable pressure set points of water pressure-reducing valves.

END OF SECTION 22 11 19

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SECTION 22 11 23 - DOMESTIC WATER PUMPS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. In-line, sealless centrifugal pumps.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

1.3 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. UL Compliance: Comply with UL 778 for motor-operated water pumps.

PART 2 - PRODUCTS

2.1 IN-LINE, SEALLESS CENTRIFUGAL PUMPS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Grundfos Pumps Corp.
 2. TACO Incorporated.
 3. Or approved equal.
- B. Description: Factory-assembled and -tested, in-line, close-coupled, canned-motor, sealless, overhung-impeller centrifugal pumps.
- C. Pump Construction:
1. Pump and Motor Assembly: Hermetically sealed, replaceable-cartridge type with motor and impeller on common shaft and designed for installation with pump and motor shaft horizontal.
 2. Casing: Bronze, with threaded or companion-flange connections.
 3. Impeller: Plastic.
 4. Motor: Single speed, unless otherwise indicated.

2.2 MOTORS

- A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 22 05 13 "Common Motor Requirements for Plumbing Equipment."
1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

2.3 CONTROLS

- A. Thermostats: Electric; adjustable for control of hot-water circulation pump.
1. Type: Water-immersion temperature sensor, for installation in piping.
 2. Range: 65 to 200 deg F.
 3. Enclosure: NEMA 250

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4. Operation of Pump: On or off.
5. Transformer: Provide if required.
6. Settings: Start pump at 105 deg F and stop pump at 110 deg F.

PART 3 - EXECUTION

3.1 PUMP INSTALLATION

- A. Comply with HI 1.4.
- B. Install in-line, sealless centrifugal pumps with shaft horizontal unless otherwise indicated.
- C. Install horizontally mounted, in-line, close-coupled centrifugal pumps with shaft horizontal.
- D. Install thermostats in hot-water return piping.

3.2 CONNECTIONS

- A. Comply with requirements for piping specified in Section 22 11 16 "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to pumps to allow service and maintenance.
- C. Connect domestic water piping to pumps. Install suction and discharge piping equal to or greater than size of pump nozzles.
 1. Install flexible connectors adjacent to pumps in suction and discharge piping of the following pumps:
 - a. Horizontally mounted, in-line, close-coupled centrifugal pumps.
 - b. Comply with requirements for flexible connectors specified in Section 22 11 16 "Domestic Water Piping."
 2. Install shutoff valve and strainer on suction side of each pump, and check, shutoff, and throttling valves on discharge side of each pump. Install valves same size as connected piping. Comply with requirements for valves specified in Section 22 05 23.12 "Ball Valves for Plumbing Piping," "Section 22 05 23.14 "Check Valves for Plumbing Piping," and comply with requirements for strainers specified in Section 22 11 19 "Domestic Water Piping Specialties."
 3. Install pressure gage and snubber at suction of each pump and pressure gage and snubber at discharge of each pump. Install at integral pressure-gage tappings were provided or install pressure-gage connectors in suction and discharge piping around pumps. Comply with requirements for pressure gages and snubbers specified in Section 22 05 19 "Meters and Gages for Plumbing Piping."
- D. Connect thermostats to pumps that they control.

3.3 ADJUSTING

- A. Adjust domestic water pumps to function smoothly, and lubricate as recommended by manufacturer.
- B. Adjust initial temperature set points.
- C. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

END OF SECTION 22 11 23

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SECTION 22 11 24 - FACILITY NATURAL-GAS PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Pipes, tubes, and fittings.
 - 2. Piping specialties.
 - 3. Piping and tubing joining materials.
 - 4. Valves.

1.2 PERFORMANCE REQUIREMENTS

- A. Minimum Operating-Pressure Ratings:
 - 1. Piping and Valves: 100 psig minimum unless otherwise indicated.
- B. Natural-Gas System Pressure within Buildings: More than 0.5 psig but not more than 2 psig.
- C. Delegated Design: Design restraints and anchors for natural-gas piping and equipment, including comprehensive engineering analysis by a qualified State of Nevada Professional engineer, using performance requirements and design criteria indicated.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For facility natural-gas piping layout. Include plans, piping layout and elevations, sections, and details for fabrication of pipe anchors, hangers, supports for multiple pipes, alignment guides, expansion joints and loops, and attachments of the same to building structure. Detail location of anchors, alignment guides, and expansion joints and loops.
- C. Delegated-Design Submittal: For natural-gas piping and equipment indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - 1. Detail fabrication and assembly of seismic restraints.
 - 2. Design Calculations: Calculate requirements for selecting seismic restraints.

1.4 INFORMATIONAL SUBMITTALS

- A. Welding certificates.
- B. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.6 QUALITY ASSURANCE

- A. Steel Support Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

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PART 2 - PRODUCTS

2.1 PIPES, TUBES, AND FITTINGS

- A. Steel Pipe: ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.
 - 1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
 - 2. Wrought-Steel Welding Fittings: ASTM A 234/A 234M for butt welding and socket welding.
 - 3. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.
 - 4. Protective Coating for Underground Piping: Factory-applied, three-layer coating of epoxy, adhesive, and PE.
 - a. Joint Cover Kits: Epoxy paint, adhesive, and heat-shrink PE sleeves.

2.2 PIPING SPECIALTIES

- A. Flexible Hose Connectors:
 - 1. Flexible hose connector to accommodate any thermal expansion, contraction, or seismic movement of the connected equipment.
 - 2. Capable of compensating for lateral movement and vibration.
 - 3. Manufactured complete with section of corrugated metal hose, compatible braid, with inlet and outlet connections as required.
 - 4. CSA / AGA certified.
 - 5. Products:
 - a. Metraflex Company model GASCT, threaded ends
 - b. Metraflex Company model GASCW, flanged ends
 - c. Or approved equal.
 - 6. Corrugated Hose:
 - a. Type 304 stainless steel.
 - 7. Braid:
 - a. Type 304 stainless steel.
 - 8. Fittings Materials of construction and end fitting type shall be consistent with pipe material and equipment/ pipe connection fittings. Copper fittings shall not be attached to stainless steel hose.
 - 9. Flexible hose connector shall be rated with a 150psi minimum operating pressure.
- B. Y-Pattern Strainers:
 - 1. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
 - 2. End Connections: Threaded ends for NPS 2 and smaller.
 - 3. Strainer Screen: 60-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
 - 4. CWP Rating: 125 psig.
- C. Weatherproof Vent Cap: Cast- or malleable-iron increaser fitting with corrosion-resistant wire screen, with free area at least equal to cross-sectional area of connecting pipe and threaded-end connection.

2.3 JOINING MATERIALS

- A. Joint Compound and Tape: Suitable for natural gas.
- B. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.4 MANUAL GAS SHUTOFF VALVES

- A. See "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles for where each valve type is applied in various services.
- B. General Requirements for Metallic Valves, NPS 2 and Smaller: Comply with ASME B16.33.
 - 1. CWP Rating: 125 psig.
 - 2. Threaded Ends: Comply with ASME B1.20.1.
 - 3. Dryseal Threads on Flare Ends: Comply with ASME B1.20.3.

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4. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
5. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction for valves 1 inch and smaller.
6. Service Mark: Valves 1-1/4 inches to NPS 2 shall have initials "WOG" permanently marked on valve body.

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

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. BrassCraft Manufacturing Co.; a Masco company.
 - b. Conbraco Industries, Inc.
 - c. Nibco
2. Body: Bronze, complying with ASTM B 584.
3. Ball: Chrome-plated bronze.
4. Stem: Bronze; blowout proof.
5. Seats: Reinforced TFE; blowout proof.
6. Packing: Threaded-body packnut design with adjustable-stem packing.
7. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
8. CWP Rating: 600 psig.
9. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

D. Bronze Plug Valves: MSS SP-78.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. A.Y. McDonald Mfg. Co.
 - b. Lee Brass Company.
2. Body: Bronze, complying with ASTM B 584.
3. Plug: Bronze.
4. Ends: Threaded, socket, as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
5. Operator: Square head or lug type with tamperproof feature where indicated.
6. Pressure Class: 125 psig.
7. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
8. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

E. Solenoid Shut Off Valve:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ASCO.
 - b. Approved equal
3. Body: Aluminum.
4. Plug: 430F stainless steel.
5. Ends: Threaded, socket,
6. Pressure Class: 125 psig.
7. Listing: FM approved to Class 7400 "Liquid and Gas Safety Shutoff Valves".
8. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

2.5 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

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inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored yellow.

PART 3 - EXECUTION

3.1 INDOOR PIPING INSTALLATION

- A. Comply with NFPA 54 for installation and purging of natural-gas piping.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Arrange for pipe spaces, chases, slots, sleeves, and openings in building structure during progress of construction, to allow for mechanical installations.
- D. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- E. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- G. Locate valves for easy access.
- H. Install natural-gas piping at uniform grade of 2 percent down toward drip and sediment traps.
- I. Install piping free of sags and bends.
- J. Install fittings for changes in direction and branch connections.
- K. Verify final equipment locations for roughing-in.
- L. Comply with requirements in Sections specifying gas-fired appliances and equipment for roughing-in requirements.
- M. Drips and Sediment Traps: Install drips at points where condensate may collect, including service-meter outlets. Locate where accessible to permit cleaning and emptying. Do not install where condensate is subject to freezing.
 - 1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use nipple a minimum length of 3 pipe diameters, but not less than 3 inches long and same size as connected pipe. Install with space below bottom of drip to remove plug or cap.
- N. Extend relief vent connections for service regulators, line regulators, and overpressure protection devices to outdoors and terminate with weatherproof vent cap.
- O. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings, below grade or floors, and in floor channels unless indicated to be exposed to view.
- P. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.
- Q. Connect branch piping from top or side of horizontal piping.
- R. Install unions in pipes NPS 2 and smaller, adjacent to each valve, at final connection to each piece of equipment.
- S. Do not use natural-gas piping as grounding electrode.

3.2 VALVE INSTALLATION

- A. Install manual gas shutoff valve for each gas appliance ahead of corrugated stainless-steel tubing or copper connector.
- B. Install underground valves with valve boxes.

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- C. Install regulators and overpressure protection devices with maintenance access space adequate for servicing and testing.
- D. Install earthquake valves aboveground outside buildings according to listing.
- E. Install anode for metallic valves in underground PE piping.

3.3 PIPING JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- C. Threaded Joints:
 - 1. Thread pipe with tapered pipe threads complying with ASME B1.20.1.
 - 2. Cut threads full and clean using sharp dies.
 - 3. Ream threaded pipe ends to remove burrs and restore full inside diameter of pipe.
 - 4. Apply appropriate tape or thread compound to external pipe threads unless dryseal threading is specified.
 - 5. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- D. Welded Joints:
 - 1. Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators.
 - 2. Bevel plain ends of steel pipe.
 - 3. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.

3.4 HANGER AND SUPPORT INSTALLATION

- A. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in Section 23 05 48 "Vibration and Seismic Controls for HVAC."
- B. Comply with requirements for pipe hangers and supports specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."
- C. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:
 - 1. NPS 1 and Smaller: Maximum span, 96 inches; minimum rod size, 3/8 inch.
 - 2. NPS 1-1/4: Maximum span, 108 inches; minimum rod size, 3/8 inch.
 - 3. NPS 1-1/2 and NPS 2: Maximum span, 108 inches; minimum rod size, 3/8 inch.
- D. Install hangers for horizontal, corrugated stainless-steel tubing with the following maximum spacing and minimum rod sizes:
 - 1. NPS 3/8: Maximum span, 48 inches; minimum rod size, 3/8 inch.
 - 2. NPS 1/2: Maximum span, 72 inches; minimum rod size, 3/8 inch.
 - 3. NPS 3/4 and Larger: Maximum span, 96 inches; minimum rod size, 3/8 inch.

3.5 CONNECTIONS

- A. Connect to utility's gas main according to utility's procedures and requirements.
- B. Install natural-gas piping electrically continuous, and bonded to gas appliance equipment grounding conductor of the circuit powering the appliance according to NFPA 70.
- C. Install piping adjacent to appliances to allow service and maintenance of appliances.
- D. Connect piping to kitchen appliances using manual gas shutoff valves, unions, and appliance connectors. Install valve within 72 inches of each gas-fired appliance. Install union between valve and appliances.

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- E. Connect piping to equipment (boilers, water heaters, unit heaters, etc.) using manual gas shutoff valves, unions, and flexible connectors. Install valve within 72 inches of each gas-fired equipment. Install union between valve and equipment
- F. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance.
- G. Flexible piping to unit to be full size of the rigid gas pipe not connection size of unit.

3.6 LABELING AND IDENTIFYING

- A. Comply with requirements in Section 23 05 53 "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.

3.7 FIELD QUALITY CONTROL

- A. Test, inspect, and purge natural gas according to NFPA 54 and authorities having jurisdiction.
- B. Natural-gas piping will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

3.8 INDOOR PIPING SCHEDULE

- A. Aboveground, branch piping NPS 1 and smaller shall be the following:
 - 1. Steel pipe with malleable-iron fittings and threaded joints.
- B. Aboveground, distribution piping shall be the following:
 - 1. Steel pipe with malleable-iron fittings and threaded joints.
 - 2. Steel pipe with wrought-steel fittings and welded joints.

3.9 ABOVEGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE

- A. Valves for pipe sizes NPS 4 and smaller at main piping shall be the following:
 - 1. Carbon Steel plug valve.
- B. Distribution piping valves for pipe sizes NPS 2 1/2 and smaller shall be the following:
 - 1. Two-piece, full-port, bronze ball valves with bronze trim.
- C. Valves in branch piping for single appliance shall be the following:
 - 1. Two-piece, full-port, bronze ball valves with bronze trim.
- D. FLEXIBLE PIPING APPLICATION SCHEDULE
 - 1. Boilers: flexible hose connector.
 - 2. Unit heater: Flexible appliance connector

END OF SECTION 22 11 24

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SECTION 22 34 00 - FUEL-FIRED, DOMESTIC-WATER HEATERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Commercial, power-burner, gas-fired, storage, domestic-water heaters with integral storage tank.
 - 2. Domestic-water heater accessories.

1.2 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Commercial domestic-water heaters shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type and size of domestic-water heater indicated.
- B. Shop Drawings:
 - 1. Wiring Diagrams: For power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

- A. Seismic Qualification Certificates: For fuel-fired, domestic-water heaters, accessories, and components, from manufacturer.
- B. Product certificates.
- C. Domestic-Water Heater Labeling: Certified and labeled by testing agency acceptable to authorities having jurisdiction.
- D. Source quality-control reports.
- E. Field quality-control reports.
- F. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.6 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. ASHRAE/IESNA Compliance: Fabricate and label fuel-fired, domestic-water heaters to comply with ASHRAE/IESNA 90.1.
- C. ASME Compliance:
 - 1. Where ASME-code construction is indicated, fabricate and label commercial, domestic-water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
 - 2. Where ASME-code construction is indicated, fabricate and label commercial, finned-tube, domestic-water heaters to comply with ASME Boiler and Pressure Vessel Code: Section IV.
- D. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61 Annex G, "Drinking Water System Components - Health Effects."

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1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of fuel-fired, domestic-water heaters that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Periods: From date of Substantial Completion.
 - a. Commercial, Gas-Fired, Domestic-Water Heaters:
 - 1) Storage Tank: Five years.
 - 2) Controls and Other Components: One year(s).

PART 2 - PRODUCTS

2.1 COMMERCIAL, GAS-FIRED, STORAGE TANK, DOMESTIC-WATER HEATERS

- A. Commercial, Power-Burner, Gas-Fired, Storage Tank, Domestic-Water Heaters:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Lochinvar
 - b. Bradford White
 - c. Smith, A.O. Corporation
 - d. Or Approved Equal
 - 2. Standard: ANSI Z21.10.3/CSA 4.3.
 - 3. Storage-Tank Construction: ASME-code steel with 150-psig working-pressure rating.
 - a. Tappings: Factory fabricated of materials compatible with tank. Attach tappings to tank before testing.
 - 1) NPS 2 and Smaller: Threaded ends according to ASME B1.20.1.
 - 2) NPS 2-1/2 and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges and according to ASME B16.24 for copper and copper-alloy flanges.
 - b. Interior Finish: Comply with NSF 61 Annex barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
 - c. Lining: Glass complying with NSF 61 Annex G barrier materials for potable-water tank linings, including extending lining into and through tank fittings and outlets.
 - 4. Factory-Installed Storage-Tank Appurtenances:
 - a. Anode Rod: Replaceable magnesium.
 - b. Dip Tube: Required unless cold-water inlet is near bottom of tank.
 - c. Drain Valve: Corrosion-resistant metal complying with ASSE 1005.
 - d. Insulation: Comply with ASHRAE/IESNA 90.1. Surround entire storage tank except connections and controls.
 - e. Jacket: Steel with enameled finish.
 - f. Burner: UL 795 for power-burner, gas-fired, domestic-water heaters, and natural-gas fuel.
 - g. Automatic Ignition: ANSI Z21.20/CSA C22.2 No. 199, electric, automatic, gas-ignition system.
 - h. Temperature Control: Adjustable thermostat.
 - i. Safety Controls: Automatic, high-temperature-limit and low-water cutoff devices or systems.
 - j. Combination Temperature-and-Pressure Relief Valves: ANSI Z21.22/CSA 4.4-M. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select one relief valve with sensing element that extends into storage tank.
 - 5. Special Requirements: NSF 5 construction.
 - 6. The water heater specified on the drawings does not require an equipment pad to drain properly. If a substituted water heater requires a pad; contractor to provide an equipment pad as required for proper draining with bid at no additional cost to owner.

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2.2 WATER HEATER ACCESSORIES

- A. Domestic-Water Expansion Tanks:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AMTROL, Inc.
 - b. Wessels
 - c. Elbi
 - d. Or approved equal
 - 2. Description: Steel, pressure-rated tank constructed with welded joints and factory-installed butyl-rubber diaphragm. Include air pre-charge to minimum system-operating pressure at tank.
 - 3. Construction:
 - a. Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1 pipe thread.
 - b. Interior Finish: Comply with NSF 61 Annex G barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
 - c. Air-Charging Valve: Factory installed.
- B. Drain Pans: Corrosion-resistant metal with raised edge. Comply with ANSI/CSA LC 3. Include dimensions not less than base of domestic-water heater, and include drain outlet not less than NPS 3/4 with ASME B1.20.1 pipe threads or with ASME B1.20.7 garden-hose threads.
- C. Piping-Type Heat Traps: Field-fabricated piping arrangement according to ASHRAE/IESNA 90.1 or ASHRAE 90.2.
- D. Heat-Trap Fittings: ASHRAE 90.2.
- E. Gas Shutoff Valves: ANSI Z21.15/CSA 9.1-M, manually operated. Furnish for installation in piping.
- F. Combination Temperature-and-Pressure Relief Valves: Include relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select relief valves with sensing element that extends into storage tank.
 - 1. Gas-Fired, Domestic-Water Heaters: ANSI Z21.22/CSA 4.4-M.

2.3 SOURCE QUALITY CONTROL

- A. Factory Tests: Test and inspect assembled domestic-water heaters and storage tanks specified to be ASME-code construction, according to ASME Boiler and Pressure Vessel Code.
- B. Hydrostatically test commercial domestic-water heaters and storage tanks to minimum of one and one-half times pressure rating before shipment.
- C. Domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Section 01 40 00 "Quality Requirements" for retesting and reinspecting requirements and Section 01 73 00 "Execution" for requirements for correcting the Work.
- D. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 DOMESTIC-WATER HEATER INSTALLATION

- A. Commercial, Domestic-Water Heater Mounting: Install commercial domestic-water heaters on concrete base. Comply with requirements for concrete base specified in Section 033000 "Cast-in-Place Concrete."
 - 1. Exception: Omit concrete bases for commercial domestic-water heaters if installation on stand, bracket, suspended platform, or directly on floor is indicated.
 - 2. Maintain manufacturer's recommended clearances.
 - 3. Arrange units so controls and devices that require servicing are accessible.
 - 4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.

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5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 6. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 7. Install anchor bolts to elevations required for proper attachment to supported equipment.
 8. Anchor domestic-water heaters to substrate.
- B. Install domestic-water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.
1. Install shutoff valves on domestic-water-supply piping to domestic-water heaters and on domestic-hot-water outlet piping. Comply with requirements for shutoff valves specified in Section 22 05 23.12 "Ball Valves for Plumbing Piping," Section 22 05 23.13 "Butterfly Valves for Plumbing Piping," and Section 22 05 23.15 "Gate Valves for Plumbing Piping."
- C. Install gas-fired, domestic-water heaters according to NFPA 54.
1. Install gas shutoff valves on gas supply piping to gas-fired, domestic-water heaters without shutoff valves.
 2. Install gas pressure regulators on gas supplies to gas-fired, domestic-water heaters without gas pressure regulators if gas pressure regulators are required to reduce gas pressure at burner.
 3. Install automatic gas valves on gas supplies to gas-fired, domestic-water heaters if required for operation of safety control.
 4. Comply with requirements for gas shutoff valves, gas pressure regulators, and automatic gas valves specified in Section 23 11 23 "Facility Natural-Gas Piping."
- D. Install commercial domestic-water heaters with seismic-restraint devices. Comply with requirements for seismic-restraint devices specified in Section 22 05 48 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- E. Install combination temperature-and-pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.
- F. Install water-heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for domestic-water heaters that do not have tank drains. Comply with requirements for hose-end drain valves specified in Section 22 11 19 "Domestic Water Piping Specialties." To be CPVC piping from water heater to neutralizer and copper from neutralizer to floor drain/sink.
- G. Install thermometer on outlet piping of domestic-water heaters. Comply with requirements for thermometers specified in Section 22 05 19 "Meters and Gages for Plumbing Piping."
- H. Install piping-type heat traps on inlet and outlet piping of domestic-water heater storage tanks without integral or fitting-type heat traps.
- I. Fill domestic-water heaters with water.
- J. Charge domestic-water compression tanks with air.

3.2 CONNECTIONS

- A. Comply with requirements for domestic-water piping specified in Section 22 11 16 "Domestic Water Piping."
- B. Comply with requirements for gas piping specified in Section 23 11 23 "Facility Natural-Gas Piping."
- C. Drawings indicate general arrangement of piping, fittings, and specialties.
- D. Where installing piping adjacent to fuel-fired, domestic-water heaters, allow space for service and maintenance of water heaters. Arrange piping for easy removal of domestic-water heaters.

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3.3 IDENTIFICATION

- A. Identify system components. Comply with requirements for identification specified in Section 22 05 53 "Identification for Plumbing Piping and Equipment."

3.4 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
 2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 3. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.
 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- B. Domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Section 01 40 00 "Quality Requirements" for retesting and reinspecting requirements and Section 01 73 00 "Execution" for requirements for correcting the Work.
- C. Prepare test and inspection reports.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain commercial, gas-fired, storage, domestic-water heaters.

END OF SECTION 22 34 00

SECTION 23 00 00-COMMON WORK RESULTS FOR HVAC SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Piping materials and installation instructions common to most piping systems.
 - 2. Mechanical demolition.
 - 3. Equipment installation requirements common to equipment sections.
- B. The information indicated on the drawings as existing is based upon information taken from as-built drawings, field investigation, and information obtained from submittal data, etc. The plans do not guarantee accuracy but are only an indication of existing conditions. It is the contractor's responsibility to field verify exact conditions such as equipment placement, ductwork (size, routing, and elevation), piping (size, routing, and elevation), etc. The drawings are intended to provide the contractor an indication of the system installed in the facility to date. It will be the contractor's responsibility to make adjustments to the drawing information as required to match existing field conditions.
- C. The contractor shall install the new equipment, ductwork, and piping around all existing obstacles including: electrical conduit, domestic water piping, waste and vent piping, chilled and heating water piping, and fire sprinkler piping. Provide offsets to avoid relocation of other utilities. Relocate utilities if they are in conflict with the mechanical system installation, cause deviations in the design intent, unsatisfactory operation, noisy conditions, or interfere with maintenance. It is the mechanical contractor's responsibility to coordinate any utility relocation with the appropriate subcontractor.
- D. Provide all necessary labor, materials, equipment, services, and insurances to complete the heating, ventilating, and air conditioning work within the full intent of the drawings and specifications contained hereon and to the entire satisfaction of the engineer.
- E. All dimensions and measurements shall be verified at the jobsite before fabrication and/or installation of the equipment.
- F. Contractor shall visit the site and become familiar with the project before bidding.

1.2 DEFINITIONS

- A. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- B. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and chases.

1.3 SUBMITTALS

- A. See specification section 00 13 30, "Submittal Procedures".
- B. Welding certificates.

1.4 WORKMANSHIP

- A. All work to be performed by qualified personnel normally engaged in the respective line of work.
- B. Perform all work in a manner not to disturb the normal operation of the building.
- C. Coordinate all work with the owner's representative.
- D. The mechanical contractor is responsible for performing all work acceptable to the owner's representative.

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1.5 PROJECT/SITE CONDITIONS

- A. Examine the site, verify dimensions and locations against the drawings, and inform self of conditions under which work is to be done before submitting proposal. No allowance will be made for extra expense on account of error.
- B. Information shown relative to existing locations is based upon available records and data but shall be regarded as approximate only. Make minor deviations found necessary to conform with actual locations and conditions without extra cost.
- C. Install work in locations shown on drawings, unless prevented by project conditions.
- D. Prepare drawings showing proposed rearrangement of work to meet project conditions, including changes to work specified in other sections. Obtain permission of Owner/Engineer before proceeding.

1.6 QUALITY ASSURANCE

- A. Steel Pipe Welding: Qualify processes and operators shall be in accordance with the following:
 - 1. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.
- B. Electrical Characteristics for Mechanical Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.
- C. Reference Building Codes and Standards:
 - 1. IBC – 2018 International Building Code
 - 2. UMC – 2018 Uniform Mechanical Code
 - 3. UPC – 2018 Uniform Plumbing Code
 - 4. IFC – 2018 International Fire Code
 - 5. IECC – 2018 International Energy Conservation Code
 - 6. NFPA – National Fire Protection Association
 - 7. NEC – National Electrical Code
 - 8. Nevada State Regulatory Agencies
 - 9. ANSI – American National Standards Institute
 - 10. SMACNA – Sheet Metal and Air Conditioning Contractors National Association
 - 11. ASME – American Society of Mechanical Engineers
 - 12. UL – Underwriters Laboratory
 - 13. ASHRAE Handbooks
 - 14. ASHRAE Standards
 - 15. SMACNA Duct Construction Standards
 - 16. ASPE Data Books
 - 17. ASME CSD-1, latest adopted edition by the State of Nevada.

PART 2 - NOT USED

PART 3 - EXECUTION

3.1 MECHANICAL DEMOLITION

- A. coordinate with the owner prior to the beginning of demolition work of equipment and material that the owner will salvage.
- B. Disconnect, demolish, and remove mechanical systems, equipment, and components indicated to be removed.
 - 1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
 - 2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.

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- 3. Equipment to Be Removed: Disconnect and cap services and remove equipment.
 - 4. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
- C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.2 PRODUCT HANDLING

- A. Protection: use all means necessary to protect the materials of this section before, during, and after installation and to protect the materials and work of the other trades.
- B. Replacements: in the event of damage, immediately make all repairs and replacements necessary to the approval of the engineer and at no additional cost to the owner.

3.3 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.
- B. Install equipment level and plumb, parallel, and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- C. Install mechanical equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
- D. Install equipment to allow right of way for piping installed at required slope.

3.4 CARE AND CLEANING

- A. Replace broken, damaged, or otherwise defective parts, materials, and work. Leave the entire work in a condition satisfactory to the architect and owner. At completion, carefully clean and adjust equipment, fixtures, and trim which are installed as part of this work. Leave systems and equipment in satisfactory operating condition.
- B. Drain and flush piping to remove grease and foreign matter.
- C. Clean out and remove surplus materials and debris resulting from the work, including surplus excavated material.

END OF SECTION 23 00 00

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SECTION 23 05 13 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small, and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.2 COORDINATION

- A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:
 - 1. Motor controllers.
 - 2. Torque, speed, and horsepower requirements of the load.
 - 3. Ratings and characteristics of supply circuit and required control sequence.
 - 4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

- A. Comply with NEMA MG 1 unless otherwise indicated.

2.2 MOTOR CHARACTERISTICS

- A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 4,500 above sea level.
- B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS

- A. Description: NEMA MG 1, Design B, medium induction motor.
- B. Efficiency: Energy efficient, as defined in NEMA MG 1.
- C. Service Factor: 1.15.
- D. Multispeed Motors: Variable torque.
 - 1. For motors with 2:1 speed ratio, consequent pole, single winding.
 - 2. For motors with other than 2:1 speed ratio, separate winding for each speed.
- E. Rotor: Random-wound, squirrel cage.
- F. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
- G. Temperature Rise: Match insulation rating.
- H. Insulation: Class F
- I. Code Letter Designation:
 - 1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
 - 2. Motors Smaller Than 15 HP: Manufacturer's standard starting characteristic.
- J. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

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2.4 ADDITIONAL REQUIREMENTS FOR POLYPHASE MOTORS

- A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.
- B. Motors Used with Variable-Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.
 - 1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width-modulated inverters.
 - 2. Energy and Premium-Efficient Motors: Class B temperature rise; Class F insulation.
 - 3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
 - 4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

2.5 SINGLE-PHASE MOTORS

- A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:
 - 1. Permanent-split capacitor.
 - 2. Split phase.
 - 3. Capacitor start, inductor run.
 - 4. Capacitor start, capacitor run.
- B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.
- C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
- D. Motors 1/20 HP and Smaller: Shaded-pole type.
- E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

2.6 ELECTRONICALLY COMMUTATED MOTORS (ECM)

- A. Electronically commuted motors (ECM), shall be permanently lubricated with heavy-duty ball bearings to match load.
- B. Internal motor circuitry shall convert AC power supplied to the fan to DC power to operate the motor.
- C. Motor shall be speed controlled down to 20% full speed.
- D. Motor speed shall be controlled by either a potentiometer dial mounted on the motor or by a 0-10 VDC signal.
- E. Motor shall be a minimum of 85% efficient at all speeds.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 23 05 13

SECTION 23 05 19 - METERS AND GAGES FOR HVAC PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Bimetallic-actuated thermometers.
 - 2. Thermowells.
 - 3. Dial-type pressure gages.
 - 4. Gage attachments.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Wiring Diagrams: For power, signal, and control wiring.

1.3 INFORMATIONAL SUBMITTALS

- A. Product certificates.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 BIMETALLIC-ACTUATED THERMOMETERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Miljoco Corporation.
 - 2. Trerice, H. O. Co.
 - 3. Weiss Instruments, Inc.
 - 4. Or Approved equal.
- B. Standard: ASME B40.200.
- C. Case: Sealed type(s); cast aluminum or drawn steel; 5-inch nominal diameter
- D. Dial: Nonreflective aluminum with permanently etched scale markings and scales in deg F.
- E. Connector Type(s): Union joint, adjustable angle and rigid, bottom, with unified-inch screw threads.
- F. Connector Size: 1/2 inch, with ASME B1.1 screw threads.
- G. Stem: 0.25 or 0.375 inch in diameter; stainless steel.
- H. Window: Plain glass.
- I. Ring: Stainless steel.
- J. Element: Bimetal coil.
- K. Pointer: Dark-colored metal.
- L. Accuracy: Plus, or minus 1 percent of scale range.

2.2 THERMOWELLS

- A. Thermowells:
 - 1. Standard: ASME B40.200.
 - 2. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.

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3. Material for Use with Copper Tubing: CNR or CUNI.
4. Material for Use with Steel Piping: CRES.
5. Type: Stepped shank unless straight or tapered shank is indicated.
6. External Threads: NPS 1/2, NPS 3/4, or NPS 1, ASME B1.20.1 pipe threads.
7. Internal Threads: 1/2, 3/4, and 1 inch, with ASME B1.1 screw threads.
8. Bore: Diameter required to match thermometer bulb or stem.
9. Insertion Length: Length required to match thermometer bulb or stem.
10. Lagging Extension: Include on thermowells for insulated piping and tubing.
11. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.

- B. Heat-Transfer Medium: Mixture of graphite and glycerin.

2.3 PRESSURE GAGES

A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Miljoco Corporation.
 - b. Terice, H. O. Co.
 - c. Weiss Instruments, Inc.
 - d. Or approved equal.
2. Standard: ASME B40.100.
3. Case: Sealed type(s); cast aluminum or drawn steel; 4-1/2-inch nominal diameter.
4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
5. Pressure Connection: Brass, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
6. Movement: Mechanical, with link to pressure element and connection to pointer.
7. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi.
8. Pointer: Dark-colored metal.
9. Window: Glass.
10. Ring: Metal.
11. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

2.4 GAGE ATTACHMENTS

- A. Snubbers: ASME B40.100, brass; with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and porous-metal-type surge-dampening device. Include extension for use on insulated piping.
- B. Siphons: Loop-shaped section of brass pipe with NPS 1/4 or NPS 1/2 pipe threads.
- C. Valves: Brass or stainless-steel needle, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install thermowells with socket extending one-third of pipe diameter and in vertical position in piping tees.
- B. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.
- C. Install thermowells with extension on insulated piping.
- D. Fill thermowells with heat-transfer medium.
- E. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.
- F. Install remote-mounted thermometer bulbs in thermowells and install cases on panels; connect cases with tubing and support tubing to prevent kinks. Use minimum tubing length.

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- G. Install duct-thermometer mounting brackets in walls of ducts. Attach to duct with screws.
- H. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.
- I. Install remote-mounted pressure gages on panel.
- J. Install valve and snubber in piping for each pressure gage for fluids (except steam).
- K. Install valve and syphon fitting in piping for each pressure gage for steam.
- L. Install flow indicators in piping systems in accessible positions for easy viewing.
- M. Assemble and install connections, tubing, and accessories between flow-measuring elements and flowmeters according to manufacturer's written instructions.
- N. Install flowmeter elements in accessible positions in piping systems.
- O. Install differential-pressure-type flowmeter elements, with at least minimum straight lengths of pipe, upstream and downstream from element according to manufacturer's written instructions.
- P. Install permanent indicators on walls or brackets in accessible and readable positions.
- Q. Install connection fittings in accessible locations for attachment to portable indicators.
- R. Mount thermal-energy meters on wall if accessible; if not, provide brackets to support meters.
- S. Install thermometers in the following locations:
 - 1. Inlet and outlet of each hydronic zone.
 - 2. Inlet and outlet of each hydronic boiler.
 - 3. Two inlets and two outlets of each chiller.
 - 4. Inlet and outlet of each hydronic coil in air-handling units.
 - 5. Two inlets and two outlets of each hydronic heat exchanger.
 - 6. Inlet and outlet of each thermal-storage tank.
- T. Install pressure gages in the following locations:
 - 1. Discharge of each pressure-reducing valve.
 - 2. Inlet and outlet of each chiller chilled-water and condenser-water connection.
 - 3. Suction and discharge of each pump.

3.2 CONNECTIONS

- A. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.
- B. Connect flowmeter-system elements to meters.
- C. Connect flowmeter transmitters to meters.

3.3 ADJUSTING

- A. After installation, calibrate meters according to manufacturer's written instructions.
- B. Adjust faces of meters and gages to proper angle for best visibility.

3.4 THERMOMETER SCHEDULE

- A. Thermometers at inlet and outlet of each hydronic boiler shall be the following:
 - 1. Sealed, bimetallic-actuated type.
- B. Thermometer stems shall be of length to match thermowell insertion length.

3.5 THERMOMETER SCALE-RANGE SCHEDULE

- A. Scale Range for Chilled-Water Piping: 0 to 150 deg F.

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- B. Scale Range for Heating, Hot-Water Piping: 0 to 250 deg F.
- C. Scale Range for Heat Exchanger Loop Piping: 0 to 250 deg F.

3.6 PRESSURE-GAGE SCHEDULE.

- A. Pressure gages at inlet and outlet of each chiller chilled-water and condenser-water connection shall be the following:
 - 1. Sealed, direct-mounted, metal case.

3.7 RANGE SCHEDULE

- A. Scale Range for Heating, Hot-Water Piping: 0 to 160 psi.
- B. Scale Range for Chilled-Water Piping: 0 to 160 psi.

END OF SECTION 23 05 19

SECTION 23 05 23.12 - BALL VALVES FOR HVAC PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Bronze ball valves.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of valve.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
- B. ASME Compliance:
 - 1. ASME B1.20.1 for threads for threaded-end valves.
 - 2. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
 - 3. ASME B16.18 for solder-joint connections.
 - 4. ASME B31.1 for power piping valves.
 - 5. ASME B31.9 for building services piping valves.
- C. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.
- D. Refer to HVAC valve schedule articles for applications of valves.
- E. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- F. Valve Sizes: Same as upstream piping unless otherwise indicated.
- G. Valve Actuator Types:
 - 1. Handlever: For quarter-turn valves smaller than NPS 4.
- H. Valves in Insulated Piping:
 - 1. Include 2-inch stem extensions.
 - 2. Extended operating handle of nonthermal-conductive material, and protective sleeves that allow operation of valves without breaking the vapor seals or disturbing insulation.
 - 3. Memory stops that are fully adjustable after insulation is applied.

2.2 BRONZE BALL VALVES

- A. Two-Piece Bronze Ball Valves with Full Port and Stainless-Steel Trim:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Crane; Crane Energy Flow Solutions.
 - b. Hammond Valve.
 - c. NIBCO INC.
 - d. Red-White Valve Corporation.
 - e. Watts; a Watts Water Technologies company.
 - f. Milwaukee
 - 2. Description:
 - a. Standard: MSS SP-110.
 - b. SWP Rating: 150 psig.
 - c. CWP Rating: 600 psig.

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- d. Body Design: Two piece.
- e. Body Material: Bronze.
- f. Ends: Threaded.
- g. Seats: PTFE.
- h. Stem: Stainless steel.
- i. Ball: Stainless steel, vented.
- j. Port: Full.
- k. Dezincification resistant.

PART 3 - EXECUTION

3.1 VALVE INSTALLATION

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves in horizontal piping with stem at or above center of pipe.
- D. Install valves in position to allow full stem movement.

3.2 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. If valves with specified SWP classes or CWP ratings are unavailable, the same types of valves with higher SWP classes or CWP ratings may be substituted.
- B. Select valves with the following end connections:
 - 1. For Copper Tubing, NPS 2-1/2 and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
 - 2. For Steel Piping, NPS 2-1/2 and Smaller: Threaded ends.

3.3 HEATING-WATER VALVE SCHEDULE

- A. Pipe NPS 2-1/2 and Smaller: Two-piece, full port, brass, or bronze with stainless-steel trim.
 - 1. Valves may be provided with solder-joint ends instead of threaded ends.

END OF SECTION 23 05 23.12

SECTION 23 05 23.13 - BUTTERFLY VALVES FOR HVAC PIPING

1.1 SUMMARY

- A. Section Includes:
 - 1. High-performance butterfly valves.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of valve.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. ASME Compliance:
 - 1. ASME B16.1 for flanges on iron valves.
 - 2. ASME B16.5 for flanges on steel valves.
 - 3. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
 - 4. ASME B31.9 for building services valves.
- B. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- C. Valve Sizes: Same as upstream piping unless otherwise indicated.
- D. Valve Actuator Types:
 - 1. Hand Lever: For valves NPS 6 and smaller.
- E. Valves in Insulated Piping: Provide with 2-inch extended neck stems.

2.2 HIGH-PERFORMANCE BUTTERFLY VALVES

- A. Single-Flange (Lug-Type), High-Performance Butterfly Valves, Class 150:
 - 1. Subject to compliance with the specifications, provide a product by one of the following manufacturers:
 - a. Nibco
 - b. Red-White Valve Corp.
 - c. Milwaukee Valve
 - d. Or approved equal
 - 2. Standard: MSS SP-68.
 - 3. CWP Rating: 285 psig at 100 deg F
 - 4. Body Design: Single flange (lug type), suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
 - 5. Body Material: Carbon steel.
 - 6. Seat: Reinforced PTFE or metal.
 - 7. Stem: Stainless steel; offset from seat plane.
 - 8. Disc: Type 316 stainless steel.
 - 9. Service: Bidirectional.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

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- C. Examine mating flange faces for damage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- D. Do not attempt to repair defective valves; replace with new valves. Remove defective valves from site.

3.2 INSTALLATION OF VALVES

- A. Install valves with unions or flanges at each piece of equipment arranged to allow space for service, maintenance, and equipment removal without system shutdown.
- B. Provide support of piping adjacent to valves such that no force is imposed upon valves.
- C. Locate valves for easy access.
- D. Install valves in horizontal piping with stem at or above center of pipe.
- E. Install valves in position to allow full valve actuation movement.
- F. Valve Tags: Comply with requirements in Section 23 05 53 "Identification for HVAC Piping and Equipment" for valve tags and schedules.
- G. Adjust or replace valve packing after piping systems have been tested and put into service, but before final adjusting and balancing. If leakage cannot be repaired, replace valve.

3.3 HEATING-WATER VALVE SCHEDULE

- A. Pipe NPS 2-1/2 and Larger:
 - 1. High-Performance Butterfly Valves: Single flange, carbon-steel body, and Class 150].

END OF SECTION 23 05 23.13

SECTION 23 05 29 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Metal pipe hangers and supports.
 - 2. Trapeze pipe hangers.
 - 3. Thermal-hanger shield inserts.
 - 4. Fastener systems.
 - 5. Equipment supports.

1.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Structural Performance: Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
 - 1. Design supports for multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.
 - 2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
 - 3. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

1.3 ACTION SUBMITTALS

- A. See Section 01 33 00 – Submittals for submittal requirements.
- B. Product Data: For each type of product indicated.
- C. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following; include Product Data for components:
 - 1. Trapeze pipe hangers.
 - 2. Equipment supports.
- D. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified State of Nevada Professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

- A. Welding certificates.

1.5 QUALITY ASSURANCE

- A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

- A. Carbon-Steel Pipe Hangers and Supports:
 - 1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
 - 2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
 - 3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
 - 4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
 - 5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
- B. Copper Pipe Hangers:
 - 1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
 - 2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.

2.2 TRAPEZE PIPE HANGERS

- A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.3 THERMAL-HANGER SHIELD INSERTS

- A. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength and vapor barrier.
- B. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig ASTM C 552 or Type II cellular glass with 100-psig minimum compressive strength.
- C. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- D. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- E. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.4 FASTENER SYSTEMS

- A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
- B. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.5 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.6 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.
- B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
 - 1. Properties: Nonstaining, noncorrosive, and nongaseous.
 - 2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
- B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
 - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
 - 2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
- C. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- D. Fastener System Installation:
 - 1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
 - 2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- E. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- F. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- G. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- H. Install lateral bracing with pipe hangers and supports to prevent swaying.
- I. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- J. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- K. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- L. Insulated Piping:
 - 1. Attach clamps and spacers to piping.
 - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
 - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
 - c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
 - 2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
 - 3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
 - 4. Shield Dimensions for Pipe: Not less than the following:

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- a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
 - b. NPS 4: 12 inches long and 0.06 inch thick.
 - c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
 - d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
 - e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.
5. Pipes NPS 8 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
 6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.2 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make bearing surface smooth.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.3 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:
 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 2. Obtain fusion without undercut or overlap.
 3. Remove welding flux immediately.
 4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.4 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1 inch.

3.5 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use carbon-steel pipe hangers and supports and metal trapeze pipe hangers and attachments for general service applications.
- F. Use copper-plated pipe hangers and copper attachments for copper piping and tubing.
- G. Use padded hangers for piping that is subject to scratching.
- H. For black steel piping, provide and install 2-layers of 10 mil, PVC tape around piping at all supports.
- I. Use thermal-hanger shield inserts for insulated piping and tubing.

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- J. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
 2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F, pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.
 3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
 4. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
 5. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
 6. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
 7. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
 8. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction might occur.
 9. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
- K. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.
- L. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
 2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
- M. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
 2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
 3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
 4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
 5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
 6. C-Clamps (MSS Type 23): For structural shapes.
 7. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:
 - a. Light (MSS Type 31): 750 lb.
 - b. Medium (MSS Type 32): 1500 lb.
 - c. Heavy (MSS Type 33): 3000 lb.
 8. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
 9. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
- N. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
 2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent

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- 3. crushing insulation.
- 3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
- O. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
 - 2. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
 - 3. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
- P. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- Q. Use powder-actuated fasteners instead of building attachments where required in concrete construction.

END OF SECTION 23 05 29

SECTION 23 05 48 - VIBRATION AND SEISMIC CONTROLS FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

- A. Seismic bracing for mechanical systems (equipment, ductwork, piping, and conduit) shall comply with all applicable requirements of the 2018 International Building Code (IBC) including all applicable provisions of the American Society of Civil Engineers (ASCE) Minimum Design Loads for Buildings and Other Structures (ASCE Standard 7-16). Basic seismic design criteria for each project shall be as listed on the structural drawings for that project.
- B. Compliance with the applicable seismic bracing requirements shall be accomplished utilizing the most current version of one of the following design manuals (no exceptions):
 - 1. International Seismic Application Technology (ISAT) Design Manual
 - 2. Mason Industries Seismic Restraint Design Manual
 - 3. Kinetics Noise Control Seismic Design Manual
 - 4. Vibro-Acoustics Seismic Design Manual
- C. A complete bound copy of the applicable design manual shall be provided to the Owner at the beginning of the construction period for use/reference during the course of the project.
- D. Component Importance Factors (Ip) for all mechanical equipment, ductwork, piping, and conduit shall be determined and assigned in accordance with ASCE Standard 7-16 Section 13.1.3.

1.2 SUBMITTALS

- A. See Section 01 33 00 – Submittals for submittal requirements.
- B. The Contractor shall provide the required number of seismic shop drawing submittal sets for review and approval by the Owner. Submittals shall include a comprehensive set of shop drawings clearly depicting the seismic bracing requirements for all mechanical equipment, ductwork, piping, and conduit. Any equipment that does not require seismic bracing shall be specifically identified in the submittal, and the reason for exemption shall be provided.
- C. Submittals shall be fully coordinated with the structural drawings and shall include all applicable structural attachment details. Seismic bracing shop drawings shall include all vertical support anchorage loads and all seismic bracing anchorage loads. Each specific load shall be indicated and the structural element that the support is attached to shall be clearly depicted/identified. Seismic bracing submittals shall be stamped and signed by a structural or civil engineer licensed in the State of Nevada.
- D. Seismic shop drawing submittals will be reviewed by both the mechanical engineer and the structural engineer.

1.3 INFORMATIONAL SUBMITTALS

- A. Welding certificates.
- B. Field quality-control reports.

1.4 QUALITY ASSURANCE

- A. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.
- B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

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- C. An authorized representative of the seismic bracing system manufacturer shall visit the job site during the construction period to confirm that the seismic bracing installation complies with the shop drawings, with all applicable code requirements, and with the seismic bracing system manufacturer's written installation requirements and associated details. A minimum of three site visits shall be provided, with the first visit scheduled just prior to installation of the first seismic braces, the second visit at the approximate midpoint of construction, and the third visit when the seismic bracing installation is complete (and prior to installation of ceilings).
- D. A written report shall be issued within one week of each site visit summarizing the observations made during the site visit and listing all required corrective actions and/or deficiencies.
- E. Site visits shall be coordinated with the Owner and shall be scheduled in writing a minimum of two weeks prior to the proposed site visit date.
- F. After all equipment installation is complete and all seismic bracing has been verified, the authorized representative that conducted the field verification shall issue a letter certifying that the installation is complete and that the installation complies with the specified requirements.

1.5 SPECIAL INSPECTION

- A. Special inspections will be arranged and paid for by the Owner when and if required by 2018 IBC Section 1704. When special inspection is required for a particular system or item of equipment the Contractor shall be available on site during each special inspection to facilitate the on-site review process.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Wind-Restraint Loading:
 - 1. Basic Wind Speed: 140 mph.
 - 2. Building Classification Category: III.
 - 3. Minimum 10 lb./sq. ft. multiplied by maximum area of HVAC component projected on vertical plane normal to wind direction, and 45 degrees either side of normal.
- B. Seismic-Restraint Loading:
 - 1. Site Class as Defined in the IBC: D.
 - 2. Assigned Seismic Risk as Defined in the IBC: III.
 - a. Component Importance Factor: 1.0.
 - b. Component Response Modification Factor: 6.0 for air-side units and ducts of sheet metal; wet-side components: 2.5.
 - c. Component Amplification Factor: 2.5 for air-side components and 1.0 for wet-side components.
 - 3. Design Spectral Response Acceleration Parameter at Short Periods (0.2 Second): 1.610g.
 - 4. Design Spectral Response Acceleration Parameter at 1-Second Period: 0.565g.

2.2 SEISMIC RESTRAINTS

- A. Compliance with the applicable seismic bracing requirements shall be accomplished utilizing the most current version of one of the following design manuals (no exceptions):
 - 1. International Seismic Application Technology (ISAT) Design Manual
 - 2. Mason Industries Seismic Restraint Design Manual
 - 3. Kinetics Noise Control Seismic Design Manual
 - 4. Vibro-Acoustics Seismic Design Manual

PART 3 - EXECUTION

3.1 APPLICATIONS

- A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by an agency acceptable to authorities having jurisdiction.
- B. Hanger-Rod Stiffeners: Install hanger-rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.
- C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength is adequate to carry present and future static and seismic loads within specified loading limits.

3.2 VIBRATION CONTROL AND SEISMIC-RESTRAINT DEVICE INSTALLATION

- A. Installation of vibration isolators must not cause any change of position of equipment, piping, or ductwork resulting in stresses or misalignment.
- B. Comply with requirements in Section 07 72 00 "Roof Accessories" for installation of roof curbs, equipment supports, and roof penetrations.
- C. Equipment Restraints:
 - 1. Install seismic snubbers on HVAC equipment mounted on vibration isolators. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.
 - 2. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch.
 - 3. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction that provides required submittals for component.
 - 4. All equipment shall be anchored to concrete bases.
- D. Piping Restraints:
 - 1. Comply with requirements in MSS SP-127.
 - 2. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.
 - 3. Brace a change of direction longer than 12 feet.
- E. Install cables so they do not bend across edges of adjacent equipment or building structure.
- F. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction that provides required submittals for component.
- G. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.
- H. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.
- I. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.
- J. Drilled-in Anchors:
 - 1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
 - 2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
 - 3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
 - 4. Set anchors to manufacturer's recommended torque, using a torque wrench.

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5. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.3 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

- A. Install flexible connections in piping where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment. Comply with requirements in Section 23 21 13 "Hydronic Piping" for piping flexible connections.

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Perform tests and inspections.
- C. Tests and Inspections:
 1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
 2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless post connection testing has been approved), and with at least seven days' advance notice.
 3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
 4. Test to 90 percent of rated proof load of device.
 5. Measure isolator restraint clearance.
 6. Measure isolator deflection.
 7. Verify snubber minimum clearances.
- D. Remove and replace malfunctioning units and retest as specified above.
- E. Prepare test and inspection reports.

3.5 ADJUSTING

- A. Adjust isolators after piping system is at operating weight.
- B. Adjust limit stops on restrained-spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

END OF SECTION 23 05 48

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SECTION 23 05 53 – IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Equipment labels.
 - 2. Warning signs and labels.
 - 3. Pipe labels.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

- A. Plastic Labels for Equipment (Indoor equipment only):
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Brimar Industries, Inc.
 - b. Craftmark Pipe Markers.
 - c. LEM Products Inc.
 - d. Marking Services, Inc.
 - 2. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8-inch-thick and having predrilled holes for attachment hardware.
 - 3. Letter Color: White.
 - 4. Background Color: Black.
 - 5. Maximum Temperature: Able to withstand temperatures up to 160 deg F
 - 6. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch
 - 7. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches 1/2 inch for viewing distances up to 72 inches and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
 - 8. Fasteners: Stainless-steel rivets.
- B. Label Content: Include equipment's Drawing designation or unique equipment number, drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.
- C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number, and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Brimar Industries, Inc.
 - 2. Craftmark Pipe Markers.
 - 3. LEM Products Inc.
 - 4. Marking Services, Inc.
- B. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8-inch-thick, and having predrilled holes for attachment hardware.

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- C. Letter Color: White.
- D. Background Color: Red.
- E. Maximum Temperature: Able to withstand temperatures up to 160 deg F
- F. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch
- G. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches 1/2 inch for viewing distances up to 72 inches and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
- H. Fasteners: Stainless-steel rivets.
- I. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- J. Label Content: Include caution and warning information plus emergency notification instructions.

2.3 PIPE LABELS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Brimar Industries, Inc.
 - 2. Craftmark Pipe Markers.
 - 3. LEM Products Inc.
 - 4. Marking Services Inc.
- B. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction according to ASME A13.1.
- C. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.
- D. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- E. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings; also include pipe size and an arrow indicating flow direction.
 - 1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
 - 2. Lettering Size: Size letters according to ASME A13.1 for piping.

2.4 VALVE TAGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Brimar Industries, Inc.
 - 2. Craftmark Pipe Markers.
 - 3. LEM Products Inc.
 - 4. Marking Services Inc.
- B. Material and Thickness: 2-inch diameter, 20-gauge thick brass, and having predrilled hole.
- C. Top row shall indicate system connected to
- D. Bottom row shall be a unique number
- E. Provide owner with a schedule of valve numbers and locations of valves.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean piping and equipment surface of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

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3.2 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

- A. Pipe Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
 - 1. Near each valve and control device.
 - 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
 - 3. Near penetrations and on both sides of through walls, floors, ceilings, and inaccessible enclosures.
 - 4. At access doors, manholes, and similar access points that permit view of concealed piping.
 - 5. Near major equipment items and other points of origination and termination.
 - 6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
 - 7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

3.4 EQUIPMENT LABEL SCHEDULE:

- 1. Indoor equipment: Plastic Tags

3.5 PIPE LABEL SCHEDULE:

- 1. Heating hot water: Red background with White Letters. Provide with flow arrows.
- 2. Chilled Water: Blue Background with White Letters. Provide with flow arrows.

END OF SECTION 23 05 53

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SECTION 23 05 93 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Balancing Hydronic Piping Systems:
 - a. Variable-flow hydronic systems.
- B. Test & Balance to be conducted by Raglen System Balance or a member of the associated air balance council.
 - 1. TAB listed office on AABC website shall be within 60 miles of job site.
- C. Test & Balance of plumbing systems such as circulation pumps, balance valves, and tempering stations are to be included. The Test & Balance contractor shall review the plumbing drawings to determine systems that fall under the procedures identified in this section.

1.2 DEFINITIONS

- A. AABC: Associated Air Balance Council.
- B. TAB: Testing, adjusting, and balancing.
- C. TAB Specialist: An independent entity, meeting qualifications to perform TAB work.
- D. TDH: Total dynamic head.

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 Specialists Qualifications: Certified by AABC.
 - 1. TAB Field Supervisor: Employee of the TAB specialist and certified by AABC.
 - 2. TAB Technician: Employee of the TAB specialist and certified by AABC as a TAB technician.
- B. Instrumentation Type, Quantity, Accuracy, and Calibration: Comply with requirements in ASHRAE 111, Section 4, "Instrumentation."
- C. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."
- D. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.7.2.3 - "System Balancing."

PART 2 - PRODUCTS (Not Applicable)

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 installed systems for 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 applicable for intended purpose and are accessible.

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- 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 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 verify that bearings are greased, belts are aligned and tight, filters are clean, and equipment with functioning controls is ready for operation.
- J. Examine strainers. Verify that startup screens have been replaced by permanent screens with indicated perforations.
- K. Examine control valves for proper installation for their intended function of throttling, diverting, or mixing fluid flows.
- L. Examine heat-transfer coils for correct piping connections and for clean and straight fins.
- M. Examine system pumps to ensure absence of entrained air in the suction piping.
- N. Examine operating safety interlocks and controls on HVAC equipment.
- O. 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.

3.2 PREPARATION

- A. Prepare a TAB plan that includes strategies and step-by-step procedures for balancing the systems.
- B. Perform system-readiness checks of HVAC systems and equipment to verify system readiness for TAB work. Include, at a minimum, the following:
 - 1. Airside:
 - a. Duct systems are complete with terminals installed.
 - b. Volume, smoke, and fire dampers are open and functional.
 - c. Clean filters are installed.
 - d. Fans are operating, free of vibration, and rotating in correct direction.
 - e. Variable-frequency controllers' startup is complete and safeties are verified.
 - f. Automatic temperature-control systems are operational.
 - g. Ceilings are installed.
 - h. Windows and doors are installed.
 - i. Suitable access to balancing devices and equipment is provided.
 - 2. Hydronics:
 - a. Verify leakage and pressure tests on water distribution systems have been satisfactorily completed.
 - b. Piping is complete with terminals installed.

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- c. Water treatment is complete.
- d. Systems are flushed, filled, and air purged.
- e. Strainers are pulled and cleaned.
- f. Control valves are functioning per the sequence of operation.
- g. Shutoff and balance valves have been verified to be 100 percent open.
- h. Pumps are started and proper rotation is verified.
- i. Pump gage connections are installed directly at pump inlet and outlet flanges or in discharge and suction pipe prior to valves or strainers.
- j. Variable-frequency controllers' startup is complete and safeties are verified.
- k. Suitable access to balancing devices and equipment is provided.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

- A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance" and in this Section.
- B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.
 - 1. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Section 23 07 19 "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. Cross-check the summation of required outlet volumes with required fan volumes.
- B. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.
- C. 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.
- D. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- E. Verify that motor starters are equipped with properly sized thermal protection.
- F. Check dampers for proper position to achieve desired airflow path.
- G. Check for airflow blockages.
- H. Check condensate drains for proper connections and functioning.

3.5 GENERAL PROCEDURES FOR HYDRONIC SYSTEMS

- A. Prepare test reports for pumps, coils, and heat exchangers. Obtain approved submittals and manufacturer-recommended testing procedures. Crosscheck the summation of required coil and heat exchanger flow rates with pump design flow rate.
- B. Prepare schematic diagrams of systems' "as-built" piping layouts.
- C. In addition to requirements in "Preparation" Article, prepare hydronic systems for testing and balancing as follows:
 - 1. Check liquid level in expansion tank.
 - 2. Check highest vent for adequate pressure.
 - 3. Check flow-control valves for proper position.
 - 4. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
 - 5. Verify that motor starters are equipped with properly sized thermal protection.
 - 6. Check that air has been purged from the system.

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3.6 PROCEDURES FOR VARIABLE-FLOW HYDRONIC SYSTEMS

- A. Balance systems with automatic two- and three-way control valves by setting systems at maximum flow through heat-exchange terminals, and proceed as specified above for hydronic systems.
- B. Adjust the variable-flow hydronic system as follows:
 - 1. Verify that the differential-pressure sensor is located as indicated.
 - 2. Determine whether there is diversity in the system.
- C. For systems with no diversity:
 - 1. Adjust pumps to deliver total design gpm.
 - a. Measure total water flow.
 - 1) Position valves for full flow through coils.
 - 2) Measure flow by main flow meter, if installed.
 - 3) If main flow meter is not installed, determine flow by pump TDH or exchanger pressure drop.
 - b. Measure pump TDH as follows:
 - 1) Measure discharge pressure directly at the pump outlet flange or in discharge pipe prior to any valves.
 - 2) Measure inlet pressure directly at the pump inlet flange or in suction pipe prior to any valves or strainers.
 - 3) Convert pressure to head and correct for differences in gage heights.
 - 4) Verify pump impeller size by measuring the TDH with the discharge valve closed. Note the point on manufacturer's pump curve at zero flow and verify that the pump has the intended impeller size.
 - 5) With valves open, read pump TDH. Adjust pump discharge valve until design water flow is achieved.
 - c. Monitor motor performance during procedures and do not operate motor in an overloaded condition.
 - 2. Adjust flow-measuring devices installed in mains and branches to design water flows.
 - a. Measure flow in main and branch pipes.
 - b. Adjust main and branch balance valves for design flow.
 - c. Re-measure each main and branch after all have been adjusted.
 - 3. Adjust flow-measuring devices installed at terminals for each space to design water flows.
 - a. Measure flow at terminals.
 - b. Adjust each terminal to design flow.
 - c. Re-measure each terminal after it is adjusted.
 - d. Position control valves to bypass the coil and adjust the bypass valve to maintain design flow.
 - e. Perform temperature tests after flows have been balanced.
 - 4. For systems with pressure-independent valves at terminals:
 - a. Measure differential pressure and verify that it is within manufacturer's specified range.
 - b. Perform temperature tests after flows have been verified.
 - 5. For systems without pressure-independent valves or flow-measuring devices at terminals:
 - a. Measure and balance coils by either coil pressure drop or temperature method.
 - b. If balanced by coil pressure drop, perform temperature tests after flows have been verified.
 - 6. Prior to verifying final system conditions, determine the system differential-pressure set point.
 - 7. If the pump discharge valve was used to set total system flow with variable-frequency controller at 60 Hz, at completion open discharge valve 100 percent and allow variable-frequency controller to control system differential-pressure set point. Record pump data under both conditions.
 - 8. Mark final settings and verify that all memory stops have been set.
 - 9. Verify final system conditions as follows:
 - a. Re-measure and confirm that total water flow is within design.
 - b. Re-measure final pumps' operating data, TDH, volts, amps, and static profile.
 - c. Mark final settings.
 - 10. Verify that memory stops have been set.
- D. For systems with diversity:

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1. Determine diversity factor.
2. Simulate system diversity by closing required number of control valves, as approved by the design engineer.
3. Adjust pumps to deliver total design gpm.
 - a. Measure total water flow.
 - 1) Position valves for full flow through coils.
 - 2) Measure flow by main flow meter, if installed.
 - 3) If main flow meter is not installed, determine flow by pump TDH or exchanger pressure drop.
 - b. Measure pump TDH as follows:
 - 1) Measure discharge pressure directly at the pump outlet flange or in discharge pipe prior to any valves.
 - 2) Measure inlet pressure directly at the pump inlet flange or in suction pipe prior to any valves or strainers.
 - 3) Convert pressure to head and correct for differences in gage heights.
 - 4) Verify pump impeller size by measuring the TDH with the discharge valve closed. Note the point on manufacturer's pump curve at zero flow and verify that the pump has the intended impeller size.
 - 5) With valves open, read pump TDH. Adjust pump discharge valve until design water flow is achieved.
 - c. Monitor motor performance during procedures and do not operate motor in an overloaded condition.
4. Adjust flow-measuring devices installed in mains and branches to design water flows.
 - a. Measure flow in main and branch pipes.
 - b. Adjust main and branch balance valves for design flow.
 - c. Re-measure each main and branch after all have been adjusted.
5. Adjust flow-measuring devices installed at terminals for each space to design water flows.
 - a. Measure flow at terminals.
 - b. Adjust each terminal to design flow.
 - c. Re-measure each terminal after it is adjusted.
 - d. Position control valves to bypass the coil, and adjust the bypass valve to maintain design flow.
 - e. Perform temperature tests after flows have been balanced.
6. For systems with pressure-independent valves at terminals:
 - a. Measure differential pressure, and verify that it is within manufacturer's specified range.
 - b. Perform temperature tests after flows have been verified.
7. For systems without pressure-independent valves or flow-measuring devices at terminals:
 - a. Measure and balance coils by either coil pressure drop or temperature method.
 - b. If balanced by coil pressure drop, perform temperature tests after flows have been verified.
8. Open control valves that were shut. Close a sufficient number of control valves that were previously open to maintain diversity, and balance terminals that were just opened.
9. Prior to verifying final system conditions, determine system differential-pressure set point.
10. If the pump discharge valve was used to set total system flow with variable-frequency controller at 60 Hz, at completion open discharge valve 100 percent and allow variable-frequency controller to control system differential-pressure set point. Record pump data under both conditions.
11. Mark final settings and verify that memory stops have been set.
12. Verify final system conditions as follows:
 - a. Re-measure and confirm that total water flow is within design.
 - b. Re-measure final pumps' operating data, TDH, volts, amps, and static profile.
 - c. Mark final settings.
13. Verify that memory stops have been set.

3.7 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.

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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.

3.8 PROCEDURES FOR BOILERS

- A. Hydronic Boilers: Measure and record entering- and leaving-water temperatures and water flow.

3.9 TOLERANCES

- A. Set HVAC system's airflow 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. Heat Pump - Water Flow Rate: Plus, or minus 10 percent.
- B. Maintaining pressure relationships as designed shall have priority over the tolerances specified above.

3.10 FINAL REPORT

- A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.
1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
 2. Include a list of instruments used for procedures, along with proof of calibration.
 3. Certify validity and accuracy of field data.
- B. 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.
- C. General Report Data: In addition to form titles and entries, include the following data:
1. Title page.
 2. Name and address of the TAB specialist.
 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.

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12. Nomenclature sheets for each item of equipment.
 13. Data for terminal units, including manufacturer's name, type, size, and fittings.
 14. Notes to explain why certain final data in the body of reports vary from indicated values.
 15. Test conditions for fans and pump performance forms including the following:
 - a. Settings for outdoor-, return-, and exhaust-air dampers.
 - b. Conditions of filters.
 - c. Cooling coil, wet- and dry-bulb conditions.
 - d. Face and bypass damper settings at coils.
 - e. Fan drive settings including settings and percentage of maximum pitch diameter.
 - f. Inlet vane settings for variable-air-volume systems.
 - g. Settings for supply-air, static-pressure controller.
 - h. Other system operating conditions that affect performance.
- D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:
1. Quantities of outdoor, supply, return, and exhaust airflows.
 2. 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.
- E. System-Coil Reports: For reheat coils and water coils of terminal units, include the following:
1. Unit Data:
 - a. System and air-handling-unit identification.
 - b. Location and zone.
 - c. Room or riser served.
 - d. Coil make and size.
 - e. Flowmeter type.
 2. Test Data (Indicated and Actual Values):
 - a. Airflow rate in cfm.
 - b. Entering-water temperature in deg F.
 - c. Leaving-water temperature in deg F.
 - d. Water pressure drop in feet of head or psig.
 - e. Entering-air temperature in deg F.
 - f. Leaving-air temperature in deg F.
- F. Pump Test Reports: Calculate impeller size by plotting the shutoff head on pump curves and include the following:
1. Unit Data:
 - a. Unit identification.
 - b. Location.
 - c. Service.
 - d. Make and size.
 - e. Model number and serial number.
 - f. Water flow rate in gpm.
 - g. Water pressure differential in feet of head or psig.
 - h. Required net positive suction head in feet of head or psig.
 - i. Pump rpm.
 - j. Impeller diameter in inches.
 - k. Motor make and frame size.
 - l. Motor horsepower and rpm.
 - m. Voltage at each connection.
 - n. Amperage for each phase.
 - o. Full-load amperage and service factor.
 - p. Seal type.

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2. Test Data (Indicated and Actual Values):
 - a. Static head in feet of head or psig.
 - b. Pump shutoff pressure in feet of head or psig.
 - c. Actual impeller size in inches.
 - d. Full-open flow rate in gpm.
 - e. Full-open pressure in feet of head or psig.
 - f. Final discharge pressure in feet of head or psig.
 - g. Final suction pressure in feet of head or psig.
 - h. Final total pressure in feet of head or psig.
 - i. Final water flow rate in gpm.
 - j. Voltage at each connection.
 - k. Amperage for each phase.

G. Instrument Calibration Reports:

1. Report Data:
 - a. Instrument type and make.
 - b. Serial number.
 - c. Application.
 - d. Dates of use.
 - e. Dates of calibration.

3.11 VERIFICATION OF TAB REPORT

- A. The TAB specialist's test and balance engineer shall conduct the inspection in the presence of Construction Manager and commissioning authority.
- B. Commissioning authority shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.
- C. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
- D. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.
- E. If TAB work fails, proceed as follows:
 1. TAB specialists shall recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.
 2. If the second final inspection also fails, Owner may contract the services of another TAB specialist to complete TAB work according to the Contract Documents and deduct the cost of the services from the original TAB specialist's final payment.
- F. Prepare test and inspection reports.

END OF SECTION 23 05 93

SECTION 23 07 19 - HVAC PIPING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes insulating the following HVAC piping systems:
 - 1. Chilled water piping - indoors.
 - 2. Heating hot-water piping, indoors.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. See section 01 33 00 for submittal requirements.

1.3 SYSTEM PERFORMANCE

- A. Insulation materials furnished should meet the minimum thickness requirements of 2009 International Energy Conservation Code.
- B. Insulation materials furnished and installed hereunder shall meet the fire hazard requirements of applicable building codes when tested in composite form per one of the following nominally equivalent test methods:
 - 1. American Society for Testing of Materials ASTM E 84
 - 2. Underwriters' Laboratories, Inc. UL 723, CAN/ULC-S102-M88
 - 3. National Fire Protection Association NFPA 255

1.4 QUALITY ASSURANCE

- A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
 - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

1.5 REFERENCES

- A. Thermal insulation materials shall meet the property requirements of one or more of the following specifications as applicable to the specific product or end use:
 - 1. American Society for Testing of Materials Specifications:
 - a. ASTM C 547, "Standard Specification for Mineral Fiber Pipe Insulation"
 - b. ASTM C 585, "Standard Practice for Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe and Tubing (NPS System)"
 - c. ASTM C 1136, "Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation"

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

- A. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- B. Mineral-Fiber, Preformed Pipe Insulation:
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Johns Manville; Micro-Lok.
 - b. Knauf Insulation; 1000-Degree Pipe Insulation.
 - c. Owens Corning; Fiberglas Pipe Insulation.

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- d. Certaineed.
- 2. Material:
 - a. Fiberglass ASJ Pipe Insulation with factory applied all service jacket and adhesive closure system, rated for a maximum service temperature of 850F. Circumferential joints shall be sealed with paper free butt strips. Sufficient thickness of insulation shall be used to maintain the outer surface temperature of the operating system below +150F. Manufacturer's data regarding thickness constraints in relation to operating temperature shall be followed.
 - b. Fittings and valves shall be insulated with pre-formed fiberglass fittings. Thickness shall be equal to adjacent pipe insulation. Finish shall be with pre-formed PVC fitting covers or as otherwise specified on contract drawings.
 - 1) Flanges, couplings, and valve bonnets shall be covered with an oversized pipe insulation section sized to provide the same insulation thickness as on the main pipe section. An oversized insulation section shall be used to form a collar between the two insulation sections with low-density blanket insulation being used to fill gaps. Jacketing shall match that used on straight pipe sections. Rough cut ends shall be coated with suitable weather or vapor resistant mastic as dictated by the system location and service. On hot systems where fittings are to be left exposed, insulation ends should be beveled away from bolts for easy access.
 - a) On cold systems, particular care must be given to vapor sealing the fitting cover or finish to the pipe insulation vapor barrier. All valve stems shall be sealed with caulking to allow free movement of the stem but provide a seal against moisture incursion.

2.2 INSULATING CEMENTS

- A. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Ramco Insulation, Inc.; Ramcote 1200 and Quik-Cote.

2.3 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
- B. Fiberglass Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127.
 - b. Eagle Bridges - Marathon Industries; 225.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70.
 - d. Mon-Eco Industries, Inc.; 22-25.
 - 2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- C. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
 - 1. Products: Subject to compliance with requirements, [provide the following] [provide one of the following] [available products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.

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- b. Eagle Bridges - Marathon Industries; 225.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-50.
 - d. Mon-Eco Industries, Inc.; 22-25.
 - 2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- D. PVC Jacket Adhesive: Compatible with PVC jacket.
- 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Dow Corning Corporation; 739, Dow Silicone.
 - b. Johns Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
 - c. P.I.C. Plastics, Inc.; Welding Adhesive.
 - d. Speedline Corporation; Polyco VP Adhesive.
 - 2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.4 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.

2.5 SEALANTS

- A. ASJ Flashing Sealants and PVC Jacket Flashing Sealants:
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Products, Division of ITW; CP-76.
 - 2. Materials shall be compatible with insulation materials, jackets, and substrates.
 - 3. Fire- and water-resistant, flexible, elastomeric sealant.
 - 4. Service Temperature Range: Minus 40 to plus 250 deg F.
 - 5. Color: White.
 - 6. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.6 FACTORY-APPLIED JACKETS

- A. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.

2.7 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Johns Manville; Zeston.
 - b. P.I.C. Plastics, Inc.; FG Series.
 - c. Proto PVC Corporation; LoSmoke.
 - d. Speedline Corporation; SmokeSafe.
 - e. Approved Equal.
 - 2. Adhesive: As recommended by jacket material manufacturer.

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3. Color: White.
4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
 - a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.
5. Factory-fabricated tank heads and tank side panels.

2.8 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0835.
 - b. Compac Corp.; 104 and 105.
 - c. Ideal Tape Co., Inc., an American Biltrite Company; 428 AWF ASJ.
 - d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.
 2. Width: 3 inches.
 3. Thickness: 11.5 mils.
 4. Adhesion: 90 ounces force/inch in width.
 5. Elongation: 2 percent.
 6. Tensile Strength: 40 lbf/inch in width.
 7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

2.9 SECUREMENTS

- A. Aluminum Bands: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing or closed seal.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Products; Bands.
 - b. PABCO Metals Corporation; Bands.
 - c. RPR Products, Inc.; Bands.
- B. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.
- C. Wire: 0.080-inch nickel-copper alloy.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. C & F Wire.
 - b. Childers Products.
 - c. PABCO Metals Corporation.
 - d. RPR Products, Inc.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
- C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.2 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.

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- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 1. Install insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
 - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
 - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
 - 1. Draw jacket tight and smooth.
 - 2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
 - 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at [2 inches] [4 inches] o.c.
 - a. For below-ambient services, apply vapor-barrier mastic over staples.
 - 4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
 - 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- P. For above-ambient services, do not install insulation to the following:
 - 1. Vibration-control devices.
 - 2. Testing agency labels and stamps.
 - 3. Nameplates and data plates.
 - 4. Manholes.
 - 5. Handholes.
 - 6. Cleanouts.

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3.3 PENETRATIONS

- A. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
 - 1. Seal penetrations with flashing sealant.
 - 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 - 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
 - 4. Seal jacket to wall flashing with flashing sealant.
- B. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- C. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
- D. Insulation Installation at Floor Penetrations:
 - 1. Pipe: Install insulation continuously through floor penetrations.
 - 2. Seal penetrations through fire-rated assemblies.

3.4 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
 - 1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
 - 2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
 - 3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
 - 4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
 - 5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
 - 6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
 - 7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
 - 8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions.

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Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.

9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.
10. All piping shall be supported in such a manner that neither the insulation nor the vapor/weather barrier is compromised by the hanger or the effects of the hanger. In all cases, hanger spacing shall be such that the circumferential joint may be made outside the hanger. On cold systems, vapor barrier shall be continuous, including material covered by the hanger saddle.
11. For hot or cold piping systems larger than 3" in diameter, operating at temperatures less than +200F (93C) and insulated with fiber glass, high density inserts such as fiberglass or foam with sufficient compressive strength shall be used to support the weight of the piping system. At temperatures exceeding +200F, high temperature pipe insulation shall be used for high density inserts.
 - a. Where pipe shoes and roller supports are required, insulation shall be inserted in the pipe shoe to minimize pipe heat loss. Where possible, the pipe shoe shall be sized to be flush with the outer pipe insulation diameter.
 - b. Thermal expansion and contraction of the piping and insulation system can generally be taken care of by utilizing double layers of insulation and staggering both longitudinal and circumferential joints. Where long runs are encountered, expansion joints may be required where single layers of insulation are being used and should be so noted on the contract drawings.
 - c. On vertical runs, insulation support rings shall be used as indicated on contract drawings.

- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

3.5 INSTALLATION OF FIBERGLASS PIPE INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward-clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

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1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.6 FIELD QUALITY CONTROL

- A. Perform tests and inspections.

3.7 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

3.8 PIPING INSULATION SCHEDULE

- A. Heating Hot Water. Insulation shall be the following for pipe sizes 1-1/4-inch and smaller:
 1. Fiber Glass, Preformed Pipe Insulation, Type I: 1-1/2 inch thick with Factory ASJ jackets and field applied PVC elbows.
- B. Heating Hot Water. Insulation shall be the following for pipe sizes larger than 1-1/4-inch:
 1. Fiber Glass, Preformed Pipe Insulation, Type I: 2 inch thick with Factory ASJ jackets and field applied PVC elbows.
- C. Chilled water piping insulation shall be the following:
 1. Fiberglass: 1 1/2 inch and larger - 1" thick.
 2. Fiberglass: 1 1/4 inch and smaller-0.5-inch thick.

END OF SECTION 23 07 19

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SECTION 23 09 00 - DIRECT DIGITAL CONTROL SYSTEM

PART 1 GENERAL

1.1 GENERAL

- A. The control system shall provide direct digital control (DDC) with Windows-based user interface. Only pre-approved manufacturers and contractors will be allowed. All Control System Equipment is to be Alerton Inc., furnished and installed by the local Alerton representative, to match existing who shall be recognized by Alerton as an approved "Associate Dealer," and shall be as follows:
 - 1. Alerton Controls, Cerris Systems. (775) 826-8998
 - 2. No exceptions.

1.2 HARDWARE

- A. Remote Access:
 - 1. The system shall have the capability for Douglas County School District via the Douglas County School District Wide Area Network.
- B. Controllers:
 - 1. Communication speed between global controllers and equipment controllers shall be as required to match existing EMCS system.

1.3 SUBMITTALS AND AS-BUILT DOCUMENTATION

- A. The submittals shall include complete written control sequences for each item of equipment requiring control. The sequences shall include all set points, dead-bands, throttling ranges, etc.
- B. Seven complete sets of submittals shall be provided.

1.4 WARRANTY PERIOD SERVICES

- A. The Contractor shall provide full service for the temperature control system for a period of one year after the date of Substantial Completion. Service shall include, but shall not be limited to, calibration of all sensors and other control devices, adjustments to set-points, and modifications to control sequences or programming as required/desired to fine-tune and/or finalize all control sequences.

1.5 TRAINING

- A. Upon completion of work, the Temperature Control Contractor shall instruct the Owner's designated personnel on the operation of all control system software features, shall provide a complete explanation of the control sequence for each item of equipment, and shall provide instructions on the operation and maintenance of all control devices. Training time shall be a minimum of two total hours.

1.6 EMCS SOFTWARE AND PROGRAMMING REQUIREMENTS

- A. Provide a security/password system with two passwords of up to four characters each. The security/password system shall allow access based on four levels of security as follows:
 - Level 1 Viewing only
 - Level 2 room temperature adjustments
 - Level 3 Adjustment of all set-points
 - Level 4 Full access to all set-points and programming
- B. No set-points related to the equipment control sequences or programming shall be accessible by anyone other than the Temperature Control Contractor during the commissioning.

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- C. The Temperature Control Contractor shall program the eleven Holidays into the EMCS software for the three years following the date of the installation. Verify the holiday schedule with the owner prior to programming. The eleven Holidays each year are as follows:

January 1	New Year's Day
Third Monday in January	Martin Luther King, Jr's Birthday
Third Monday in February	Washington's Birthday
Last Monday in May	Memorial Day
June 19	Juneteenth
July 4	Independence Day
First Monday in September	Labor Day
Last Friday in October	Nevada Day
November 11	Veterans' Day
Fourth Thursday in November	Thanksgiving Day
Friday following Thanksgiving	Family Day
December 25	Christmas Day

- D. When January 1, July 4, November 11, or December 25 falls on a Saturday, the preceding Friday is the observed holiday. If these days fall on Sunday, the following Monday is the observed holiday.
- E. Equipment Schedules - A separate occupied/unoccupied schedule shall be provided for each air handling unit, and each tenant's zone control. A graphic display shall be provided to allow for access to each of the schedules from the display screen.

1.7 GRAPHIC DISPLAYS

- A. All temperature set points and all other setpoints identified as adjustable shall be adjustable from the appropriate graphic displays. Setpoints given in the control sequences are for initial set-up and trial of system operations. Control system shop drawings shall utilize the same (or similar) written sequences with all set points, and differentials identified.
- B. Monitored points and alarms for each system shall be shown on the displays with full color graphics and real-time data as listed below. Where indicated, graphic displays shall be dynamic (animated). Space temperature set points shall be 72 degrees (heating), and 76 degrees (cooling).
- C. Valve and damper positions shall be displayed as per cent open and shall be displayed with zero decimal places.
- D. All set points which are identified as "adjustable" in the written control sequences shall be adjustable via the associated graphic displays (including dead band between heating and cooling room set point).
- E. All occupied mode and unoccupied mode room temperature set points shall have an adjustable dead band (adjustable from the associated graphic display).
- F. All displays specified to be dynamic shall depict motion (as minimum dynamic displays shall include rotating fan wheels and rotating pump impellers).
- G. All set points adjustable from the graphic displays shall be programmed with the dead band on one side of the set point (not split evenly across the set point) unless otherwise specified.

1.8 MANUFACTURERS

- A. Approved Manufacturers subject to compliance with requirements:(See Part 3 - Execution, General, 01.).
1. Alerton to match existing DCSD systems, no exceptions.

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1.9 MATERIALS AND EQUIPMENT

- A. General:
 - 1. Provide a distributed processing system complete with Direct Digital Control (DDC) software. The system shall be a fully integrated package of controls and instrumentation to control all heat pumps, valves, fans, pumps, etc. directly without intervening conventional controls. Control system components shall be manufacturers' standard as indicated through published product information, designed, and constructed as recommended by the manufacturer.
- B. System Architecture:
 - 1. The system shall be a complete stand-alone energy management and control system consisting of a state-of-the-art menu-driven technology, dynamic graphics, and simple user-friendly operation completely programmable and highly modular in construction.
 - 2. The basic elements shall be built up of standard components kept in inventory by the EMCS supplier. Components shall not require customizing other than setting jumpers and switches, adding firmware modules or software programming to perform required functions.
 - 3. The system shall be a true distributed processing system with all software control functions to be performed by the remote field panels. Control software shall be in nonvolatile memory. System shall provide "on-line" programming by both "local" and "remote" computer terminals allowing any and all data to be changed, added, deleted, etc. from either terminal. Remote field computers shall communicate with the central processor and the terminal unit control panels.
- C. Global Controller:
 - 1. The existing site global controller can be used, if applicable. Existing Global Controller to be utilized.

1.10 COMPONENTS

- A. DDC Unit Controllers:
 - 1. Each controller shall be microprocessor based and communicate with its respective GC and also be stand-alone maintaining its own control strategy in the event of communication failure with the GC or remote computer terminals. Each controller shall contain RAM and ROM and be capable of controlling boilers, RTUs, heat pump units, pumps, etc. as specified in control sequence. Inputs shall be either analog or digital. Momentary type switch closure allows an input to be both analog and digital. Outputs shall be analog or digital with LED's provided to indicate status. Each controller is linked serially by a pair of wires and communicates to its respective GC. Controllers default to last programmed temperature or to fixed operator selectable control whenever communication to GC is lost. Default mode shall be field changeable. All operating modes (except default) and set points shall be modified at the computer terminals. Each unit shall allow complete calibration of all temperatures.
 - 2. System shall be capable of accomplishing any controller-to-controller command in a maximum of 1 second.
- B. OA Temperature Sensor:
 - 1. Sensor shall be pre-calibrated thermistor type resistance element complete with terminal housing and sensor shield.
 - 2. Outdoor temperature sensor shall sense dry bulb temperature.
- C. Immersion Temperature Sensors:
 - 1. Sensor shall be similar to OA sensor, except a stainless steel well shall be included providing sensor with fluid contact and capability for sensor removal without draining system.
- D. Relays:

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1. Relays shall be plug-in type complete with sockets for panel mounting. Poles shall be as required and contact rated for intended use.
- E. Control Valves:
1. Factory fabricated of type, body material, and pressure class based on maximum pressure and temperature rating of piping system, unless otherwise indicated, manufactured, brand labeled or distributed by BELIMO.
 2. Heat pump control valves shall be Pressure Independent Characterized Control Valves, Nickel plated forged brass body rated at no less than 400 psi, chrome plated brass ball and blowout proof stem, female NPT end fittings, with a dual EPDM O-Ring packing design, fiberglass reinforced Teflon seats, and a TEFZEL flow characterizing disc. Provide with dynamic pressure regulator assembly with stainless steel brass and Nitrile components, optional PT ports, flow verification orifice, field adjustable flow rates.
 3. Sizing:
 - a. Two-Position: Line size or size using a pressure differential of 1psi.
 - b. Two-Way Modulating: 5 psig or twice the load pressure drop, whichever is more.
 - c. Three-Way Modulating: Twice the load pressure drop, but not more than 5 psig.
 4. Close-Off Pressure Rating: 200 PSI.
 5. The actuator shall be the same manufacturer as the valve, integrally mounted to the valve at the factory with a single screw on a four-way DIN mounting-base.

1.11 INSTALLATION

- A. General:
1. By "Alerton Technologies" by: Building Control Services Inc., no exceptions.
- B. Interlock and Control Wiring:
1. Installation shall be in a neat and workman like manner with all runs parallel to or perpendicular to building lines.
 2. All wiring within mechanical and boiler room shall be installed in EMT raceway.
 3. All wiring within existing walls, ceilings, may be run using "plenum rated cabling", where code permits. Existing wiring may be used if applicable.
 4. In accessible ceiling areas above finished ceiling exposed "plenum rated cabling" shall be permissible, where code permits. Cabling shall be supported above finished ceiling as high as permissible in a neat and workmanship like manner. Cabling shall not lie on top of finished ceiling.
 5. Installation shall be in accordance with manufacturers written instructions and with recognized industry standards.
 6. All wiring shall be in conformance with all local and national code requirements.
 7. Verify all room thermostat locations in the field prior to installation.
- C. Control Panels:
1. Mount controllers, relays, switches, etc., for equipment located in equipment rooms in enclosed control panels with hinged doors. Control devices for equipment located in exposed areas subject to outside weather conditions shall be mounted inside weatherproof enclosures. Location of each panel shall be convenient for adjustment service. Provide labels beneath each panel-mounted control device describing function of device.
 2. Pre-wire electrical devices within the panel to numbered terminal strips with interdevice wiring within panel completed prior to installation. Terminal numbers to match terminals shown on control diagram.
 3. Coordinate with Division 23 and 26, including power distribution and mechanical and electrical equipment, as necessary.
- D. Wiring and junction design:
1. All conduit and junction boxes to be PVC type.

END OF SECTION 23 09 00

SECTION 23 21 13 - HYDRONIC PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes pipe and fitting materials and joining methods for the following:
 - 1. Hot water heating piping.
 - 2. Chilled Water Piping.
 - 3. Makeup water piping.
 - 4. Air Vent piping.
 - 5. Safety valve inlet and outlet piping.

1.2 ACTION SUBMITTALS

- A. See Section 01 33 00 – Submittals for submittal requirements.
- B. Product Data: For each type of the following:
 - 1. Pipe materials.
 - 2. Pipe fittings.
 - 3. Pipe joining materials.

1.3 INFORMATIONAL SUBMITTALS

- A. Field quality control reports.

1.4 QUALITY ASSURANCE

- A. ASME Compliance” Comply with ASME B31.9, “Building Services Piping,” for materials, products, and installation. Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Hydronic piping components and installation shall be capable of withstanding the following minimum working pressures and temperatures:
 - 1. Chilled-Water Piping: 150 psig.
 - 2. Heating hot water piping: 150 psig at 200 deg F.
 - 3. Make-up water piping: 80 psig at 150 deg F.
 - 4. Drain piping: 150 deg F.
 - 5. Air vent piping: 200 deg F.
 - 6. Safety valve inlet and outlet Piping: Equal to the pressure of the piping system to which it is attached.

2.2 COPPER TUBE AND FITTINGS.

- A. Drawn-Temper Copper Tube: ASTM B88, Type L.
- B. Drawn-Temper Copper Tube: ASTM B88, Type M.
- C. Annealed-Temper Copper Tube: ASTM B88, Type K.
- D. Copper Fittings: ASME B16.22.
- E. Copper Unions: ASME B16.22.

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2.3 STEEL PIPE AND FITTINGS

- A. Steel Pipe: ASTM A53/A53M black steel with plain ends; welded and seamless, Grade B, and schedule number as indicated in Part 3, "Piping Applications" Article.
- B. Malleable-Iron Threaded Fittings: ASME B16.3, Classes 150 and 300 as indicated in Part 3, "Piping Applications" Article.
- C. Malleable-Iron Unions: ASME B16.39; Classes 150, 250, and 300 as indicated in "Piping Applications" Article.
- D. Cast iron flanges and flanged fittings: ASME B16.1, Classes 25, 125, and 250; raised ground face, and bolt holes spot faced as indicated in "Piping Applications" Article.
- E. Wrought cast and forged steel flanges and flanged fittings: ASME B16.5, including bolts, nuts, and gaskets of the following material group, end connections and facings:
 - 1. Material Group: 1.1
 - 2. End Connections: Butt welding.
 - 3. Facings: Raised face.

2.4 JOINING MATERIALS

- A. Pipe flange gasket materials: Suitable for chemical and thermal conditions of piping systems contents.
 - 1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch maximum thickness unless otherwise indicated.
 - a. Full face type: For flat-face, Class 125, cast iron and cast bronze flanges.
 - b. Narrow face type: For raised face, Class 250, cast iron and steel flanges.
 - 2. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
 - 3. Solder filler metals: ASTM B32, lead free alloys. Include water flushable flux according to ASTM B813.
 - 4. Brazing filler metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for joining copper with copper; or BAg-1, silver alloy for joining copper with bronze or steel.
 - 5. Welding filler metals: Comply with AWS D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.5 DIELECTRIC FITTINGS

- A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
- B. Dielectric Unions:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Precision Plumbing Products (PPP) Clearflow.
 - b. MIFAB MI-DE.
 - 2. Description:
 - a. Standard: ASTM F1545.
 - b. Pressure Rating: 300 psig minimum at 225 deg F.
 - c. End connections: Threaded.

2.6 VALVES

- A. Check, ball, and butterfly valves: Comply with requirements specified in Division 23 Section "Valves".
- B. Automatic temperature control valves, actuators, and sensors: Comply with requirements specified in Division 23 Section "HVAC Instrumentation and Controls. "See editing instruction No. 1, in evaluations for cautions about named manufacturers and products. For an explanation of options and Contractor's product selection procedures, see Section 01 60 00 – Product requirements.

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PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

- A. Hot-Water Heating, aboveground shall be the following:
 - 1. Sizes up to 1 ½": ASTM B88, Type "L", hard drawn copper with wrought-copper solder joint fittings.
 - 2. Sizes up to 2 to 2 ½": ASTM B88, Type "L", hard drawn copper with wrought-copper brazed joint fittings.
 - 3. Sizes over 3": ASTM A53, Schedule 40, 0.375 wall for sizes over 10", black steel with welded joints. Victaulic (grooved) couplings are not acceptable.
- B. Chilled-Water Heating, aboveground shall be the following:
 - 1. Sizes up to 1 ½": ASTM B88, Type "L", hard drawn copper with wrought-copper solder joint fittings.
 - 2. Sizes up to 2 to 2 ½": ASTM B88, Type "L", hard drawn copper with wrought-copper brazed joint fittings.
 - 3. Sizes over 3": ASTM A53, Schedule 40, 0.375 wall for sizes over 10", black steel with welded joints. Victaulic (grooved) couplings are not acceptable.
- C. Makeup-water piping installed aboveground shall be the following:
 - 1. Type "L," drawn-temper copper tubing, wrought-copper fittings, and soldered joints.
- D. Air-Vent Piping:
 - 1. Inlet: Same as service were installed with metal-to-plastic transition fittings for plastic piping systems, according to piping manufacturer's written instructions.
 - 2. Outlet: Type K, annealed-temper copper tubing with soldered or flared joints.
- E. Safety-valved inlet and outlet piping for hot water piping: Same materials and joining methods as for piping specified for the service in which safety valve is installed with metal-to-plastic transition fittings for plastic piping systems, according to piping manufacturer's written instructions.

3.2 INSTALLATION OF PIPING

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Install piping as indicated unless deviations to layout are approved on coordination drawings.
- B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- E. Install piping to permit valve servicing.
- F. Install piping at indicated slopes.
- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.
- I. Install piping to allow application of insulation.
- J. Select system components with pressure rating equal to or greater than system operating pressure.
- K. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.
- L. Install drains, consisting of a tee fitting, NPS 3/4 ball valve, and short NPS 3/4 threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.
- M. Install piping at a uniform grade of 0.2 percent upward in direction of flow.

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- N. Reduce pipe sizes using eccentric reducer fitting installed with level side up.
- O. Install branch connections to mains using tee fittings in main pipe, with the branch connected to the bottom of the main pipe. For up-feed risers, connect the branch to the top of the main pipe.
- P. Install valves according to Section 23 05 23.12 "Ball Valves for HVAC Piping", Section 23 05 23.13 "Butterfly Valves for HVAC Piping", and Section 23 05 23.14 "Check Valves for HVAC Piping."
- Q. Install unions in piping, and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated.
- R. Install flanges in piping, NPS 2 ½ and larger, at final connections of equipment and elsewhere as indicated.
- S. Install shutoff valve immediately upstream of each dielectric fitting.
- T. Comply with requirements in Section 23 05 16 "Expansion Fittings and Loops for HVAC Piping" for installation of expansion loops, expansion joints, anchors, and pipe alignment guides.
- U. Comply with requirements in Section 23 05 53 "Identification for HVAC Piping and Equipment" for identifying piping.
- V. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 23 05 17 "Sleeves and Sleeve Seals for HVAC Piping."
- W. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 23 05 17 "Sleeves and Sleeve Seals for HVAC Piping."
- X. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 23 05 18 "Escutcheons for HVAC Piping."

3.3 INSTALLATION OF DIELECTRIC FITTINGS

- A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
- B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric nipples.
- C. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flanges.
- D. Dielectric Fittings for NPS 5 and Larger: Use dielectric flange kits.

3.4 INSTALLATION OF HANGERS AND SUPPORTS

- A. Comply with requirements for seismic-restraint devices specified in Section 23 05 29 "Vibration and Seismic Controls for HVAC."
- B. Comply with requirements in Section 23 05 29 "Hangers and Supports for HVAC Piping and Equipment" for hangers, supports, and anchor devices.
 - 1. Comply with the following requirements for maximum spacing of supports.
- C. Install the following piping attachments:
 - 1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet long.
 - 2. Adjustable roller hangers and spring hangers for individual horizontal piping 20 feet or longer.
 - 3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping less than 20 feet or longer, supported on a trapeze.
 - 4. Spring hangers to support vertical runs.
 - 5. Provide copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.
 - 6. On plastic pipe, install pads or cushions on bearing surfaces to prevent hanger from scratching pipe.
- D. Install hangers for steel piping, with the following maximum spacing and minimum rod sizes:
 - 1. NPS ¾: Maximum span, 7 feet.
 - 2. NPS 1: Maximum span, 7 feet.

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3. NPS 1 ½: Maximum span, 9 feet.
 4. NPS 2: Maximum span, 10 feet.
 5. NPS 2 ½: Maximum span, 11 feet.
 6. NPS 3 and larger: Maximum span, 12 feet.
- E. Install hangers for drawn-temper copper piping, with the following maximum spacing and minimum rod sizes:
1. NPS ¾: Maximum span, 5 feet; minimum rod size, ¼ inch.
 2. NPS 1: Maximum span, 6 feet; minimum rod size, ¼ inch.
 3. NPS 1¼: Maximum span, 7 feet; minimum rod size, 3/8 inch.
 4. NPS 1 1/2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
 5. NPS 2 1/2: Maximum span, 9 feet; minimum rod size, 3/8 inch.
 6. NPS 3 and larger: Maximum span, 10 feet; minimum rod size, 3/8 inch.
- F. Plastic piping hanger spacing: Space hangers according to pipe manufacturer's written instructions for service conditions. Avoid point loading. Space and install hangers with the fewest practical rigid anchor points.
- G. Support vertical runs at roof, at each floor, and at 10-foot intervals between floors.

3.5 PIPE JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain end of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- C. Solder joints: Apply ASTM B813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B828 or CDA's "Copper Tube Handbook", using lead free solder alloy complying with ASTM B32.
- D. Brazed joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8/A5.8M.
- E. Threaded joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 2. Damaged threads: DO NOT use pipe or pipe fittings with threads that are corroded or damaged. DO NOT use pipe sections that have cracked or open welds.

3.6 CHEMICAL TREATMENT

- A. Refer to chemical water treatment specification.

3.7 FIELD QUALITY CONTROL

- A. Prepare hydronic piping in accordance with ASME B31.9 and as follows:
1. Leave joints, including welds, uninsulated and exposed for examination during test.
 2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
 3. Flush hydronic piping systems with clean water; then remove and clean or replace strainer screens.
 4. Isolate equipment from piping. If a valve is used to isolate equipment, its closure is to be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.
 5. Install safety valve, set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.
- B. Perform the following tests on hydronic piping:

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1. Use ambient-temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
 2. While filling system, use vents installed at high points of system to release air. Use drains installed at low points for complete draining of test liquid.
 3. Isolate expansion tanks and determine that hydronic system is full of water.
 4. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the system's working pressure. Test pressure is not to exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed 90 percent of specified minimum yield strength or 1.7 times the "SE" value in Appendix A in ASME B31.9. "Building Services Piping."
 5. After hydrostatic test pressure has been applied for at least 10 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.
 6. Prepare written report of testing.
- 3.8 Perform the following before operating the system:
1. Open manual valves fully.
 2. Inspect pumps for proper rotation.
 3. Set makeup pressure-reducing valves for required system pressure.
 4. Inspect air vents at high points of system and determine if all are installed and operating freely (automatic type), or bleed air completely (manual type).
 5. Set temperature controls so all coils are calling for full flow.
 6. Inspect and set operating temperatures of hydronic equipment, such as boilers, chillers, cooling towers, to specified values.
 7. Verify lubrication of motors and bearings

END OF SECTION 23 21 13

SECTION 23 21 16 - HYDRONIC PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes special-duty valves and specialties for the following:
 - 1. Air-vent piping.
 - 2. Safety-valve-inlet and -outlet piping.
 - 3. Manual air vents.
 - 4. Expansion tanks.
 - 5. Strainers.
 - 6. Air/Dirt Separators.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of the following:
 - 1. Valves: Include flow and pressure drop curves based on manufacturer's testing for calibrated-orifice balancing valves and automatic flow-control valves.
 - 2. Air-control devices.
 - 3. Hydronic specialties.

1.3 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.4 QUALITY ASSURANCE

- A. ASME Compliance: Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Hydronic piping components and installation shall be capable of withstanding the following minimum working pressure and temperature unless otherwise indicated:
 - 1. Hot-Water Heating Piping: 150 psig at 200 deg F
 - 2. Makeup-Water Piping: 80 psig at 150 deg F
 - 3. Condensate-Drain Piping: 150 deg F
 - 4. Air-Vent Piping: 200 deg F
 - 5. Safety-Valve-Inlet and -Outlet Piping: Equal to the pressure of the piping system to which it is attached.

2.2 VALVES

- A. Check, Ball, and Butterfly Valves: Comply with requirements specified in Section 23 05 23.12 "Ball Valves for HVAC Piping," Section 23 05 23.13 "Butterfly Valves for HVAC Piping," and Section 23 05 23.14 "Check Valves for HVAC Piping".
- B. Automatic Temperature-Control Valves, Actuators, and Sensors: Comply with requirements specified in Section 23 09 23 Direct Digital Control System and Section 23 09 23.11 Control Valves.

2.3 AIR-CONTROL DEVICES

- A. Manual Air Vents:

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1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AMTROL, Inc.
 - b. Bell & Gossett; a Xylem brand.
 - c. Taco, Inc.
2. Body: Bronze.
3. Internal Parts: Nonferrous.
4. Operator: Screwdriver or thumbscrew.
5. Inlet Connection: NPS 1/2 (DN 15).
6. Discharge Connection: NPS 1/8 (DN 6).
7. CWP Rating: 150 psig.
8. Maximum Operating Temperature: 225 deg F.

B. Expansion Tanks:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AMTROL, Inc.
 - b. Bell & Gossett; a Xylem brand.
 - c. Elbi
 - d. Taco, Inc.
 - e. Wessels.
2. Tank: Welded steel, rated for 125-psig working pressure and 375 deg F maximum operating temperature, with taps in bottom of tank for tank fitting and taps in end of tank for gage glass. Tanks shall be factory tested after taps are fabricated and shall be labeled according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
3. Air-Control Tank Fitting: Cast-iron body, copper-plated tube, brass vent tube plug, and stainless-steel ball check, 100-gal. unit only; sized for compression-tank diameter. Provide tank fittings for 125-psig working pressure and 250 deg F maximum operating temperature.
4. Tank Drain Fitting: Brass body, nonferrous internal parts; 125-psig working pressure and 240 deg F maximum operating temperature; constructed to admit air to compression tank, drain water, and close off system.
5. Gage Glass: Full height with dual manual shutoff valves, 3/4-inch-diameter gage glass, and slotted-metal glass guard.

2.4 HYDRONIC PIPING SPECIALTIES

A. Bronze Y-Pattern Strainers:

1. Manufacturers:
 - a. Watts
 - b. Zurn Wilkins.
2. Body: bronze with bolted cover and bottom drain connection.
3. End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.
4. CWP Rating: 125 psig.
5. Strainer shall be Zurn, Wilkins Model FS wye strainer with 0.62" (1/16") openings, size for no more than 0.5 psi pressure drop.

B. Air/Dirt Separator:

1. Manufacturers:
 - a. Caleffi.
 - b. Bell and Gossett.
 - c. Taco.
 - d. Wessels.
 - e. Or Approved Equal.
2. Description: air and dirt separation for closed hydronic systems. The following features shall be provided:
 - a. Stainless steel or copper coalescing filter medium to separate the air and dirt from the water.

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- b. Gauge tapings on the inlet and outlet connections.
- c. Drain outlet for flushing collected sediment.
- d. Body: Painted steel.
- e. End Connections: Flanged.
- f. CWP Rating: 150 psig.
- g. Maximum Operating Temperature: 250 deg F.

PART 3 - EXECUTION

3.1 VALVE APPLICATIONS

- A. Install shut off-duty valves at each branch connection to supply mains and at supply connection to each piece of equipment.
- B. Install check valves at each pump discharge and elsewhere as required to control flow direction.
- C. Install safety valves at hot-water generators and elsewhere as required by ASME Boiler and Pressure Vessel Code. Install drip-pan elbow on safety-valve outlet and pipe without valves to the outdoors; pipe drain to nearest floor drain or as indicated on Drawings. Comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1, for installation requirements.
- D. Install pressure-reducing valves at makeup-water connection to regulate system fill pressure.

3.2 FLEXIBLE CONNECTOR APPLICATION SCHEDULE

- A. Install flexible connectors at the following locations:
 - 1. Pump suction and discharge.

3.3 HYDRONIC SPECIALTIES INSTALLATION

- A. Install manual air vents at high points in piping, at heat-transfer coils, and elsewhere as required for system air venting.
- B. Install drain valve on Air/Dirt separators.
- C. Install expansion tanks above the air separator. Install tank fitting in tank bottom and charge tank. Use manual vent for initial fill to establish proper water level in tank.
 - 1. Install tank fittings that are shipped loose.
 - 2. Support tank from floor or structure above with sufficient strength to carry weight of tank, piping connections, fittings, plus tank full of water. Do not overload building components and structural members.
- D. Install expansion tanks on the floor. Vent and purge air from hydronic system, and ensure that tank is properly charged with air to suit system Project requirements.

END OF SECTION 23 21 16

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SECTION 23 21 23 - HYDRONIC PUMPS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Close-coupled, in-line centrifugal pumps.
 - 2. Separately coupled, base-mounted, end-suction centrifugal pumps.
 - 3. Separately coupled, horizontally mounted, in-line centrifugal pumps.

1.2 DEFINITIONS

- A. ECM: Electronically commutated motor.
- B. EPDM: Ethylene propylene diene monomer.
- C. FKM: Fluoroelastomer polymer.
- D. HI: Hydraulic Institute.
- E. NBR: Nitrile rubber or Buna-N.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of pump.
- B. Shop Drawings: For each pump.
 - 1. Show pump layout and connections.
 - 2. Include setting drawings with templates for installing foundation and anchor bolts and other anchorages.
 - 3. Include diagrams for power, signal, and control wiring.
- C. See division 01 for submittal requirements.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.
- B. Pump Startup report, filled out startup checklist, and laser alignment report.

PART 2 - PRODUCTS

2.1 CLOSE-COUPLED, IN-LINE CENTRIFUGAL PUMPS

- A. Manufacturers: Subject to compliance with the specified product on the drawings, provide products by one of the following:
 - 1. Grundfos.
 - 2. TACO Incorporated.
 - 3. Goulds.
- B. If product is substituted from the basis of design on the drawings and needs redesign by the design team, contractor shall compensate design team for redesign.
- C. Description: Factory-assembled and -tested, centrifugal, overhung-impeller, close-coupled, in-line pump as defined in HI 1.1-1.2 and HI 1.3; designed for installation with pump and motor shafts mounted horizontally or vertically.
- D. Pump Construction:
 - 1. Casing: Radially split, cast iron, with threaded gage tappings at inlet and outlet, replaceable bronze wear rings, and threaded companion-flange connections.

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2. Impeller: ASTM B 584, cast bronze; statically and dynamically balanced, keyed to shaft, and secured with a locking cap screw. For constant-speed pumps, trim impeller to match specified performance.
 3. Pump Shaft: Stainless steel.
 4. Seal: Mechanical seal consisting of carbon rotating ring against a ceramic seat held by a stainless-steel spring, and Buna-N bellows and gasket. Include water slinger on shaft between motor and seal.
 5. Seal: Packing seal consisting of stuffing box with a minimum of four rings of graphite-impregnated braided yarn with bronze lantern ring between center two graphite rings, and bronze packing gland.
 6. Pump Bearings: Permanently lubricated ball bearings.
- E. Motor: Single speed and rigidly mounted to pump casing.
1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 2. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 23 05 13 "Common Motor Requirements for HVAC Equipment."
- F. Provide and install shaft grounding ring.

2.2 SEPARATELY COUPLED, BASE MOUNTED, END SUCTION CENTRIFUGAL PUMPS

- A. Manufacturers: Subject to compliance with the specified product on the drawings, provide products by one of the following:
1. Grundfos.
 2. TACO Incorporated.
 3. Goulds.
- B. If product is substituted from the basis of design on the drawings and needs redesign by the design team, contractor shall compensate design team for redesign.
- C. Description: Factory-assembled and -tested, centrifugal, overhung-impeller, separately coupled, base mounted pump as defined in HI 1.1-1.2 and HI 1.3; designed for installation with pump and motor shafts mounted horizontally.
- D. Pump Construction:
1. Casing: Radially split, cast iron, with threaded gage tappings at inlet and outlet, and threaded companion-flange connections.
 2. Impeller: ASTM B 584, cast bronze; statically and dynamically balanced, and keyed to shaft. For pumps not frequency-drive controlled, trim impeller to match specified performance.
 3. Pump Shaft: Stainless steel.
 4. Mechanical Seal: Carbon rotating ring against a ceramic seat held by a stainless-steel spring, and Buna-N bellows and gasket. Include water slinger on shaft between motor and seal.
 5. Pump Bearings: Oil lubricated; bronze-journal or thrust type.
- E. Shaft Coupling: Molded-rubber insert with interlocking spider capable of absorbing vibration.
- F. Motor: Single speed and resiliently mounted to pump casing.
1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 2. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 23 05 13 "Common Motor Requirements for HVAC Equipment."
- G. Motor shall be NEMA Premium Efficient inverter duty motor.
- H. Provide and install shaft grounding ring.

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2.3 SEPARATELY COUPLED, HORIZONTALLY MOUNTED, IN-LINE CENTRIFUGAL PUMPS

- A. Manufacturers: Subject to compliance with the specified product on the drawings, provide products by one of the following:
 - 1. Grundfos.
 - 2. TACO Incorporated.
 - 3. Bell and Gossett.
- B. Description: Factory-assembled and -tested, centrifugal, overhung-impeller, separately coupled, in-line pump as defined in HI 1.1-1.2 and HI 1.3; designed for installation with pump and motor shafts mounted horizontally.
- C. Pump Construction:
 - 1. Casing: Radially split, cast iron, with threaded gauge tappings at inlet and outlet, and threaded union-end connections.
 - 2. Impeller: ASTM B584, cast bronze; statically and dynamically balanced, and keyed to shaft. For pumps that are not frequency-drive controlled, trim impeller to match specified performance.
 - 3. Pump Shaft: Type 316 stainless steel.
 - 4. Seal: Mechanical seal consisting of carbon rotating ring against a ceramic seat held by a stainless steel spring, and NBR bellows and gasket.
 - 5. Pump Bearings: Permanently lubricated ball bearings.
- D. Shaft Coupling: Molded-rubber insert with interlocking spider capable of absorbing vibration.
- E. Capacities and Characteristics:
 - a. See drawings for capacities and characteristics.
- F. Motor shall be NEMA Premium Efficient inverter duty motor.
- G. Provide and install shaft grounding ring.

2.4 PUMP SPECIALTY FITTINGS

- A. Suction Diffuser:
 - 1. Angle pattern.
 - 2. 175-psig pressure rating, ductile-iron body and end cap, pump-inlet fitting.
 - 3. Bronze startup and bronze or stainless-steel permanent strainers.
 - 4. Bronze or stainless-steel straightening vanes.
 - 5. Drain plug.
 - 6. Factory-fabricated support.
- B. Triple-Duty Valve:
 - 1. Angle or straight pattern.
 - 2. 175-psig pressure rating, ductile-iron body, pump-discharge fitting.
 - 3. Drain plug and bronze-fitted shutoff, balancing, and check valve features.
 - 4. Brass gage ports with integral check valve and orifice for flow measurement.

2.5 ELECTRONICALLY COMMUTATED MOTOR (ECM)

- A. Motors shall be:
 - 1. Synchronous, constant torque, ECM with permanent magnet rotor. Rotor magnets to be time-stable, nontoxic ceramic magnets (Sr-Fe).
 - 2. Driven by a frequency converter with an integrated power factor correction filter. Conventional induction motors will not be acceptable.
 - 3. Each motor with an integrated variable-frequency drive, tested as one unit by manufacturer.
 - 4. Motor speed adjustable over full range from 0 rpm to maximum scheduled speed.

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5. Variable motor speed to be controlled by a 0- to 10 V-dc or 4- to 20-mA input.
6. Integrated motor protection verified by UL to protect the pump against over-/undervoltage, overtemperature of motor and/or electronics, overcurrent, locked rotor, and dry run (no-load condition).

PART 3 - EXECUTION

3.1 PUMP INSTALLATION

- A. Comply with HI 1.4.
- B. Install pumps to provide access for periodic maintenance including removing motors, impellers, couplings, and accessories.
- C. Independently support pumps and piping so weight of piping is not supported by pumps and weight of pumps is not supported by piping.
- D. Automatic Condensate Pump Units: Install units for collecting condensate and extend to open drain.
- E. Equipment Mounting:
 1. Install base-mounted pumps on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases and foundations specified in Section 03 30 00 "Cast-in-Place Concrete."
 2. Comply with requirements for vibration isolation and seismic control devices specified in Section 23 05 48 "Vibration and Seismic Controls for HVAC."
- F. Equipment Mounting: Install in-line pumps with continuous-thread hanger rods and elastomeric hangers of size required to support weight of in-line pumps.
 1. Comply with requirements for seismic-restraint devices specified in Section 23 05 48 "Vibration and Seismic Controls for HVAC."
 2. Comply with requirements for hangers and supports specified in Section 23 05 29 "Hangers and Supports for HVAC Piping and Equipment."

3.2 ALIGNMENT

- A. Engage a factory-authorized service representative to perform laser alignment services.
- B. Comply with requirements in Hydronics Institute standards for alignment of pump and motor shaft. Add shims to the motor feet and bolt motor to base frame. Do not use grout between motor feet and base frame.
- C. Comply with pump and coupling manufacturers' written instructions.
- D. After alignment is correct, tighten foundation bolts evenly but not too firmly. Completely fill baseplate with nonshrink, nonmetallic grout while metal blocks and shims or wedges are in place. After grout has cured, fully tighten foundation bolts.

3.3 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Where installing piping adjacent to pump, allow space for service and maintenance.
- C. Connect piping to pumps. Install valves that are same size as piping connected to pumps.
- D. Install suction and discharge pipe sizes equal to or greater than diameter of pump nozzles.
- E. Install triple-duty valve on discharge side of pumps.
- F. Install suction diffuser and shutoff valve on suction side of pumps.
- G. Install flexible connectors on suction and discharge sides of base-mounted pumps between pump casing and valves.

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- H. Install pressure gages on pump suction and discharge or at integral pressure-gage tapping, or install single gage with multiple-input selector valve.
- I. Install check valve and gate or ball valve on each condensate pump unit discharge.
- J. Ground equipment according to Section 26 05 26 "Grounding and Bonding for Electrical Systems."
- K. Connect wiring according to Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

END OF SECTION 23 21 23

SECTION 23 25 00 - HVAC WATER TREATMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following HVAC water-treatment systems:
 - 1. Bypass chemical-feed equipment
 - 2. Chemical treatment test equipment.
 - 3. HVAC water-treatment chemicals.

1.2 PERFORMANCE REQUIREMENTS

- A. Water quality for HVAC systems shall minimize corrosion, scale buildup, and biological growth for optimum efficiency of HVAC equipment without creating a hazard to operating personnel or the environment.
- B. Base HVAC water treatment on quality of water available at Project site, HVAC system equipment material characteristics and functional performance characteristics, operating personnel capabilities, and requirements and guidelines of authorities having jurisdiction.
- C. Closed hydronic systems, including hot-water heating, shall have the following water qualities:
 - 1. pH: Maintain a value within 9.0 to 10.5.
 - 2. "P" Alkalinity: Maintain a value within 100 to 500 ppm.
 - 3. Boron: Maintain a value within 100 to 200 ppm.
 - 4. Chemical Oxygen Demand: Maintain a maximum value of 100 ppm.
 - 5. Soluble Copper: Maintain a maximum value of 0.20 ppm.
 - 6. TDS: Maintain a maximum value of 10 ppm.
 - 7. Ammonia: Maintain a maximum value of 20 ppm.
 - 8. Free Caustic Alkalinity: Maintain a maximum value of 20 ppm.
 - 9. Microbiological Limits:
 - a. Total Aerobic Plate Count: Maintain a maximum value of 1000 organisms/ml.
 - b. Total Anaerobic Plate Count: Maintain a maximum value of 100 organisms/ml.
 - c. Nitrate Reducers: Maintain a maximum value of 100 organisms/ml.
 - d. Sulfate Reducers: Maintain a maximum value of 0 organisms/ml.
 - e. Iron Bacteria: Maintain a maximum value of 0 organisms/ml.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Pretreatment and chemical treatment equipment showing tanks, maintenance space required, and piping connections to HVAC systems. Include plans, elevations, sections, details, and attachments to other work.
- C. Field quality-control test reports.

1.4 QUALITY ASSURANCE

- A. HVAC Water-Treatment Service Provider Qualifications: An experienced HVAC water-treatment service provider capable of analyzing water qualities, installing water-treatment equipment, and applying water treatment as specified in this Section.

1.5 OPERATING AND MAINTENANCE (O&M) MANUALS & INSTRUCTIONS

- A. On-site start-up, service, and instruction shall be provided for each chemical treatment system by the water treatment specialist. Start-up of chemical treatment system and on-going chemical treatment of each system shall commence within 24 hours of the time that the system is started.

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- B. O&M manuals with initial dosage rates, on-going dosage recommendations, and O&M instructions shall be typed and submitted to the Owner.
- C. The Contractor shall provide a minimum of seven days written advance notice of the proposed day and time for O&M instructions to the Owner and/or his representatives.
- D. Furnish and install an appropriately sized wall-mounted shelf at or near the condenser water system controller to allow for storage of the operating and maintenance manual, test kit, and monthly treatment reports. Provide fixed bookends on the shelf to prevent the manual(s) and test kit from sliding off of the shelf ends.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. San Joaquin Chemicals Telephone No. (800) 647-9577
 - 2. Chemtex Corporation Telephone No. (775) 846-8045
 - 3. Garratt Callahan Telephone No. (972) 661-5006

2.2 MANUAL CHEMICAL-FEED EQUIPMENT

- A. Bypass Feeders: Steel, with corrosion-resistant exterior coating, minimum 3-1/2-inch fill opening in the top, and NPS 3/4 bottom inlet and top side outlet. Quarter turn or threaded fill cap with gasket seal and diaphragm to lock the top on the feeder when exposed to system pressure in the vessel.
 - 1. Capacity: 5 gal.
 - 2. Minimum Working Pressure: 125 psig.

2.3 CHEMICAL TREATMENT TEST EQUIPMENT

- A. Test Kit: Manufacturer-recommended equipment and chemicals in a wall-mounting cabinet for testing pH, TDS, inhibitor, chloride, alkalinity, and hardness; sulfite and testable polymer tests for high-pressure boilers, and oxidizing biocide test for open cooling systems.
- B. Corrosion Test-Coupon Assembly: Constructed of corrosive-resistant material, complete with piping, valves, and mild steel and copper coupons. Locate copper coupon downstream from mild steel coupon in the test-coupon assembly.
 - 1. Two-station rack for closed-loop systems.

2.4 CHEMICALS

- A. Add a non-chromate corrosion inhibitor (Sanacor 2301, or approved equal) to the recommended level of concentration (600 to 900 ppm sodium nitrite). Furnish the Owner with an inhibitor test kit, Taylor nitrite test set No. 1510, or approved equal.
- B. Chemicals shall be as recommended by water-treatment system manufacturer that are compatible with piping system components and connected equipment, and that can attain water quality specified in Part 1 "Performance Requirements" Article.
- C. Cleaning Chemical
 - 1. Provide a general dispersant for iron, mud, silt, and microbiological matter at a concentration recommended by the chemical manufacturer that is suitable for the materials in the existing chilled water system.

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PART 3 - EXECUTION

3.1 WATER ANALYSIS

- A. Perform an analysis of supply water to determine quality of water available at Project site. Analysis to be submitted to Engineer for approval prior to inclusion into Operation and Maintenance Manuals.

3.2 INSTALLATION

- A. Install chemical application equipment on concrete bases, level and plumb. Maintain manufacturer's recommended clearances. Arrange units so controls and devices that require servicing are accessible. Anchor chemical tanks and floor-mounting accessories to substrate.
- B. Install water testing equipment on wall near water chemical application equipment.
- C. Bypass Feeders: Install in closed hydronic systems, including hot-water heating, and equipped with the following:
 - 1. Install bypass feeder in a bypass circuit around circulating pumps, unless otherwise indicated on Drawings.
 - 2. Install a gate or full-port ball isolation valves on inlet, outlet, and drain below feeder inlet.
 - 3. Install a swing check on inlet after the isolation valve.
 - 4. Install test equipment and provide test-kit to Owner. Install test-coupon assembly in bypass circuit around circulating pumps, unless otherwise indicated on Drawings.

3.3 CONNECTIONS

- A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment to allow service and maintenance.
- C. Make piping connections between HVAC water-treatment equipment and dissimilar-metal piping with dielectric fittings. Dielectric fittings are specified in Division 23 Section "Common Work Results for HVAC."
- D. Install shutoff valves on HVAC water-treatment equipment inlet and outlet. Metal general-duty valves are specified in Division 23 Section "General-Duty Valves for HVAC Piping."

3.4 FIELD QUALITY CONTROL

- A. During the first-year warranty period (and during the period of time that the equipment is operational prior to commencement of the warranty period) the water treatment specialist shall provide complete chemical treatment service. The service shall include all required chemicals and a minimum of monthly on-site visits to test and adjust water treatment (twice monthly during start-up period prior to commissioning). The warranty period commences on the date that the Notice of Substantial Completion is executed.
- B. The water treatment specialist shall provide written reports of the activities performed and test results/water analyses for each visit. One copy of each report shall be left in an appropriate plastic folder at the chemical treatment equipment area on site.
- C. During the last month of the one-year warranty period the Contractor shall perform a thorough cleaning of the cooling tower (sump, interior surfaces, media, etc.).
- D. At the end of the warranty period the treated equipment and piping systems shall be in as-new condition or the Contractor shall provide the required cleaning, service, repair, and/or replacement of any components that are not in as-new condition. The Contractor shall meet with the Owner's representative(s) during the last month of the warranty period so that the Owner's representative(s) can verify the condition of the equipment, piping systems, the strainers along with the Contractor.

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- E. In addition to the specified warranty period service the chemical treatment specialist shall also provide a second year of chemical treatment service. The service shall include all required chemicals and a minimum of monthly on-site visits to test and adjust water treatment.
- F. System Flushing:
 - 1. Install a 20-mesh screen on all strainers during system flushing.
 - 2. Replace strainer screens with specified after system flushing has been completed.

3.5 PAU WA LU CHILLED WATER SYSTEM FLUSHING

- A. Circulate cleaning solution for a minimum of 48 hours or as recommended by chemical manufacturer's instructions.
- B. Clean all system strainers and dead end piping legs.
- C. Provide test results as part of the Operation and Maintenance Manual.
- D. Provide temporary piping, valving, and pumping system isolated from the existing building system as needed to perform cleaning procedures prior to final connection to the existing building system.

END OF SECTION 23 25 00

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SECTION 23 51 00 - BREECHINGS, CHIMNEYS, AND STACKS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Polypropylene flue and combustion air piping (PP).
 - 2. Listed double-wall vents.
 - 3. Combustion air ducting.

1.2 SUBMITTALS

- A. Product Data: For the following:
 - 1. Special gas vents.
- B. Shop Drawings: For vents, breechings, chimneys, and stacks. Include plans, elevations, sections, details, and attachments to other work.

PART 2 - PRODUCTS

2.1 POLYPROPYLENE VENT PIPING

- A. Manufactures:
 - 1. DuraVent
 - 2. Centrotherm
 - 3. Or approved equal

2.2 Polypropylene pipe for use with ANSI Category II and IV gas burning appliances.

- 1. Fittings: Polypropylene compatible with supplied piping.
- 2. Joints: Gaskets with locking band.

2.3 LISTED SPECIAL GAS VENTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Heat-Fab, Inc.
 - 2. Metal-Fab, Inc.
 - 3. Jeremiah's
 - 4. Or approved equal.
- B. Description: Double-wall metal vents tested according to UL 1738 and rated for 480 deg F continuously, with positive or negative flue pressure complying with NFPA 211. The vent shall be of the double-wall, factory-built type for use on condensing appliances or pressurized venting systems serving Category II, III or IV appliances or as specified by the equipment manufacturer.
- C. Maximum temperature shall not exceed 550°F.
- D. Vent shall be listed for an internal static pressure of 6" w.g. and tested to 15" w.g.
- E. Vent shall be constructed with an inner and outer wall, with a 1" annular insulating air space.
- F. The inner wall (vent) shall be constructed of AL29-4C, Type 444, or 316L superferritic stainless steel, .015 thickness for 3"-12" diameters and .024 thickness for 14"-24" diameters. The outer wall (casing) shall be constructed of 304 stainless steel, .018 thickness for 3"-12" diameters and .024 thickness for 14"-24" diameters. Inner and outer walls shall be connected by means of spacer clips that maintain the concentricity of the annular space and allow unobstructed differential thermal expansion of the inner and outer walls.

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- G. All supports, roof or wall penetrations, terminations, appliance connectors and drain fittings, required to install the vent system shall be included.
- H. Roof penetration pieces shall be UL listed and provided by the vent manufacturer. Roof curbs shall be required on roofs greater than 12:12 pitch.
- I. All inner vent connections shall be secured by means of profiled connector bands with gear clamp tighteners. Joints shall be sealed with P077 Sealant. Where exposed to weather, the outer closure band shall be sealed to prevent rainwater from entering the space between inner and outer walls.
- J. Vent shall terminate in accordance with installation instructions and local codes.
- K. Construction: Inner shell and outer jacket separated by at least a 1-inch airspace.
- L. Inner Shell: UL 1738 compliant stainless steel.
- M. Outer Jacket: 304 Stainless Steel.
- N. Accessories: Tees, elbows, increasers, draft-hood connectors, terminations, adjustable roof flashings, storm collars, support assemblies, thimbles, firestop spacers, and fasteners; fabricated from similar materials and designs as vent-pipe straight sections; all listed for same assembly.
 - 1. Termination: Stack cap designed to exclude minimum 90 percent of rainfall.

2.4 COMBUSTION AIR DUCTING

- A. Combustion air ducting to be 24-gauge galvanized steel in accordance with current SMACNA duct construction standards.
- B. Exterior to be painted to match existing building.
- C. Termination: boiler manufacturer combustion air inlet with bird screen.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Listed Special Gas Vents: Condensing gas appliances.

3.2 POLYPROPYLENE SCHEDULE

- A. Water Heater flue and combustion air piping and fittings shall be the following:
 - 1. Polypropylene (PP).

3.3 INSTALLATION OF LISTED VENTS AND CHIMNEYS

- A. Locate to comply with minimum clearances from combustibles and minimum termination heights according to product listing or NFPA 211, whichever is most stringent.
- B. Seal between sections of positive-pressure vents and grease exhaust ducts according to manufacturer's written installation instructions, using sealants recommended by manufacturer.
- C. Support vents at intervals recommended by manufacturer to support weight of vents and all accessories, without exceeding appliance loading.
- D. Slope breechings down in direction of appliance, with condensate drain connection at lowest point piped to nearest drain.
- E. Lap joints in direction of flow.
- F. After completing system installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finishes.

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- G. Clean breechings internally, during and after installation, to remove dust and debris. Clean external surfaces to remove welding slag and mill film. Grind welds smooth and apply touchup finish to match factory or shop finish.
- H. Provide temporary closures at ends of breechings, chimneys, and stacks that are not completed or connected to equipment.
- I. Contractor to seismically brace all flues.

3.4 APPLICATION SCHEDULE

- A. Boiler Flues: UL 1738 compliant double wall stainless steel.
- B. Combustion Air Ducting: 24-gauge galvanized steel.

END OF SECTION 23 51 00

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SECTION 23 52 16 - CONDENSING BOILERS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes:
 - 1. packaged, factory-fabricated and -assembled, gas-fired, fire-tube condensing boilers, trim, and accessories for generating heating hot water.

1.2 SUBMITTALS

- A. Product Data: Include performance data, operating characteristics, furnished specialties, and accessories.
- B. Shop Drawings: For boilers, boiler trim, and accessories. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Wiring Diagrams: Power, signal, and control wiring.
- C. Operation and maintenance data.
- D. Warranty: Special warranty specified in this Section.
- E. See section 01 33 00 for submittal requirements.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. ASME Compliance: Fabricate and label boilers to comply with ASME Boiler and Pressure Vessel Code.
- C. ASHRAE/IESNA 90.1 Compliance: Boilers shall have minimum efficiency according to "Gas and Oil-Fired Boilers - Minimum Efficiency Requirements."
- D. DOE Compliance: Minimum efficiency shall comply with 10 CFR 430, Subpart B, Appendix N, "Uniform Test Method for Measuring the Energy Consumption of Furnaces and Boilers."
- E. UL Compliance: Test boilers for compliance with UL 795, "Commercial-Industrial Gas Heating Equipment." Boilers shall be listed and labeled by a testing agency acceptable to authorities having jurisdiction.
- F. Boiler installation shall meet the latest edition of the ASME CSD-1 code and Nevada State Boiler code.

1.4 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of boilers that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period for Fire-Tube Condensing Boilers:
 - a. Heat Exchanger Damaged by Thermal Stress and Corrosion: Non-prorated for a minimum of 20 years from date of Substantial Completion.
 - 2. Parts and labor on gas train, boiler for 1 year from date of Substantial Completion.

PART 2 - CONDENSING BOILERS

2.1 FIRE-TUBE CONDENSING BOILER

- A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - 1. Lochinvar

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2. Cleaver Brooks.
 3. Or Pre-approved Equal.
- B. Description: Factory-fabricated, -assembled, and -tested, fire-tube condensing boiler with heat exchanger sealed pressure tight, built on a steel base; including insulated jacket; flue-gas vent; combustion-air intake connections; water supply, return, and condensate drain connections; and controls. Water heating service only.
- C. The boiler's condensing capability shall allow the boiler to be operated without the use of a 3-way valve for the boiler supply water temperature reset. No minimum boiler return water temperature or secondary pump or minimum flow rate shall be required to protect the boiler against thermal shock or for minimum temperature water.
- D. Heat Exchanger: The heater exchanger shall bear the ASME "H" stamp for 160 psi working pressure and shall be National Board listed. The heat exchanger shall be constructed of a fully welded 316L stainless steel and of fire tube design. The heat exchanger shall be designed for a single-pass water flow to limit the water side pressure drop. Cast iron, aluminum, or condensing copper tube boilers will not be accepted.
- E. Combustion Chamber: The combustion chamber shall be constructed of cast-iron. It shall be a down-fired design utilizing light weight refractory around the burner housing or Stainless steel, sealed.
- F. Burner: Natural gas, negative-pressure gas valve.
- G. Blower: Centrifugal fan to operate during each burner firing sequence and to prepurge and postpurge the combustion chamber.
- a. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
- H. Gas Train: CSD-1 compliant combination gas valve with manual shutoff and pressure regulator.
- I. Ignition: Direct-spark ignition.
- J. Integral Circulator: Stainless-steel body and stainless-steel impeller sized for minimum flow required in heat exchanger.
- K. Casing:
1. Jacket: Sheet metal, with snap-in or interlocking closures.
 2. Control Compartment Enclosures: NEMA 250, Type 1A.
 3. Finish: Textured epoxy.
 4. Insulation: Minimum 1-inch-thick, mineral-fiber insulation surrounding the heat exchanger.
 5. Combustion-Air Connections: Inlet and vent duct collars.
 6. Mounting base to secure boiler.
- L. Characteristics and Capacities:
1. See drawings for characteristics and capacities.
- M. Options:
1. Manufacturers provided and installed boiler drain valve.
 2. Manufacturer's condensate neutralization kit.
 3. Manufacturer's primary boiler pump relay mounted and wired for single power connection.
 4. Flow switch or low water cutoff switch with manual reset.
 5. Digital display with alarm and status LEDs.
 6. Sequential and diagnostic control panel.
 7. ASME rated pressure relief valve.
 8. 0-10Vdc building management input system.
 9. Contacts on any failure.
 10. Modulating burner with 5:1 turn down ratio.
 11. Spark ignition.
 12. Factory system header sensor with immersion well.
 13. Vent material shall be double wall UL 1738 compliant flue.
 14. Factory appliance regulator, regulator to be vented outside.

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15. Manufacturer's RM7800 ignition system display module, one per boiler.
 16. Factory training and authorized startup.
- N. Trim
1. Include devices sized to comply with ANSI B31.9, "Building Services Piping"
 2. Aquastat Controllers: Operating, firing rate, and high limit.
 3. Safety Relief Valve: ASME rated.
 4. Pressure and Temperature Gage: Minimum 3-1/2-inch- diameter, combination water-pressure and temperature gage. Gages shall have operating-pressure and -temperature ranges so normal operating range is about 50 percent of full range.
 5. Boiler Air Vent: Automatic.
 6. Drain Valve: Minimum NPS 3/4 hose-end gate valve.
- O. Control
1. Refer to Division 23 Section "Instrumentation and Control for HVAC."
 2. The control system shall consist of a master panel and system intelligence device that is to be located within the mechanical room. The master panel shall be capable of controlling inputs and outputs of a maximum of 16 boilers. Control system is to be a wired system, wireless system will not be accepted.
 3. Boiler operating controls shall include the following devices and features:
 - a. Supply water temperature sensor.
 - b. Return water temperature sensor.
 - c. Outdoor temperature sensor.
 - d. Flow meter.
 - e. Set-Point Adjust: Set points shall be adjustable.
 - f. BacNet communication to Alerton Building Management System.
 - g. Sequence of Operation: Electric, factory-fabricated, and field-installed panel to control burner firing rate to reset supply-water temperature inversely with outside-air temperature.
 - 1) Include automatic, alternating-firing sequence for multiple boilers to ensure maximum system efficiency throughout the load range and to provide equal runtime for boilers.
- P. Burner Operating Controls: To maintain safe operating conditions, burner safety controls limit burner operation.
1. High Cutoff: Manual reset stops burner if operating conditions rise above maximum boiler design temperature.
 2. Low-Water Cutoff Switch: Electronic probe shall prevent burner operation on low water. Cutoff switch shall be manual-reset type.
 3. Blocked Inlet Safety Switch: Manual-reset pressure switch field mounted on boiler combustion-air inlet.
 4. Audible Alarm: Factory mounted on control panel with silence switch; shall sound alarm for above conditions.
- Q. Building Automation System Interface: Factory install hardware and software to enable building automation system to monitor, control, and display boiler status and alarms.
1. Hardwired Points:
 - a. Monitoring: On/off status, common trouble alarm.
 - b. Control: On/off operation, hot water supply temperature set-point adjustment.
 2. A communication interface with building automation system shall enable building automation system operator to remotely control and monitor the boiler from an operator workstation. Control features available, and monitoring points displayed, locally at boiler control panel shall be available through building automation system.
- R. Electrical Power
1. Controllers, Electrical Devices, and Wiring: Electrical devices and connections are specified in Division 26 Sections.

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2. Single-Point Field Power Connection: Factory-installed and -wired switches, motor controllers, transformers, and other electrical devices necessary shall provide a single-point field power connection to boiler.
 - a. House in NEMA 250, Type 1 enclosure.
 - b. Wiring shall be numbered and color-coded to match wiring diagram.
 - c. Install factory wiring outside of an enclosure in a metal raceway.
 - d. Field power interface shall be to fused disconnect switch.
 - e. Provide branch power circuit to each motor and to controls with a disconnect switch
 - f. Provide each motor with overcurrent protection.
 3. Pump Relay: Boiler shall have relay to energize boiler pump.
 4. Boiler shall not use a transformer to step-down main voltage.
- S. Source Quality Control
1. Burner and Hydrostatic Test: Factory adjust burner to eliminate excess oxygen, carbon dioxide, oxides of nitrogen emissions, and carbon monoxide in flue gas and to achieve combustion efficiency; perform hydrostatic test.
 2. Test and inspect factory-assembled boilers, before shipping, according to ASME Boiler and Pressure Vessel Code.

PART 3 - EXECUTION

3.1 BOILER INSTALLATION

- A. Install boilers level on concrete base. Concrete base is specified in Division 23 Section "Common Work Results for HVAC," and concrete materials and installation requirements are specified in Division 03.
- B. Install gas-fired boilers according to NFPA 54.
- C. Assemble and install boiler trim.
- D. Install electrical devices furnished with boiler but not specified to be factory mounted.
- E. Install control wiring to field-mounted electrical devices.

3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to boiler to allow service and maintenance.
- C. Install piping from equipment drain connection to nearest floor drain. Piping shall be at least full size of connection. Provide an isolation valve if required.
- D. Connect piping to boilers, except safety relief valve connections, with flexible connectors of materials suitable for service. Flexible connectors and their installation are specified in Division 23 Section "Common Work Results for HVAC."
- E. Connect gas piping to boiler gas-train inlet with union. Piping shall be at least full size of gas train connection. Provide a reducer if required.
- F. Connect hot-water piping to supply- and return-boiler tapplings with shutoff valve and union or flange at each connection.
- G. Install piping from safety relief valves to nearest floor drain.
- H. Boiler Venting:
 1. Install flue venting kit.
 2. Connect full size to boiler connections.
- I. Ground equipment according to electrical specifications.
- J. Connect wiring according to electrical specifications.

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3.3 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- B. Tests and Inspections:
 - 1. Perform installation and startup checks according to manufacturer's written instructions.
 - 2. Leak Test: Hydrostatic test. Repair leaks and retest until no leaks exist.
 - 3. Operational Test: Start units to confirm proper motor rotation and unit operation. Adjust air-fuel ratio and combustion.
 - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - a. Check and adjust initial operating set points and high- and low-limit safety set points of fuel supply, water level, and water temperature.
 - b. Set field-adjustable switches and circuit-breaker trip ranges as indicated.
- C. Remove and replace malfunctioning units and retest as specified above.

3.4 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain boilers. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 23 52 16

CC MENELEY ELEMENTARY SCHOOL BOILER REPLACEMENT

1446 MUIR DRIVE
MINDEN, NV 89460

FOR

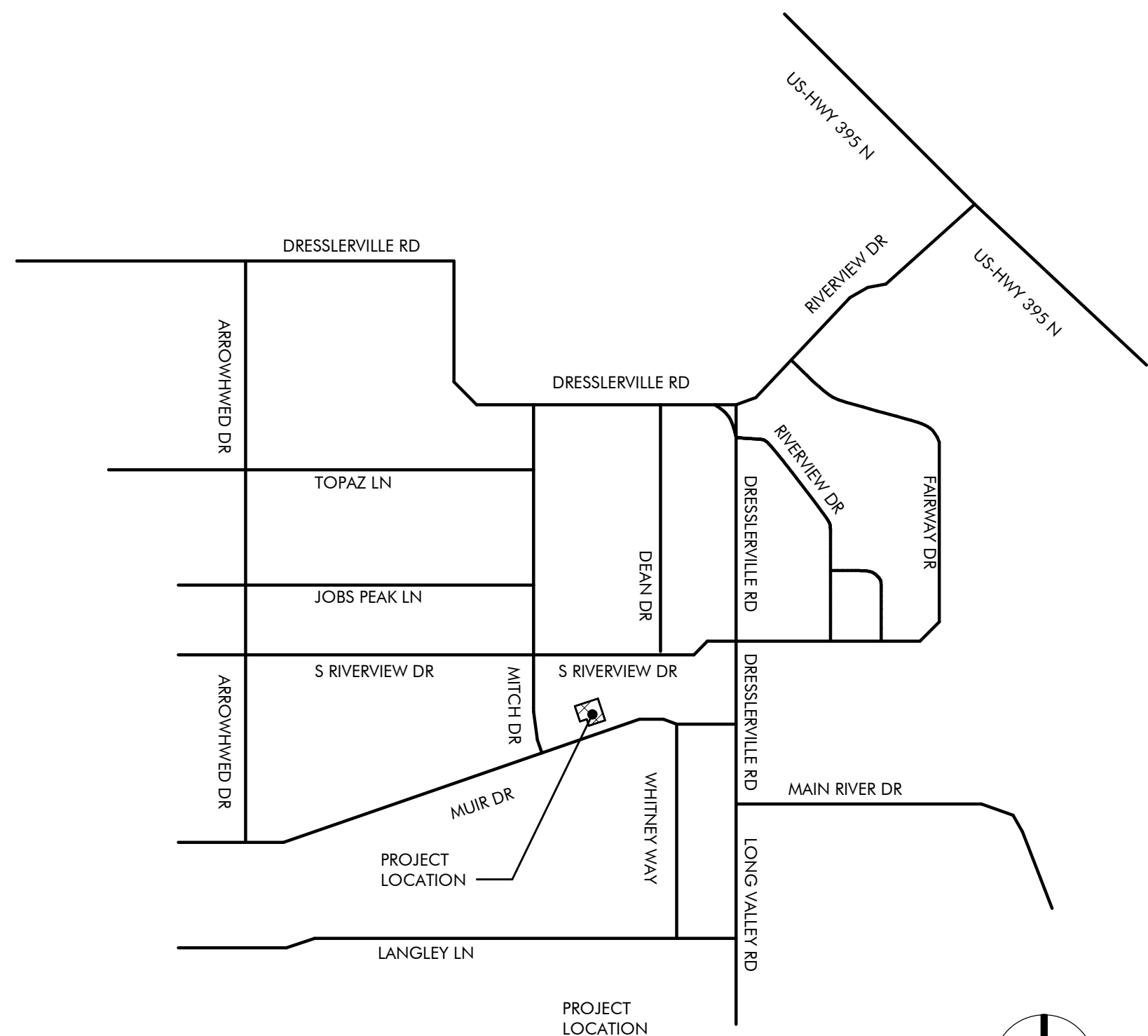
DOUGLAS COUNTY SCHOOL DISTRICT

1126 AIRPORT ROAD, BUILDING E-1
MINDEN, NV 89423
PWP-DO-2025-166

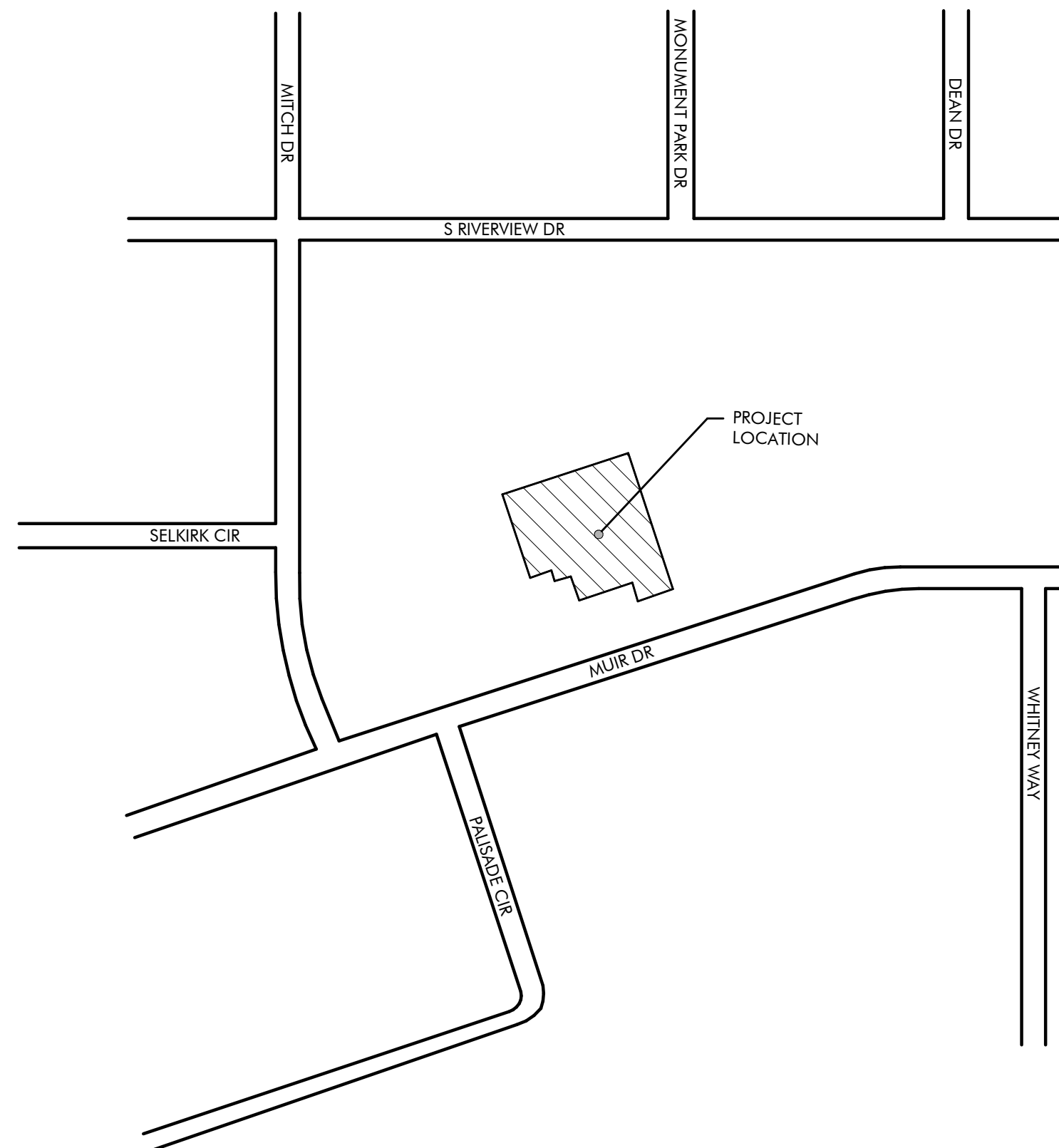


**Douglas County
School District**

VICINITY MAP



LOCATION MAP



DIRECTORY

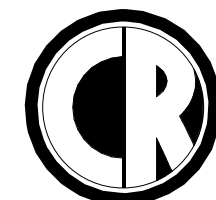
OWNER

DOUGLAS COUNTY SCHOOL DISTRICT
1126 AIRPORT ROAD, BUILDING E-1
MINDEN, NV 89423

CONTACTS: PHIL DEMUS
FACILITIES DIRECTOR
(775) 782-5134

CONSULTANTS

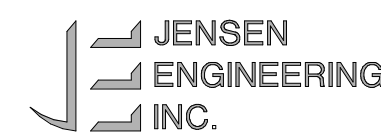
MECHANICAL



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CONTACT: CHUN LEE, P.E.
PROJECT MANAGER

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Ph. (775) 852-2288 Fax (775) 852-3388
email: kyle.jensen@jeneng.com web: www.jeneng.com

CONTACT: KYLE JENSEN
PROJECT MANAGER

GENERAL NOTES

1. THE PROJECT SPECIFICATIONS AND DRAWINGS ARE A DOCUMENT SET AND SHOULD NOT BE SEPARATED. INFORMATION AND REFERENCES ARE CONTAINED IN ALL SPECIFICATIONS AND DRAWINGS.
2. IT IS THE CONTRACTOR'S RESPONSIBILITY TO FULLY UNDERSTAND THE COMPLETE SET OF SPECIFICATIONS AND THE DRAWINGS FOR THIS PROJECT. IT IS THE CONTRACTOR'S RESPONSIBILITY TO REVIEW ALL OF THE INFORMATION CONTAINED IN THE SPECIFICATIONS AND DRAWINGS, INCLUDING ALL OTHER DISCIPLINES (ARCHITECTURAL, ELECTRICAL, STRUCTURAL, ETC.) PRIOR TO BID AND CONSTRUCTION.
3. THE CONTRACTOR SHALL INSTALL THE NEW EQUIPMENT, AND PIPING AROUND ALL EXISTING OBSTACLES INCLUDING: ELECTRICAL CONDUIT, DOMESTIC WATER PIPING, WASTE AND VENT PIPING, CHILLED AND HEATING WATER PIPING, AND FIRE SPRINKLER PIPING. PROVIDE OFFSETS TO AVOID RELOCATION OF OTHER UTILITIES. RELOCATE UTILITIES IF THEY ARE IN CONFLICT WITH THE MECHANICAL SYSTEM INSTALLATION, CAUSE DEVIATIONS IN THE DESIGN INTENT, UNSATISFACTORY OPERATION, NOISY CONDITIONS, OR INTERFERE WITH MAINTENANCE. IT IS THE MECHANICAL CONTRACTOR'S RESPONSIBILITY TO COORDINATE ANY UTILITY RELOCATION WITH THE APPROPRIATE SUBCONTRACTOR.
4. THE INFORMATION INDICATED ON THESE DRAWINGS AS EXISTING IS BASED UPON INFORMATION TAKEN FROM AS-BUILT DRAWINGS, FIELD INVESTIGATION, AND INFORMATION OBTAINED FROM SUBMITTAL DATA, ETC. THE PLANS DO NOT GUARANTEE ACCURACY BUT ARE ONLY AN INDICATION OF EXISTING CONDITIONS. IT IS THE CONTRACTOR'S RESPONSIBILITY TO FIELD VERIFY EXACT CONDITIONS SUCH AS EQUIPMENT PLACEMENT, DUCTWORK (SIZE, ROUTING, AND ELEVATION), PIPING (SIZE, ROUTING, AND ELEVATION), ETC. THE DRAWINGS ARE INTENDED TO PROVIDE THE CONTRACTOR AN INDICATION OF THE SYSTEM INSTALLED IN THE FACILITY TO DATE. IT WILL BE THE CONTRACTOR'S RESPONSIBILITY TO MAKE ADJUSTMENTS TO THE INSTALLATION AS REQUIRED TO MATCH EXISTING FIELD CONDITIONS.
5. ALL ROOF-MOUNTED EQUIPMENT OR PENETRATIONS ASSOCIATED WITH THIS PROJECT ARE TO BE FLASHED BY A LICENSED ROOFING CONTRACTOR. THE ROOFING CONTRACTOR SHALL HAVE EXPERIENCE WITH THE EXISTING ROOFING MEMBRANE. NEW FLASHING MATERIALS SHALL BE INSTALLED TO COMPLY WITH THE MEMBRANE MANUFACTURER'S SPECIFICATIONS OR DETAILS PUBLISHED BY THE NATIONAL ROOFING CONTRACTORS ASSOCIATION WATERPROOFING MANUAL. IN ACCEPTANCE OR REJECTION OF THE WORK, THE OWNER WILL MAKE NO ALLOWANCE FOR LACK OF SKILL ON THE PART OF THE CONTRACTOR.

SHEET INDEX

GENERAL INFORMATION

T0.1 TITLE SHEET

MECHANICAL

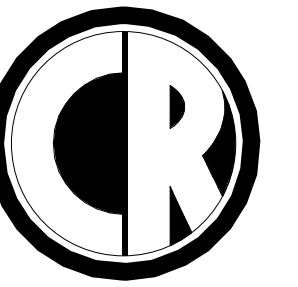
- M0.1 MECHANICAL ABBREVIATIONS AND LEGEND
- M0.2 MECHANICAL SCHEDULES
- M0.3 MECHANICAL COMPLIANCE CERTIFICATE
- M1.0 OVERALL MECHANICAL FLOOR PLAN
- M1.1 ENLARGED BOILER ROOM MECHANICAL DEMOLITION FLOOR PLAN
- M2.1 ENLARGED BOILER ROOM MECHANICAL FLOOR PLAN
- M3.1 MECHANICAL DEMOLITION SECTION AND ISOMETRICS
- M4.1 MECHANICAL SECTION AND ISOMETRICS
- M5.1 MECHANICAL DEMOLITION AND NEW PIPING DIAGRAMS
- M6.1 MECHANICAL DETAILS
- M7.1 MECHANICAL CONTROL DIAGRAMS AND SEQUENCE OF OPERATION
- M7.2 MECHANICAL CONTROL DIAGRAMS AND SEQUENCE OF OPERATION

ELECTRICAL

- E0.1 ELECTRICAL SYMBOLS & MECHANICAL EQUIPMENT CONNECTION SCHEDULE
- E0.2 ELECTRICAL SPECIFICATIONS
- E0.3 SINGLE-LINE DIAGRAMS
- E1.0 OVERALL ELECTRICAL FLOOR PLAN
- E1.1 ENLARGED BOILER ROOM ELECTRICAL DEMOLITION & NEW WORK PLAN

BUILDING CODES

- 2018 INTERNATIONAL BUILDING CODE
- 2018 INTERNATIONAL FIRE CODE
- 2018 UNIFORM MECHANICAL CODE
- 2018 INTERNATIONAL ENERGY CONSERVATION CODE
- 2018 UNIFORM PLUMBING CODE
- 2017 NATIONAL ELECTRICAL CODE

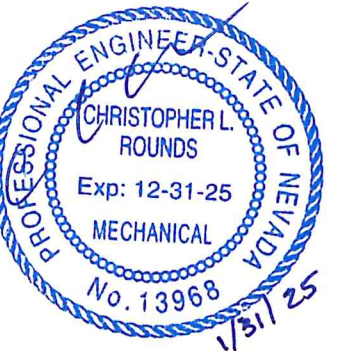


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SEAL:



CONSULTANT:

DOUGLAS COUNTY SCHOOL DISTRICT
CC MENELEY ELEMENTARY SCHOOL
BOILER REPLACEMENT
1446 MUIR DRIVE, GARDNERVILLE, NV 89460

TITLE SHEET

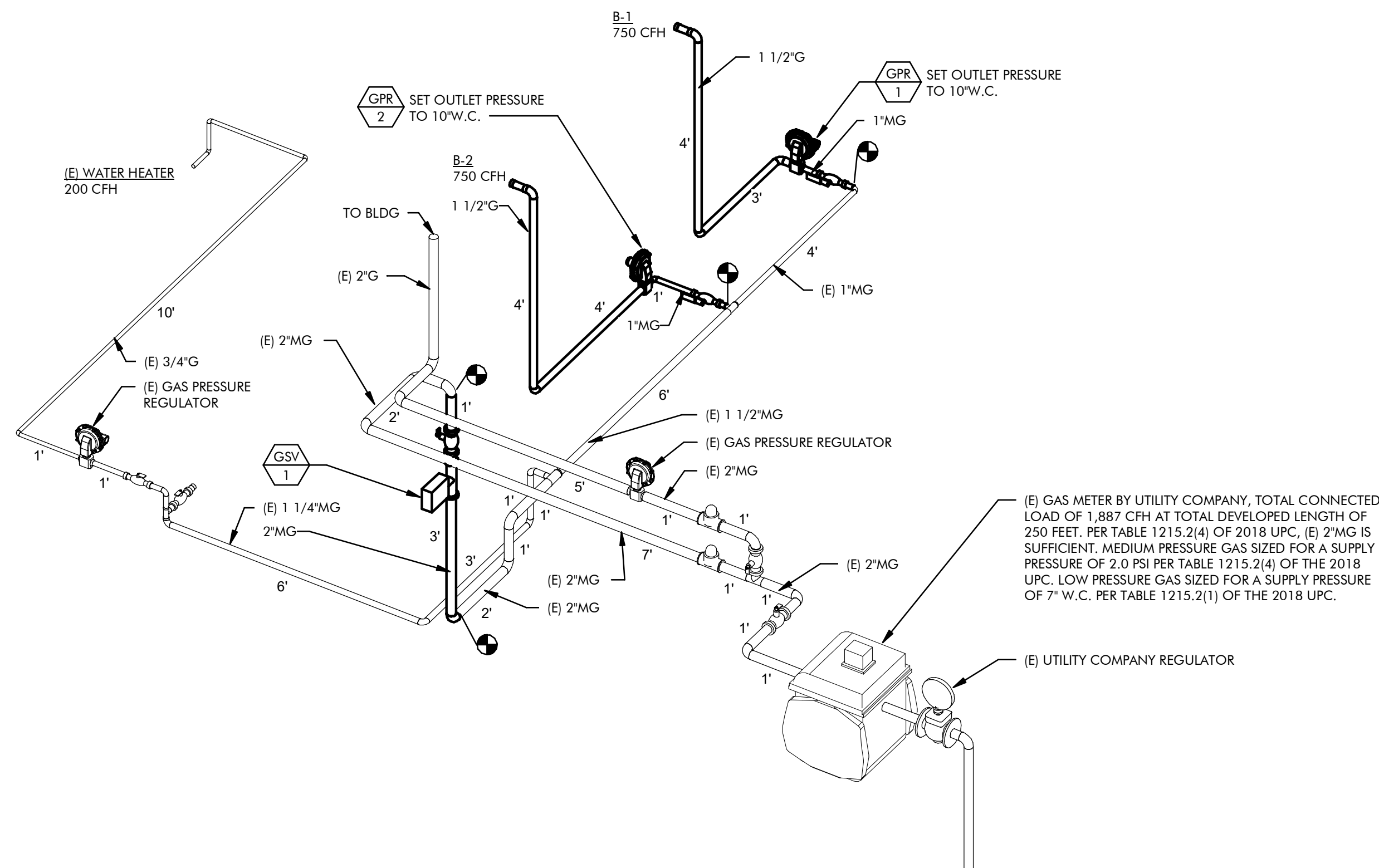
REVISIONS:

REV.	DESCRIPTION	DATE
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-

DRAWN BY: RLT
DESIGNED BY: TF
CHECKED BY: CL
APPROVED BY: CLR
DATE: 1/31/2025
PROJECT NO: 158324

SHEET NUMBER:

T0.1



1 GAS ISOMETRIC
MO.1 SCALE : NONE

MECHANICAL ABBREVIATIONS	
ACFM	ACTUAL CUBIC FEET PER MINUTE
AF	AIR FILTER
AFF/AFG	ABOVE FINISHED FLOOR/GRADE
A	AMPERE
APD	AIR PRESSURE DROP
BFF/BFG	BELOW FINISHED FLOOR/GRADE
BHP	BRAKE HORSEPOWER
BTUH	BRITISH THERMAL UNITS PER HOUR
CFM	CUBIC FEET PER MINUTE
COP	COEFFICIENT OF PERFORMANCE
Cv	VALVE FLOW COEFFICIENT
(D)	DEMOLISH
DB,WB	DRY BULB, WET BULB TEMPERATURE
DG	DOOR GRILLE
DIA	DIAMETER
DN	DOWN
DP	DIFFERENTIAL PRESSURE
(E)	EXISTING
EAT/LAT	ENTERING/LEAVING AIR TEMPERATURE
ESP	EXTERNAL STATIC PRESSURE
EWI/LWT	ENTERING/LEAVING WATER TEMPERATURE
FLA	FULL LOAD AMPERES
FPM	FEET PER MINUTE
FT	FOOT
FT ²	SQUARE FOOT
FT ³	CUBIC FOOT
GA	GAUGE
GPM	GALLONS PER MINUTE
HP	HORSEPOWER
HZ	HERTZ
IN	INCH
IN ²	SQUARE INCH
IN ³	CUBIC INCH
KW	KILOWATT
LBS	POUNDS
LRA	LOCKED ROTOR AMPERES
MAX	MAXIMUM
MBH	THOUSAND BRITISH THERMAL UNITS PER HOUR
MCA	MINIMUM CIRCUIT AMPACITY
MIN	MINIMUM
MOCP	MAXIMUM OVERCURRENT PROTECTION
(N)	NEW
PSI	POUNDS PER SQUARE INCH
PSIG	POUNDS PER SQUARE INCH GAUGE
R	REGISTER
RPM	REVOLUTIONS PER MINUTE
TDH	TOTAL DYNAMIC HEAD
TG	TRANSFER GRILLE
TSP	TOTAL STATIC PRESSURE
TYP	TYPICAL
V	VOLTS
W	WATT
WC/WG	WATER COLUMN/GAUGE

MECHANICAL SYMBOL LEGEND		
SYMBOL	ABBR.	DESCRIPTION
	SA	SUPPLY AIR
	RA	RETURN AIR
	EA	EXHAUST AIR
	OA	OUTSIDE AIR
		POSITIVE PRESSURE DUCT SECTION - FIRST SIZE IS TOP
		NEGATIVE PRESSURE DUCT SECTION - FIRST SIZE IS TOP
		DUCT SIZE - FIRST SIZE IS SIDE SHOWN
		FLEXIBLE DUCT
		FLEXIBLE DUCT CONNECTOR
	MVD	MANUAL VOLUME DAMPER
	OBD	OPPOSED BLADE DAMPER
		MOTORIZED ACTUATOR
	TSTAT	THERMOSTAT OR TEMPERATURE SENSOR @ 48" AFF
	SW	SIDE WALL DIFFUSER
	BFP	BACKFLOW PREVENTER
	BV	BALL VALVE
	BFV	BUTTERFLY VALVE
	CV	CHECK VALVE
	FCV	FLOW CONTROL (BALANCE) VALVE
	PRV	PRESSURE REDUCING VALVE
	PTRV	PRESSURE AND TEMPERATURE RELIEF VALVE
	TCV	TEMPERATURE CONTROL VALVE (2-WAY OR 3-WAY)
	TDV	TRIPLE DUTY VALVE
	STR	STRAINER
		UNION
		PIPE BREAK
		PIPE CAP OR PLUG
	ELL	PIPE ELBOW
		PIPE ELBOW DOWN
		PIPE ELBOW UP
		PIPE TEE
		PIPE RISER
		PIPE DROP
		PIPE BRANCH, TOP CONNECTION
		PIPE BRANCH, BOTTOM CONNECTION
	FLEX	FLEXIBLE PIPE CONNECTOR
		WATER METER
		PRESSURE SENSOR, TEMPERATURE SENSOR WITH WELL
		PRESSURE GAUGE, TEMPERATURE GAUGE
	P	PUMP
	CHS/CHR	CHILLED WATER SUPPLY/RETURN PIPING
	HWS/HWR	HOT WATER SUPPLY/RETURN PIPING
	D	EQUIPMENT OR CONDENSATE DRAIN PIPING
	CW	DOMESTIC COLD WATER
	DHW	DOMESTIC HOT WATER
	DHW/R	DOMESTIC HOT WATER RETURN
	G	NATURAL GAS
	POC	POINT OF CONNECTION
	POC	POINT OF DISCONNECT



CONSULTANT:

DOUGLAS COUNTY SCHOOL DISTRICT
CC MENELEY ELEMENTARY SCHOOL
BOILER REPLACEMENT
1446 MUIR DRIVE, GARDNERVILLE, NY 89460

MECHANICAL ABBREVIATIONS AND LEGEND

REVISIONS:		
REV.	DESCRIPTION	DATE
1	1	1
2	2	2
3	3	3
4	4	4
5	5	5
6	6	6
7	7	7
8	8	8
9	9	9
10	10	10

DRAWN BY: RLT
DESIGNED BY: TF
CHECKED BY: CL
APPROVED BY: CLR
DATE: 1/31/2025
PROJECT NO: 158324

SHEET NUMBER:

PLOT DATE:

CONDENSING BOILER SCHEDULE																				
UNIT GENERAL DATA						ELECTRICAL			OUTPUT DATA											
	SERVICE	MANUFACTURER	MODEL	OPERATING WEIGHT (LBS)	WATER CONTENT (GALLONS)	VOLTS/Ø/Hz	FLA	MOCp	INPUT (BTUH)	OUTPUT AT ELEVATION (BTUH)	FLUID	FLUID FLOW (GPM)	LWT (°F)	EWT (°F)	MAX WPD (FT WC)	VENT SIZE (IN)	VENT MATERIAL	COMBUSTION AIR SIZE (IN)	COMBUSTION AIR MATERIAL	UNIT OPTION
1	HEATING HOT WATER SYSTEM	CLEAVER BROOKS	CFCE 750	2,100	92	120/1/60	13	20	750,000	630,000	WATER	42	180	150	5	8	UL 1738	8	GALVANIZED	A,B,C,D,E,F,G,H,I,J,K,L,M,N,O,P,Q
2	HEATING HOT WATER SYSTEM	CLEAVER BROOKS	CFCE 750	2,100	92	120/1/60	13	20	750,000	630,000	WATER	42	180	150	5	8	UL 1738	8	GALVANIZED	A,B,C,D,E,F,G,H,I,J,K,L,M,N,O,P,Q
GENERAL NOTES:						OPTIONS/FEATURES:														
1. DESCRIPTION: FULLY MODULATING, STAINLESS STEEL HEAT EXCHANGER, CONDENSING NATURAL GAS FIRED BOILER.						A. MODULATING BURNER W/10:1 FIRING TURN DOWN RATIO.						J. CONTACTS ON ANY FAILURE.								
2. OUTPUT IS SHOWN FOR 4,700 FT ELEV.						B. SPARK IGNITION.						K. MANUFACTURER'S CAPSULE TYPE CONDENSATE NEUTRALIZATION KIT.								
3. COMBUSTION AIR AND FLUE TO BE SIZED PER MANUFACTURER'S CALCULATION. INDICATED COMBUSTION AIR AND FLUE SIZES ARE SHOWN FOR SPECIFIED BOILER ONLY, CONTRACTOR TO INCLUDE MANUFACTURER'S FLUE AND COMBUSTION AIR CALCULATION WITH SUBMITTALS.						C. ADJUSTABLE HIGH LIMIT AND MANUAL RESET TEMPERATURE CONTROL.						L. FACTORY SYSTEM HEADER SENSOR WITH IMMERSION WELL.								
4. SPECIFIED BOILER REQUIRES ALTITUDE DERATE PER THIRD PARTY TESTING IN ACCORDANCE TO ANSI Z21.13. IF SPECIFIED BOILER IS NOT PROVIDED, CONTRACTOR TO PROVIDE LETTER FROM MANUFACTURER INDICATING SUBSTITUTE BOILER HAS BEEN THIRD PARTY TESTED IN ACCORDANCE TO ANSI Z21.13 OR CONTRACTOR IS TO PROVIDE BOILER WITH THE SPECIFIED OUTPUT. LARGER INPUT MAY REQUIRE LARGER GAS PIPING, FLUE, AND COMBUSTION AIR.						D. MANUFACTURER'S LOW-WATER CUTOFF WITH MANUAL RESET, SO THAT BOILER IS COMPLIANT WITH CSD-1 AND NEVADA BOILER CODE.						M. FACTORY TRAINING AND AUTHORIZED START-UP.								
						E. ASME RATED PRESSURE RELIEF VALVE, SET AT 75 PSI.						N. MANUFACTURER'S SEISMIC ANCHORING KIT								
						F. SEQUENTIAL AND DIAGNOSTIC CONTROL PANEL.						O. INTEGRATED BOILER DRAIN VALVE.								
						G. DIGITAL DISPLAY WITH ALARM AND STATUS ON A TOUCH SCREEN.						P. MANUFACTURER'S UL LISTED FLUE ROOF TERMINATION OUTLET.								
						H. VENT MATERIAL SHALL BE UL 1738 COMPLIANT, 444 STAINLESS STEEL						Q. MANUFACTURER'S SEISMIC ANCHORING KIT								
5. FLUE MATERIAL TO BE UL1738 COMPLIANT STAINLESS STEEL. COMBUSTION AIR TO BE GALVANIZED SHEET METAL DUCT. PAINT EXTERIOR PORTION OF DUCT TO MATCH BUILDING						I. 87% OPERATING THERMAL EFFICIENCY AT 150°F RETURN WATER TEMPERATURE AND 100% INPUT														

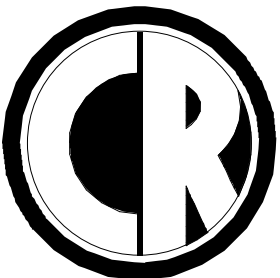
VFD SCHEDULE								
	EQUIPMENT SERVED	MANUFACTURER	MODEL	ELECTRICAL				OPTIONS
				HP	VOLTS	PHASE	HZ	
1	HWP-1	ABB	ACH580	5	460	3	60	A,B,C,D
2	HWP-2	ABB	ACH580	5	460	3	60	A,B,C,D
GENERAL NOTES:				OPTIONS				
1. ALL DRIVES TO BE SUPPLIED BY CONTROLS CONTRACTOR AND WIRED BY ELECTRICAL CONTRACTOR. CONTROLS CONTRACTOR TO COORDINATE WITH EQUIPMENT MANUFACTURER FOR INSTALLATION AND START-UP REQUIREMENTS				A. MANUFACTURER'S INTERNAL 5% INPUT LINE REACTORS				
				B. PROVIDE AND INSTALL BACNET COMMUNICATION CARDS				
				C. MANUFACTURER'S CIRCUIT BREAKER TYPE DISCONNECT				
2. COORDINATE EXACT LOCATION WITH ELECTRICAL DRAWINGS.				D. MANUFACTURER'S INTERNAL DC LINE CHOKER				

PUMP SCHEDULE																			
UNIT GENERAL DATA																			
	SERVICE	MANUFACTURER	MODEL	OPERATING WEIGHT (LBS)	SIZE	TYPE	FLOW (GPM)	TDH (FT)	FLUID	IMP. DIA (IN)	MIN EFF. (%)	SUCTION (IN)	DISCH. (IN)	TRIPLE DUTY VALVE MODEL	TRIPLE DUTY VALVE SIZE (IN)	TRIPLE DUTY PRESS DROP (PSI)	SUCTION DIFFUSER MODEL	FRAME SIZE	UNIT OPTION
HWP-1	HEATING HOT WATER SYSTEM	TACO	1509D	500	3 x 2½	BASE	84	70	WATER	9.5	61	2½	1½	N/A	N/A	N/A	SDS30025-5	182T	A,B,C,D,E
HWP-2	HEATING HOT WATER SYSTEM	TACO	1509D	500	3 x 2½	BASE	84	70	WATER	9.5	61	2½	1½	N/A	N/A	N/A	SDS30025-5	182T	A,B,C,D,E
HWP-B1	B-1	GRUNDFOS	MAGNA 3 40-120	50	N/A	INLINE	42	20	WATER	N/A	75	1½	1½	MPV	2	3.0	N/A	N/A	A,B,D
HWP-B2	B-2	GRUNDFOS	MAGNA 3 40-120	50	N/A	INLINE	42	20	WATER	N/A	75	1½	1½	MPV	2	3.0	N/A	N/A	A,B,D
INFORMATION FOR BASE MOUNTED PUMPS SCHEDULED ABOVE										INFORMATION FOR INLINE MOUNTED BOILER PUMPS SCHEDULED ABOVE									
GENERAL										GENERAL									
1. DESCRIPTION: MAINTENANCE FREE, BASE MOUNTED, END SUCTION, CAST IRON CENTRIFUGAL PUMP.										1. DESCRIPTION: MAINTENANCE FREE, INLINE, CLOSE COUPLED, VERTICAL OR HORIZONTAL POSITION, CAST IRON CENTRIFUGAL PUMP									
PUMP										PUMP									
1. PUMP VOLUTE SHALL BE CLASS 30 CAST IRON.										1. PUMP SHALL BE CLASS 30 CAST IRON WITH FLANGE CONNECTIONS.									
2. BEARING HOUSING ASSEMBLY SHALL HAVE REGREASABLE BALL BEARINGS.										2. IMPELLER SHALL BE CAST BRONZE, DYNAMICALLY BALANCED, KEYED TO SHAFT, AND SECURED BY A LOCKING CAPSCREW.									
3. IMPELLER SHALL BE CAST BRONZE, DYNAMICALLY BALANCED, KEYED TO SHAFT, AND SECURED BY A LOCKING CAPSCREW.										MOTOR									
MOTOR										1. ELECTRONICALLY COMMUTED MOTOR (ECM)									
1. PREMIUM EFFICIENCY.										2. MOTOR SHALL MEET NEMA SPECIFICATIONS AND BE NON-OVERLOADING FOR ENTIRE PUMP CURVE.									
2. MOTOR SHALL MEET NEMA SPECIFICATIONS AND BE NON-OVERLOADING FOR ENTIRE PUMP CURVE.										OPTIONS FOR PUMPS SCHEDULED ABOVE									
										A. ODP PREMIUM EFFICIENCY MOTOR									
										B. PROVIDE WITH TWIN CITY HOSE (OR APPROVED EQUAL) STAINLESS STEEL FLEX CONNECTOR.									
										C. PUMPS TO BE LASER ALIGNED BY MANUFACTURER'S REPRESENTATIVE. PROVIDE REPORT WITH CLOSE OUT DOCUMENT.									
										D. TUNGSTEN CARBIDE OR SILICONE CARBIDE SEAL, SUITABLE FOR USE IN GLYCOL SYSTEMS.									
										E. PROVIDE AND INSTALL AEGIS SHAFT GROUNDING RINGS									

EQUIPMENT SCHEDULE	
	CHEMICAL FEED TANK NU-CALGON MODEL 20L (OR APPROVED EQUAL) FLAT BOTTOM, MILD STEEL, 2-GALLON CHEMICAL FEEDER WITH 3½" QUARTER-TURN CAP AND 3/4" NPT PORTS. PROVIDE AND INSTALL MANUFACTURER'S FLOW INDICATOR AND FILTER. PROVIDE WITH MANUFACTURER'S WALL BRACKET.
	GAS SHUT OFF VALVE WNS MODEL WNMS2-120 (OR APPROVED EQUAL) NORMALLY CLOSED, POWERED OPEN GAS SHUT OFF VALVE. VALVE TO BE CONSTRUCTED OF CAST ALUMINUM WITH STAINLESS STEEL CORES AND SPRINGS. VALVE TO BE CSA CERTIFIED AND UL LISTED FOR NATURAL GAS USE. VALVE TO BE 2". ELECTRICAL: 120V/1/60, FLA: 1.0 A
	GAS PRESSURE REGULATOR AMERICAN METER COMPANY MODEL #1813C (OR APPROVED EQUAL) 1¼" OUTLET WITH AN INLET PRESSURE OF 2.0 PSI AND OUTLET PRESSURE OF 10"W.C. REGULATOR TO INCLUDE STEEL DIAPHRAGM CHAMBER, AND BUNA-N SEAL DISC. PIPE SECTION TO BE CAST IRON. REGULATOR PRESSURE RATING OF 125 PSIG. REGULATOR TO PROVIDE UP TO 1,400 CFH OF NATURAL GAS. GAS REGULATOR SHALL INCLUDE, PRESSURE TAPS, FULL CAPACITY RELIEF VALVE, AND UNIVERSAL SAFETY-OFF ASSEMBLY. USE 9/16" ORIFICE AND 6-19" W.C SPRING. GAS INLET TO BE 1", GAS OUTLET TO BE 1½", AND VENT TO BE 1¼".
	WATER METER SEAMETRICS MODEL MJNR-100-16-07 (OR APPROVED EQUAL) BRASS WATER METER WITH REED SWITCH WITH 1 GALLON PER PULSE. PROVIDE AND INSTALL MANUFACTURER'S CONTROL CONNECTOR.

AIR/DIRT SEPARATOR SCHEDULE										
UNIT GENERAL DATA					FLOW DATA					
	SERVICE	MANUFACTURER	MODEL	OPERATING WEIGHT (LBS)	OPERATING FLOW (GPM)	MAXIMUM FLOW (GPM)	PRESS. DROP (FT WC)	INLET (IN)	OUTLET (IN)	OPTIONS
1	HEATING HOT WATER	TACO	4903ADR-125	325	84	113	5	3	3	A
GENERAL NOTES:			CONSTRUCTION				OPTIONS			
1. DESCRIPTION: COALESCING TYPE AIR ELIMINATOR			1. SHELL SHALL BE CONSTRUCTED OF EPOXY COATED STEEL.				A. MANUFACTURER'S ON/OFF MAGNETIC CONTROLS			
DESIGN PRESSURE AND TEMPERATURE			2. UNIT SHALL HAVE AN AUTOMATIC AIR VENT AT THE TOP OF THE SHELL.							
1. AIR/DIRT SEPARATOR SHALL BE RATED FOR 125 PSIG @ 250°F			3. COALESCING MEDIUM SHALL BE STAINLESS STEEL.							
2. UNIT SHALL BE ASME STAMPED			4. UNIT SHALL HAVE A BLOW DOWN VALVE AND SKIM VALVE.							

EXPANSION TANK SCHEDULE													
UNIT GENERAL DATA													
	SERVICE	MANUFACTURER	MODEL	OPERATING WEIGHT (LBS)	TANK VOLUME (GALLONS)	MINIMUM ACCEPT. VOLUME (GALLONS)	OPERATING PRESSURE (PSI)			OPERATING TEMP (°F)		ESTIMATED SYSTEM VOLUME (GALLONS)	OPTIONS
							MIN	MAX	ATM	MIN	MAX		
1	HEATING HOT WATER	TACO	CA300-125	1,000	79	35	20	60	12.5	40	200	800	A,B
GENERAL NOTES:						DESIGN PRESSURE AND TEMPERATURE				OPTIONS			
1. HEATING HOT WATER EXPANSION TANK TO BE REMOVABLE BLADDER TYPE, PRE-CHARGED, THERMAL EXPANSION TANK FOR HYDRONIC SYSTEMS.						1. UNIT TO BE DESIGNED FOR 150 PSI WORKING PRESSURE AND 240°F WORKING TEMPERATURE.				A. MANUFACTURER'S SIGHT GLASS			
CONSTRUCTION						BLADDER				B. MANUFACTURER'S ANCHOR CLIP			
1. TANK SHALL BE CONSTRUCTED IN ACCORDANCE WITH SECTION VII OF THE ASME BOILER AND PRESSURE VESSEL CODE AND STAMPED 150 PSI WORKING PRESSURE.						1. REMOVABLE HEAVY BUTYL RUBBER BLADDER.							
						TANK							
						1. TANK SHALL HAVE A BOTTOM NPT STAINLESS STEEL SYSTEM CONNECTION AND A .302"-32 CHARGING VALVE CONNECTION (STANDARD TIRE VALVE) TO FACILITATE THE ON-SITE CHARGING OF THE TANK TO MEET SYSTEM REQUIREMENTS.							



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MECHANICAL ENGINEERING CONSULTANT

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RENO, NEVADA 89511
PHONE:



COMcheck Software Version COMcheckWeb
Mechanical Compliance Certificate

Project Information

Energy Code: 2021 IECC
Project Title: 158324 CC Meneley
Location: Minden, Nevada
Climate Zone: 4b
Project Type: Alteration

Construction Site: 1446 Muir Drive
Gardnerville, Nevada 89460
Owner/Agent: Phil Demus
Douglas County School District
1126 Airport Road, E-1
Minden, Nevada 89423
Designer/Contractor: Chris Rounds, P.E.
CR Engineering
5434 Longley Lane
Reno, Nevada 89511

Mechanical Systems List

Quantity System Type & Description

- 1 B-1:
Heating: Hot Water Boiler, Capacity 750 kBtu/h, Gas
Proposed Efficiency: 87.00 % Et, Required Efficiency: 80.00 % Et
- 1 B-2:
Heating: Hot Water Boiler, Capacity 750 kBtu/h, Gas
Proposed Efficiency: 87.00 % Et, Required Efficiency: 80.00 % Et

Mechanical Compliance Statement

Compliance Statement: The proposed mechanical alteration project represented in this document is consistent with the building plans, specifications, and other calculations submitted with this permit application. The proposed mechanical systems have been designed to meet the 2021 IECC requirements in COMcheck Version COMcheckWeb and to comply with any applicable mandatory requirements listed in the Inspection Checklist.

CHRIS ROUNDS, P.E.  01/31/2025
Name - Title Signature Date

Project Title: 158324 CC Meneley
Data Filename: Report date: 01/20/25
Page 1 of 8

Section # & Req.ID	Mechanical Rough-In Inspection	Complies?	Comments/Assumptions
C403.4.3 [ME69] ²	The heating of fluids in hydronic systems that have been previously mechanically cooled, and the cooling of fluids that have been previously mechanically heated are limited in accordance with Sections C403.4.3.1 - C403.4.3.3. Single boiler systems >500,000 Btu/h have multistaged or modulating burner.	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	
C403.4.1 [ME63] ²	Heating for vestibules and air curtains with integral heating include automatic controls that shut off the heating system when outdoor air temperatures > 45F. Vestibule heating and cooling systems controlled by a thermostat in the vestibule with heating setpoint <= 60F and cooling setpoint >= 80F.	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	
C408.2.2 [ME53] ²	Air outlets and zone terminal devices have means for air balancing.	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	
C403.11.3 [ME123] ^{1,2}	Refrigerated display cases, walk-in coolers or walk-in freezers served by remote compressors and remote condensers not located in a condensing unit, have fan-powered condensers that comply with Sections C403.11.3.1 and refrigeration compressor systems that comply with C403.11.3.2.	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	

Additional Comments/Assumptions:

1 | High Impact (Tier 1) | 2 | Medium Impact (Tier 2) | 3 | Low Impact (Tier 3)
Project Title: 158324 CC Meneley
Data Filename: Report date: 01/20/25
Page 5 of 8



COMcheck Software Version COMcheckWeb
Inspection Checklist
Energy Code: 2021 IECC

Requirements: 0.0% were addressed directly in the COMcheck software
Text in the "Comments/Assumptions" column is provided by the user in the COMcheck Requirements screen. For each requirement, the user certifies that a code requirement will be met and how that is documented, or that an exception is being claimed. Where compliance is itemized in a separate table, a reference to that table is provided.

Section # & Req.ID	Plan Review	Complies?	Comments/Assumptions
C103.2 [FR2] ²	Plans, specifications, and/or calculations provide all information with which compliance can be determined for the mechanical and service water heating systems and document where exceptions to the standard are claimed. Load calculations per acceptable engineering standards and handbooks. Hot water system sized per manufacturer's sizing guide.	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	

Additional Comments/Assumptions:

1 | High Impact (Tier 1) | 2 | Medium Impact (Tier 2) | 3 | Low Impact (Tier 3)
Project Title: 158324 CC Meneley
Data Filename: Report date: 01/20/25
Page 2 of 8

Section # & Req.ID	Rough-In Electrical Inspection	Complies?	Comments/Assumptions
C405.7 [EL26] ²	Low-voltage dry-type distribution electric transformers meet the minimum efficiency requirements of Table C405.6.	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	
C405.8 [EL27] ²	Electric motors meet the minimum efficiency requirements of Tables C405.7.1.1 through C405.7.1.4. Efficiency verified through certification under an approved certification program or the equipment efficiency ratings shall be provided by motor manufacturer (where certification programs do not exist).	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	
C405.9.1, C405.9.2 [EL28] ²	Escalators and moving walks comply with ASME A17.1/CSA B44 and have automatic controls configured to reduce speed to the minimum permitted speed in accordance with ASME A17.1/CSA B44 or applicable local code when not conveying passengers.	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	
C405.10 [EL29] ²	Total voltage drop across the combination of feeders and branch circuits <= 5%.	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	
C405.11.1 [EL30] ²	At least 30% of dwelling unit permanently installed lighting shall have lamp efficacy >= 65 lm/W or luminaires with efficacy >= 45 lm/W or comply with C405.2.4 or C405.3.	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	
C405.11.1 [EL31] ²	50% of 15/20 amp receptacles installed in enclosed offices, conference rooms, copy rooms, break rooms, classrooms and workstations and > 25% of branch circuit feeders for modular furniture will have automatic receptacle control in accordance with C405.11.1.	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	

Additional Comments/Assumptions:

1 | High Impact (Tier 1) | 2 | Medium Impact (Tier 2) | 3 | Low Impact (Tier 3)
Project Title: 158324 CC Meneley
Data Filename: Report date: 01/20/25
Page 6 of 8

Section # & Req.ID	Plumbing Rough-In Inspection	Complies?	Comments/Assumptions
C404.5, C404.5.1, C404.5.2 [PL6] ²	Heated water supply piping conforms to pipe length and volume requirements. Refer to section details.	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	

Additional Comments/Assumptions:

1 | High Impact (Tier 1) | 2 | Medium Impact (Tier 2) | 3 | Low Impact (Tier 3)
Project Title: 158324 CC Meneley
Data Filename: Report date: 01/20/25
Page 3 of 8

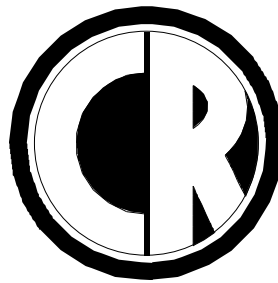
Section # & Req.ID	Final Inspection	Complies?	Comments/Assumptions
C303.3, C408.2.5 [F18] ²	Furnished O&M manuals for HVAC systems within 90 days of system acceptance.	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	
C403.1.1 [F19] ²	HVAC systems and equipment design loads calculated in accordance with ANSI/ASHRAE/ACCA Standard 183 or by an approved equivalent computational procedure.	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	
C403.3.1 [F127] ²	HVAC systems and equipment capacity does not exceed calculated loads.	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	
C403.4.1.1 [F128] ²	Thermostatic controls have a 5 °F deadband.	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	
C403.4.1 [F120] ²	Temperature controls have setpoint overlap restrictions.	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	
C403.4.2 [F129] ²	Each zone equipped with setback controls using automatic time clock or programmable control system.	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	
C403.4.2.1, C403.4.2.2 [F140] ²	Automatic Controls: Setback to 55°F (heat) and 85°F (cool); 7-day clock, 2-hour occupant override, 10-hour backup.	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	
C408.1.1 [F157] ²	Building operations and maintenance documents will be provided to the owner. Documents will cover manufacturers' information, specifications, programming procedures and means of illustrating to owner how building, equipment and systems are intended to be installed, maintained, and operated.	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	
C408.2.1 [F128] ²	Commissioning plan developed by registered design professional or approved agency.	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	
C408.2.3 [F131] ²	HVAC equipment, systems and system-to-system relationships have been tested to ensure proper operation.	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	
C408.2.3.1 [F10] ²	HVAC and service water heating control systems have been tested to ensure proper operation, calibration and adjustment of controls.	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	

1 | High Impact (Tier 1) | 2 | Medium Impact (Tier 2) | 3 | Low Impact (Tier 3)
Project Title: 158324 CC Meneley
Data Filename: Report date: 01/20/25
Page 7 of 8

Section # & Req.ID	Mechanical Rough-In Inspection	Complies?	Comments/Assumptions
C402.2.6 [ME41] ²	Thermally ineffective panel surfaces of sensible heating panels have insulation >= R-3.5.	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	
C403.9 [ME144] ²	Large diameter fans where installed shall be tested and labeled in accordance with AMCA 230.	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	
C403.13.1 [ME71] ²	Systems that heat outside the building envelope are radiant heat systems controlled by an occupancy sensing device or timer switch.	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	
C403.3 [ME55] ²	HVAC equipment efficiency verified.	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	See the Mechanical Systems list for values.
C403.2.2 [ME59] ²	Natural or mechanical ventilation is provided in accordance with International Mechanical Code Chapter 4. Mechanical ventilation has capability to reduce outdoor air supply to minimum per IMC Chapter 4.	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	
C403.7.1 [ME59] ²	Demand control ventilation provided for spaces >500 ft2 and >15 people/1000 ft2 occupant density and served by systems with air side economizer, auto modulating outside air damper control, or design airflow >3,000 cfm.	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	
C403.7.2 [ME115] ²	Enclosed parking garage ventilation has automatic contaminant detection and capacity to stage or modulate fans to 50% or less of design capacity.	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	
C403.7.6 [ME141] ²	HVAC systems serving guestrooms in Group R-1 buildings with > 50 guestrooms: Each guestroom is provided with controls that automatically manage temperature setpoint and ventilation (see sections C403.7.6.1 and C403.7.6.2).	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	
C403.7.4 [ME57] ²	Exhaust air energy recovery on systems meeting Table C403.7.4(1) and C403.7.4(2).	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	
C403.7.5 [ME116] ²	Kitchen exhaust systems comply with replacement air and conditioned supply air limitations, and satisfy hood rating requirements and maximum exhaust rate criteria.	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	
C403.12.1 [ME60] ²	HVAC ducts and plenums insulated in accordance with C403.11.1 and constructed in accordance with C403.11.2, verification may need to occur during Foundation Inspection.	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	

Additional Comments/Assumptions:

1 | High Impact (Tier 1) | 2 | Medium Impact (Tier 2) | 3 | Low Impact (Tier 3)
Project Title: 158324 CC Meneley
Data Filename: Report date: 01/20/25
Page 8 of 8

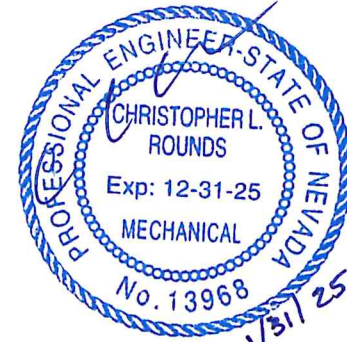


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MECHANICAL COMPLIANCE CERTIFICATE

REVISIONS:

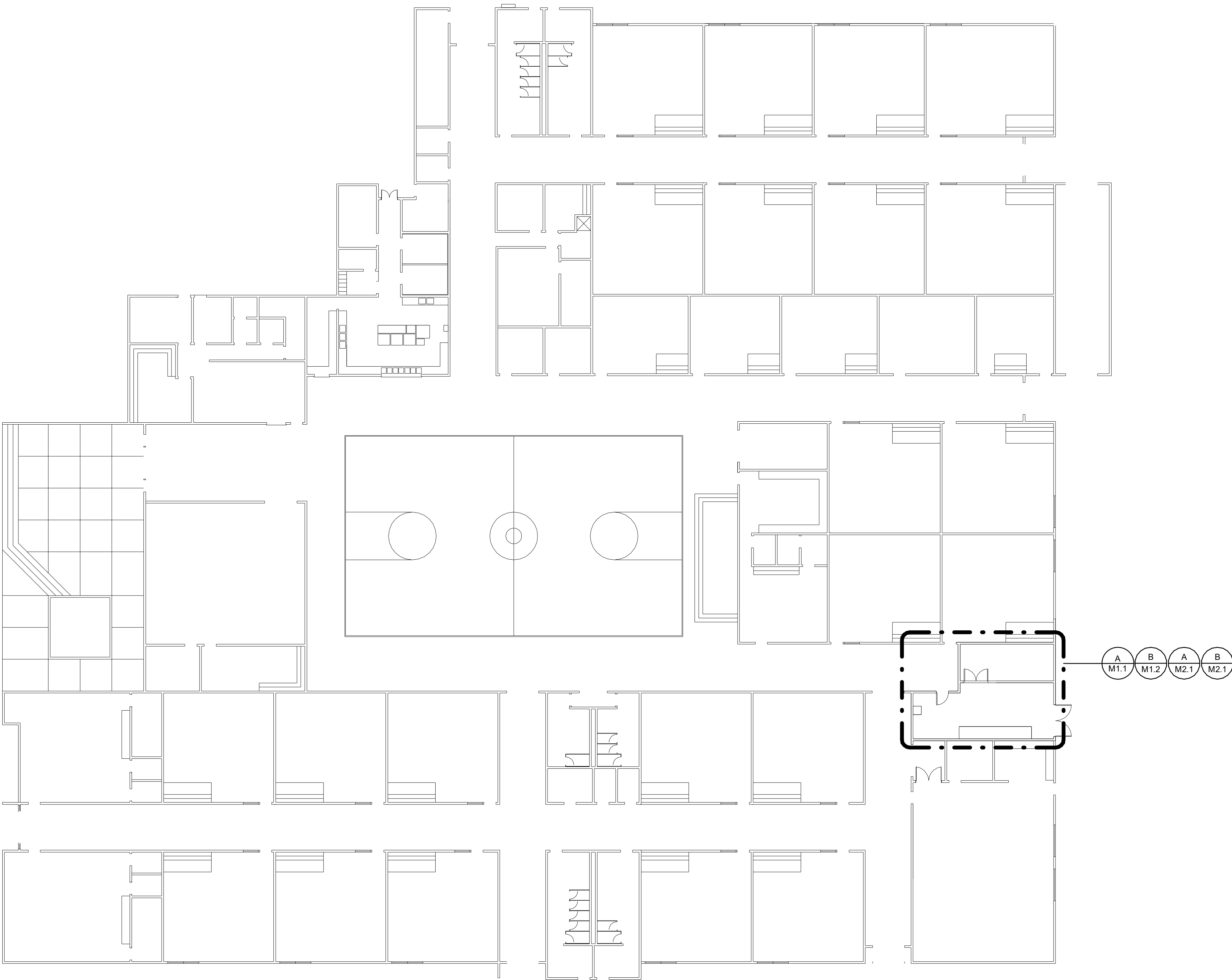
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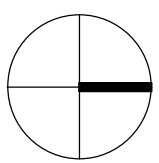
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DESIGNED BY: TF
CHECKED BY: CL
APPROVED BY: CLR
DATE: 1/31/2025
PROJECT NO: 158324

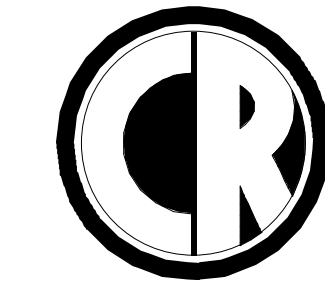
SHEET NUMBER:

M0.3

PLOT DATE:



 **A** **OVERALL MECHANICAL FLOOR PLAN**
M1.0 SCALE: 1/16" = 1'-0"

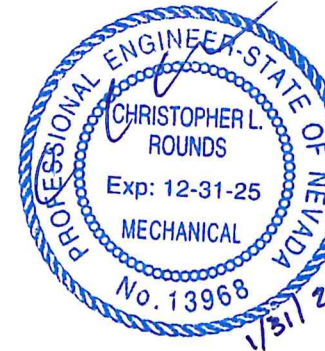


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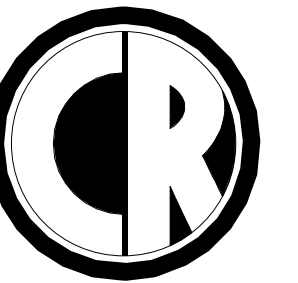
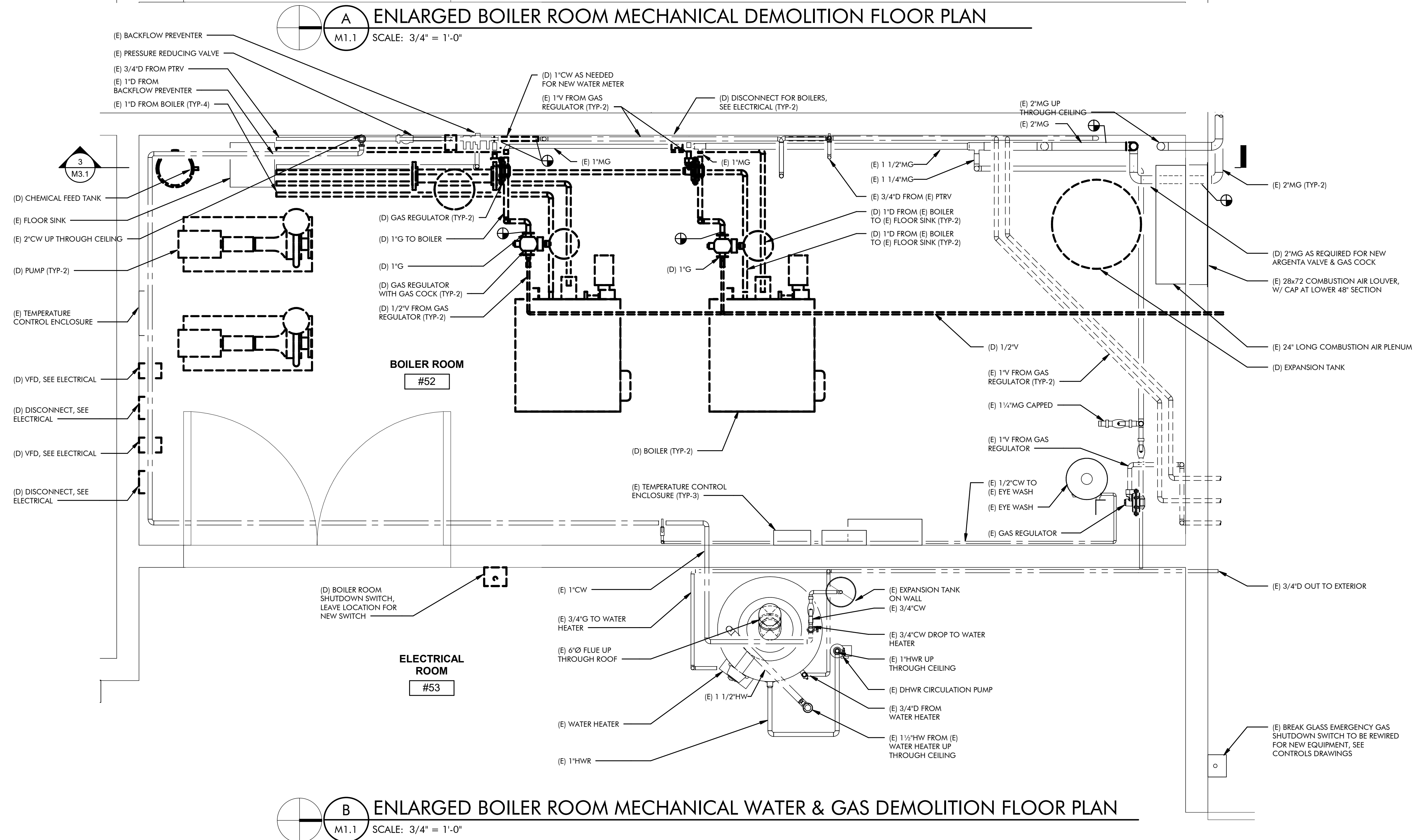
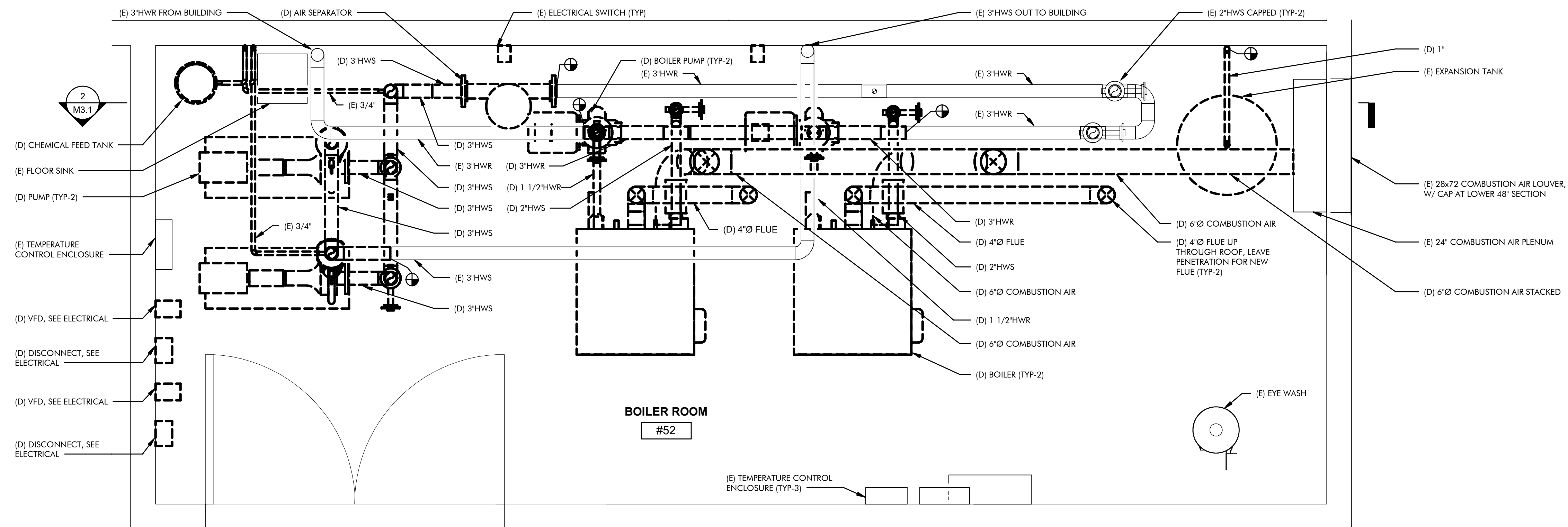
DOUGLAS COUNTY SCHOOL DISTRICT
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BOILER REPLACEMENT
1446 MUIR DRIVE, GARDNERVILLE, NV 89460
OVERALL MECHANICAL FLOOR PLAN

REVISIONS:		
REV.	DESCRIPTION	DATE
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CHECKED BY: CL
APPROVED BY: CLR
DATE: 1/31/2025
PROJECT NO: 158324

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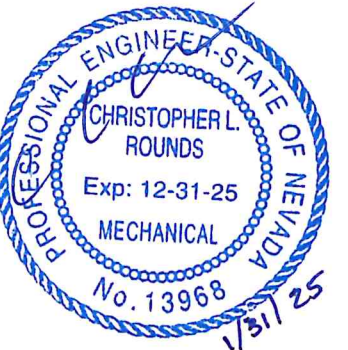


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ENLARGED BOILER ROOM MECHANICAL
DEMOLITION FLOOR PLAN

REVISIONS:

[illegible]

DRAWN BY:	RLT
DESIGNED BY:	TF
CHECKED BY:	CL
APPROVED BY:	CLR
DATE:	1/31/2025
PROJECT NO:	158324

SHEET NUMBER:

M1.1



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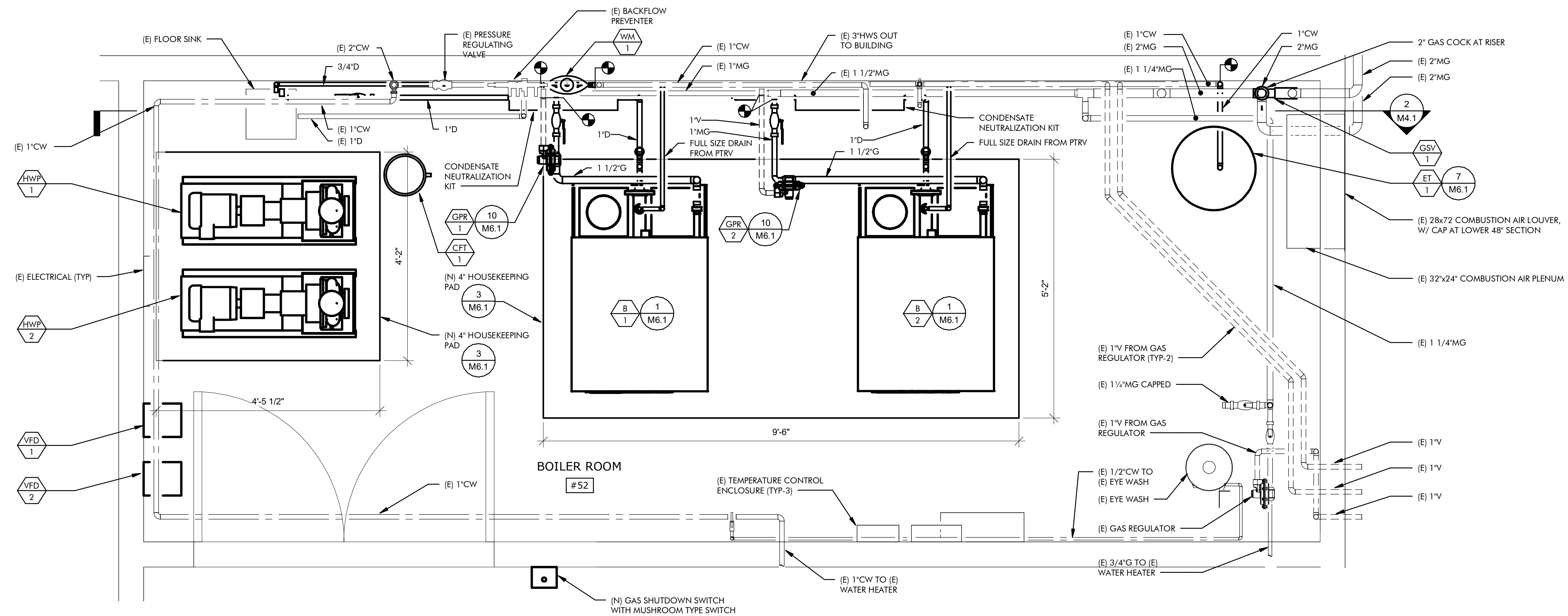
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BOILER REPLACEMENT
1446 MUJR DRIVE, GARDNERVILLE, NV 89460

ENLARGED BOILER ROOM MECHANICAL
FLOOR PLAN

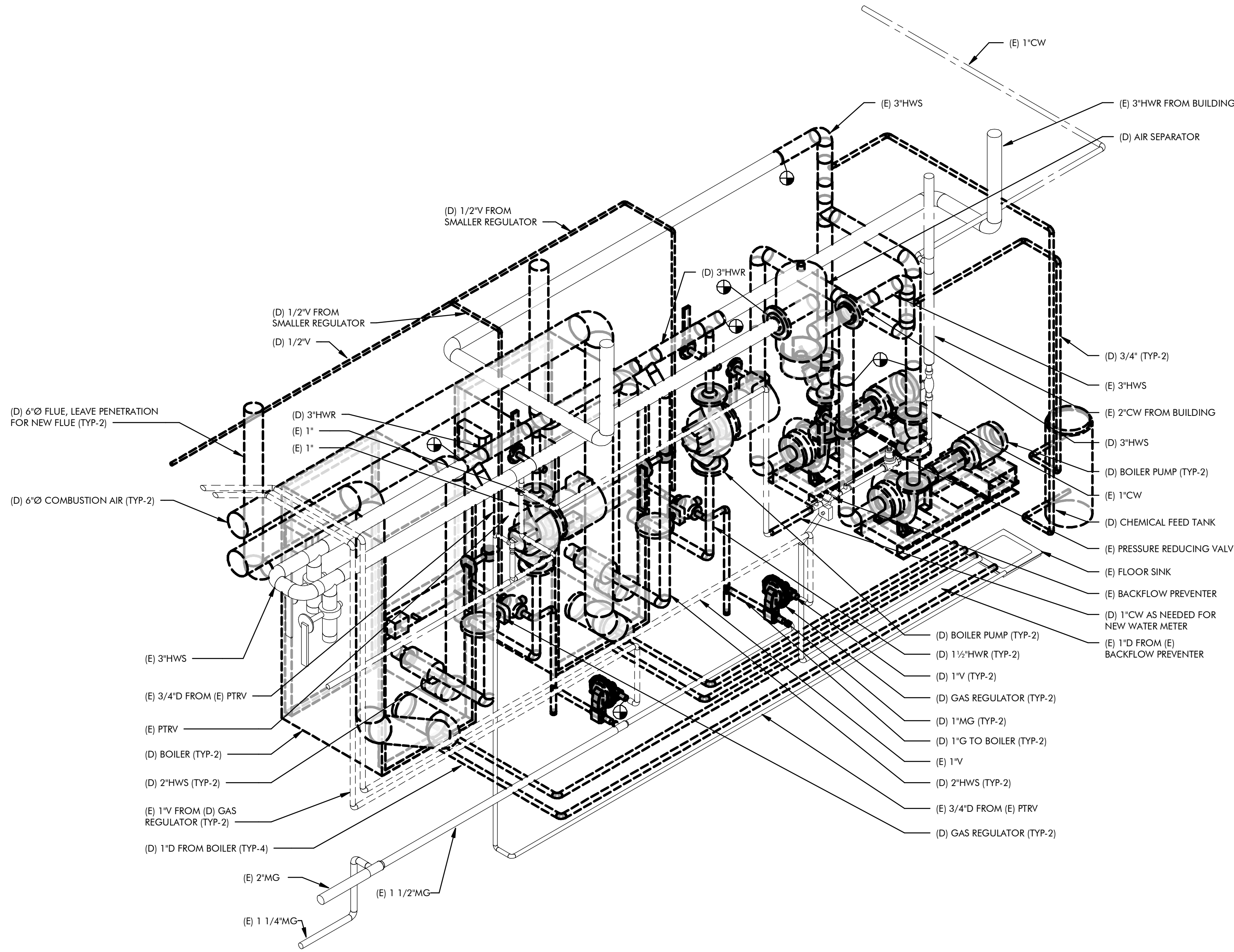
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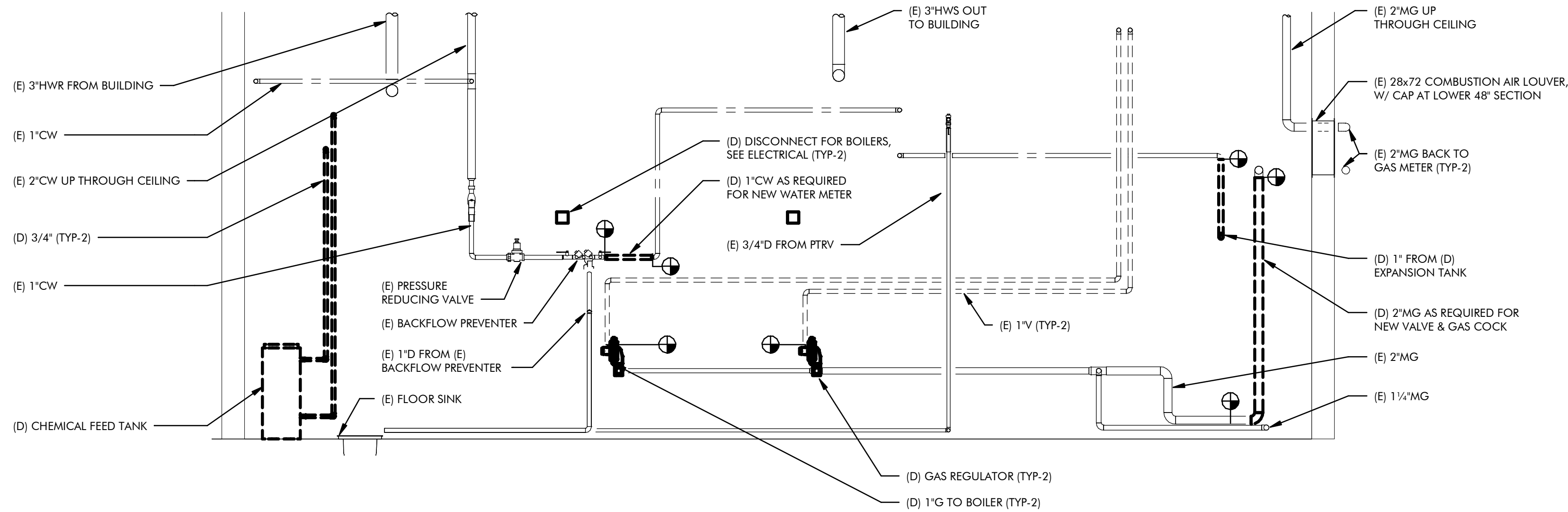
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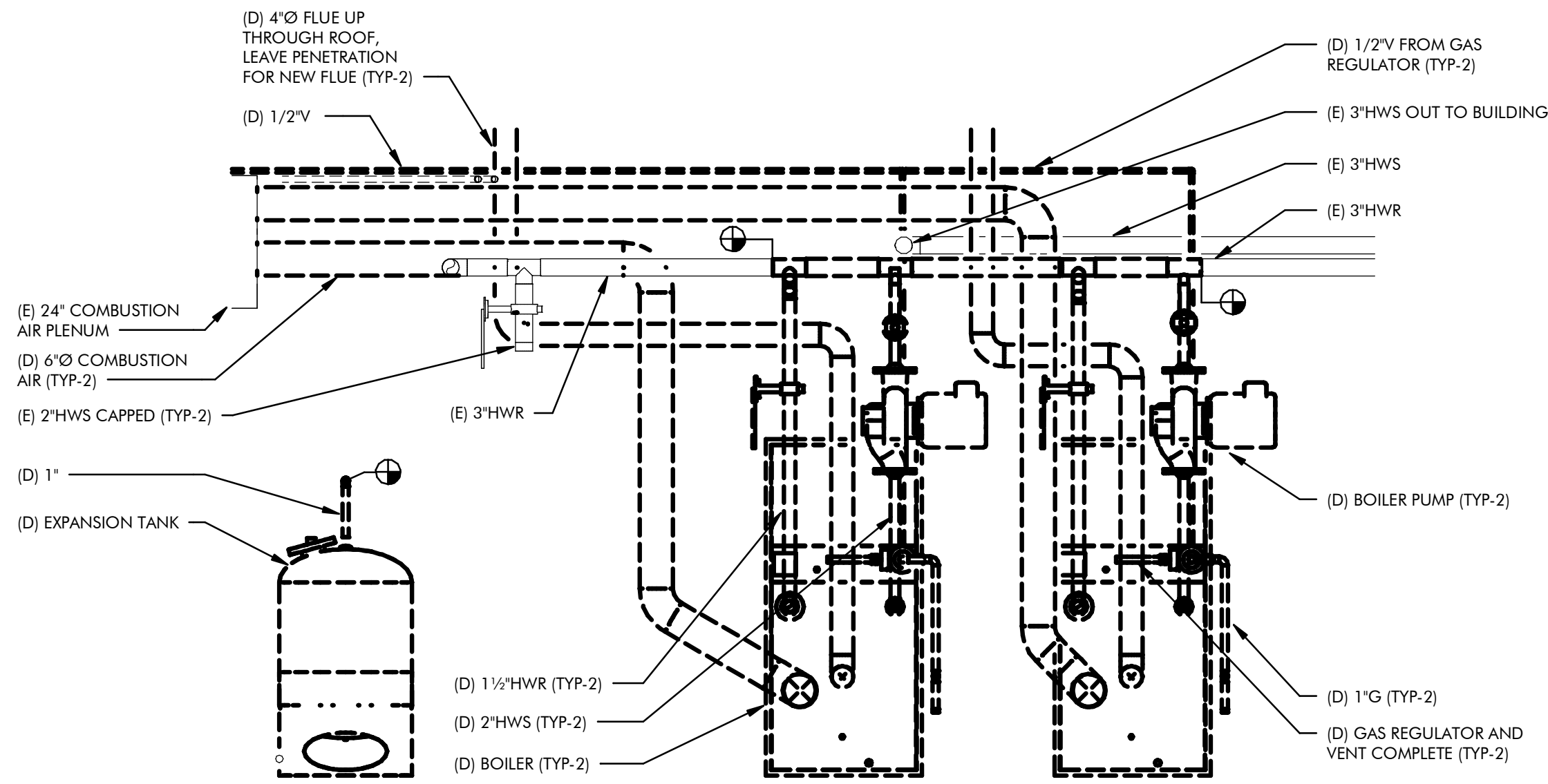
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1 DEMO BOILER ISOMETRIC
M3.1 SCALE : NONE



3 DEMOLITON GAS AND DRAIN SECTION
M3.1 SCALE: 1/2" = 1'-0"



2 DEMOLITION BOILER SECTION
M3.1 SCALE: 1/2" = 1'-0"

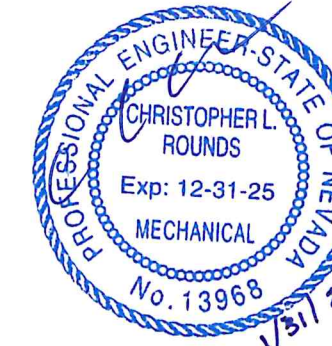


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MECHANICAL DEMOLITION SECTION AND
ISOMETRICS

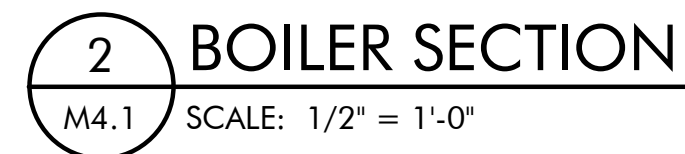
REVISIONS:

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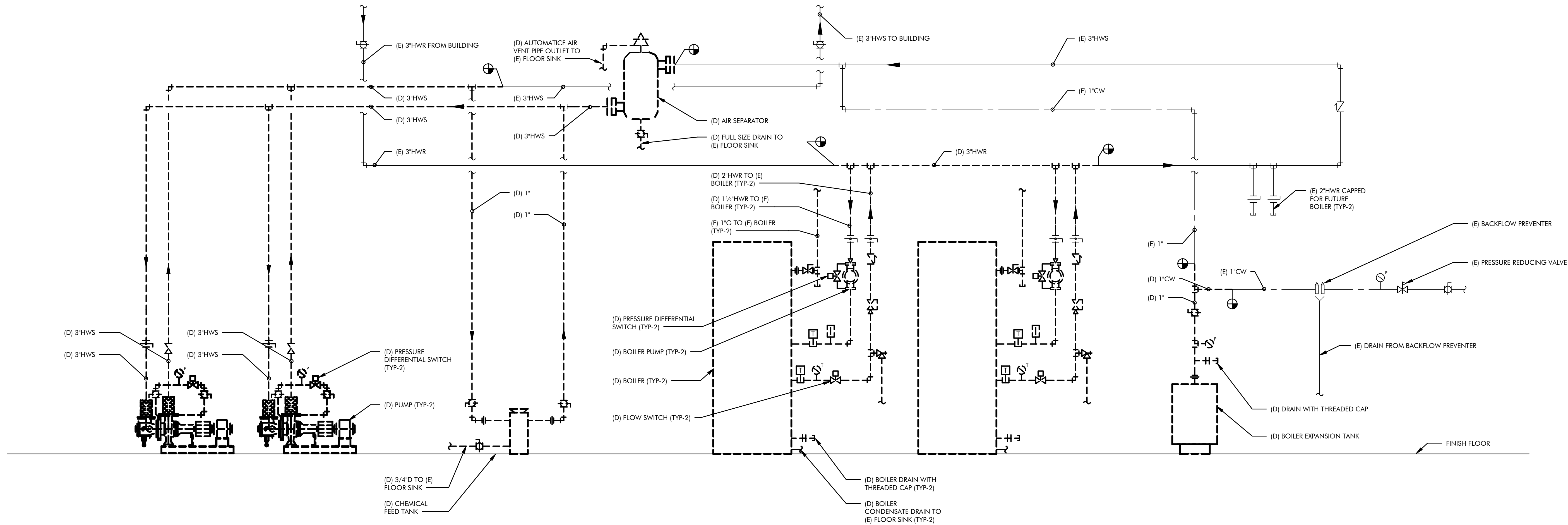
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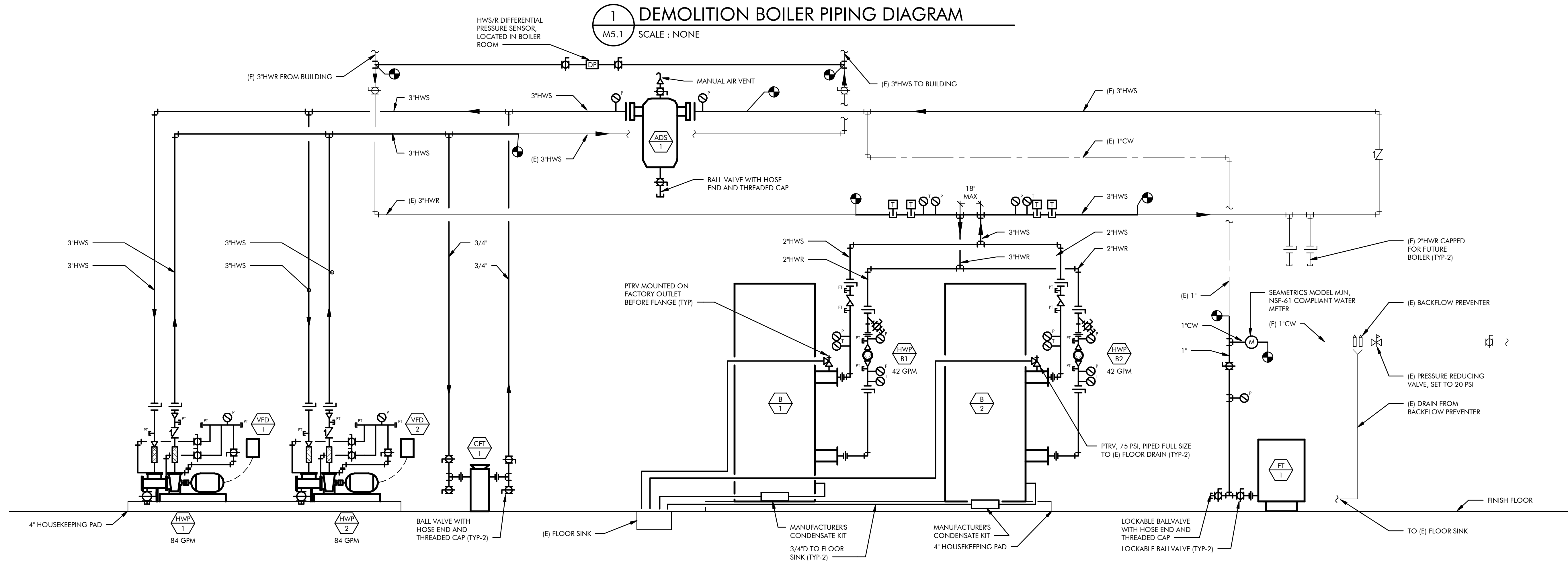


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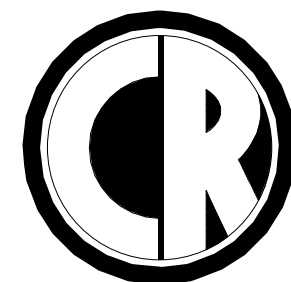
PLOT DATE:



1 DEMOLITION BOILER PIPING DIAGRAM
M5.1 SCALE : NONE



2 BOILER PIPING DIAGRAM
M5.1 SCALE : NONE

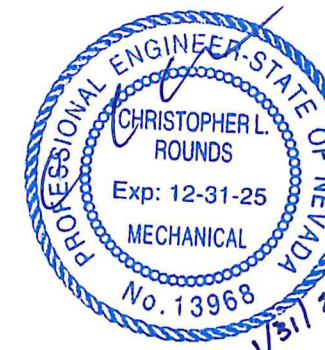


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MECHANICAL DEMOLITION AND NEW PIPING
DIAGRAMS

REVISIONS:

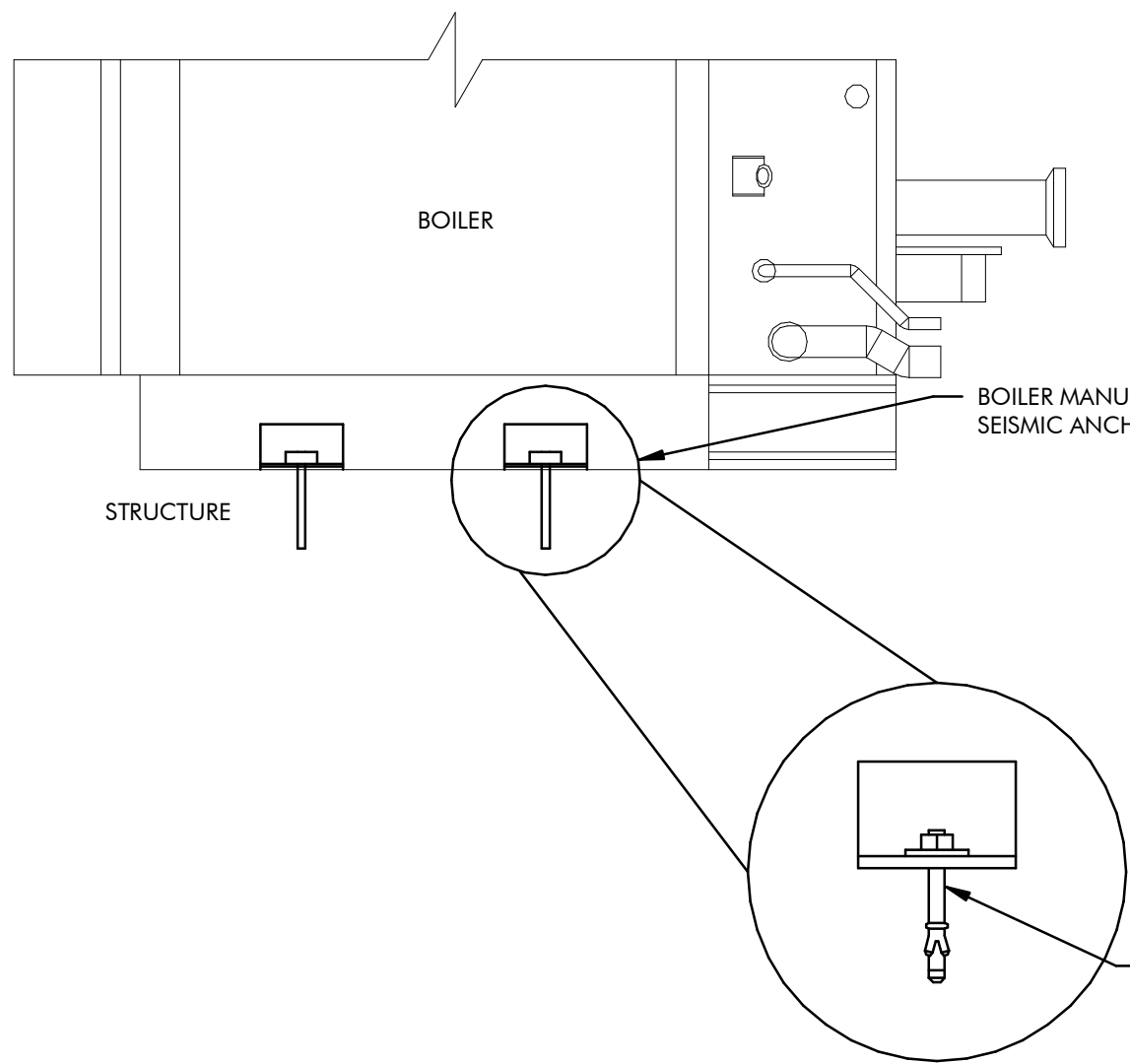
REV.	DESCRIPTION	DATE

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DATE: 1/31/2025
PROJECT NO: 158324

SHEET NUMBER:

M5.1

ANCHORAGE INSTALLATION INFORMATION					
ANCHOR	SIZE	SUPPORT	MINIMUM DIMENSIONS		
			EDGE (IN.)	DEPTH (IN.)	DEPTH (IN.)
DEWALT	3/8"Ø x 2.5"	SLAB	6	6	6
HILTI	3/8"Ø x 2.375"	SLAB	6	6	4-1/8



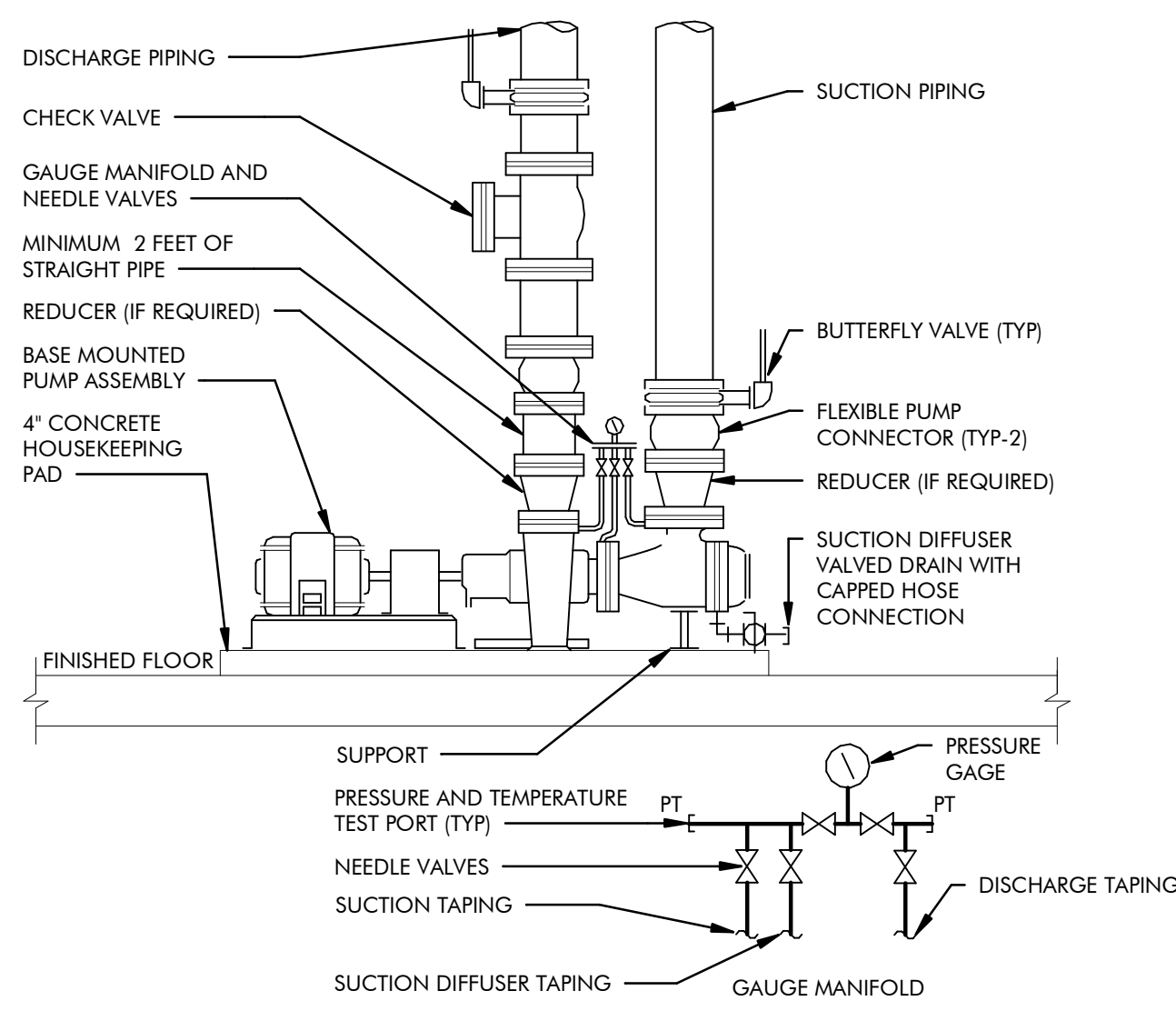
NOTE:

1. BOLT HOLES TO BE 1/16" LARGER THAN BOLT DIAMETER. FOR OVER-SIZED HOLES, CONTRACTOR TO USE WELDED WASHER AS SHOWN IN DETAIL B OR FILL OR FILL HOLE WITH EPOXY, GROUT, OR NEOPRENE GROMMET.

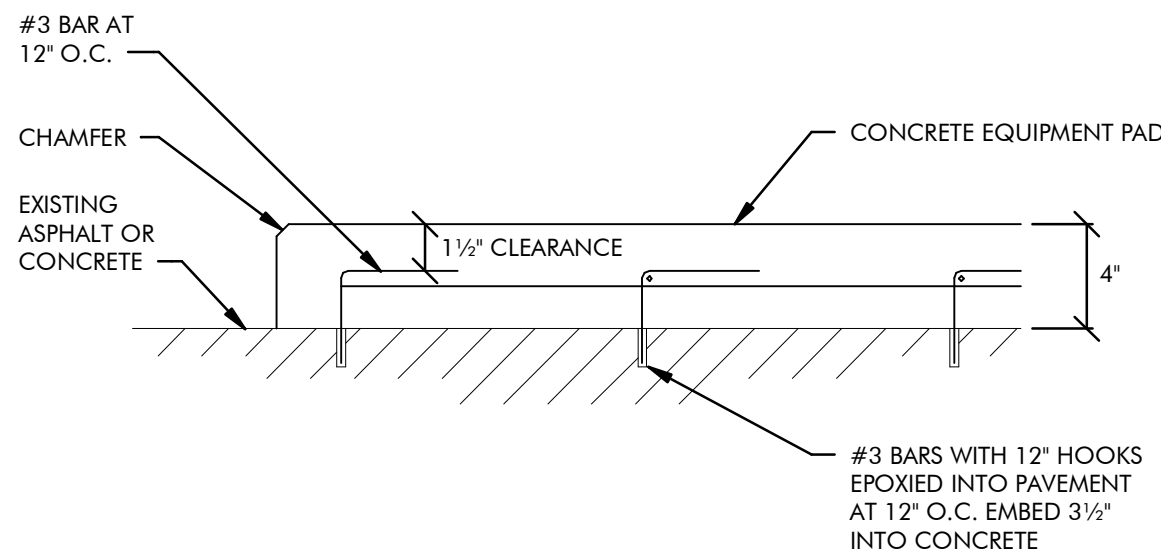
2. SEE CONDITION 4 TABLE FOR ANCHORAGE OPTIONS INTO SLAB AND FILLED DECK.

POWERSTUD+ SD2 OR HILTI KB-TZ PER CONDITION 4 TABLE. SEE ANCHORAGE INSTALLATION TABLE FOR MINIMUM SPACING AND CONCRETE DIMENSIONS. INSTALL PER ICC REPORT ESR-2502 (SD2) OR ESR-1917 (KB-TZ), TYP.

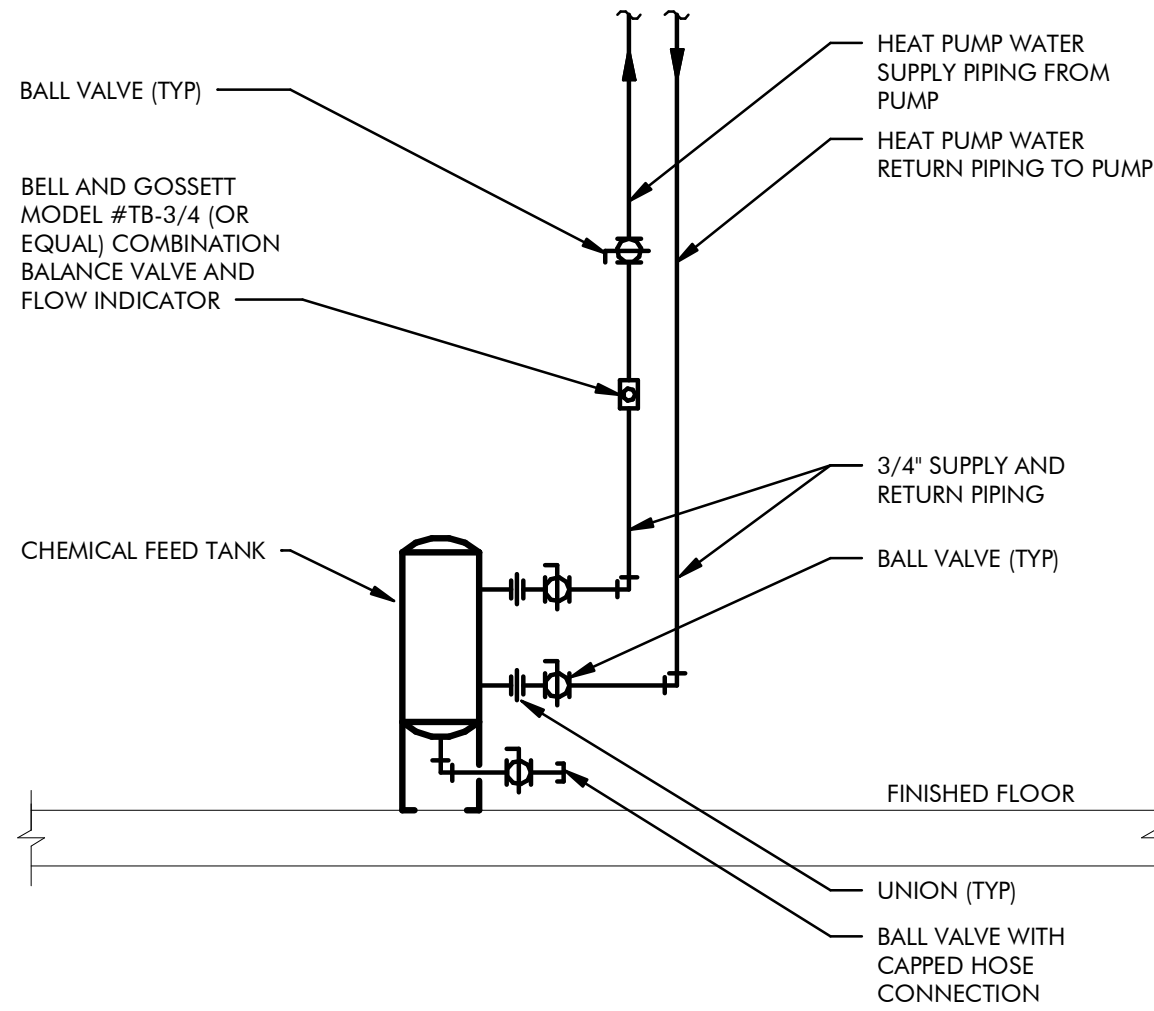
1 BOILER ANCHORAGE DETAIL
M6.1 SCALE : NONE



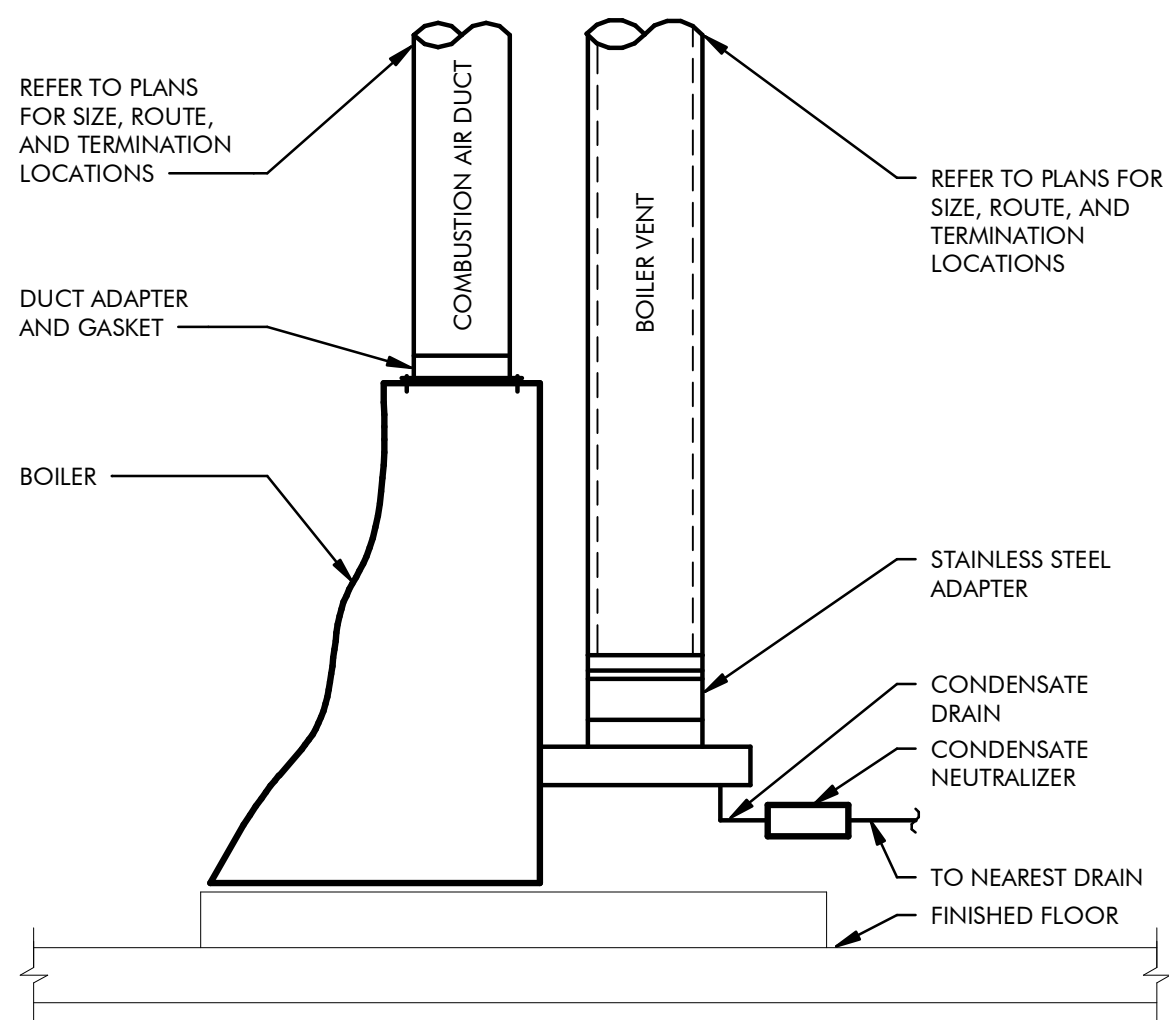
2 BASE-MOUNTED PUMP DETAIL
M6.1 SCALE : NONE



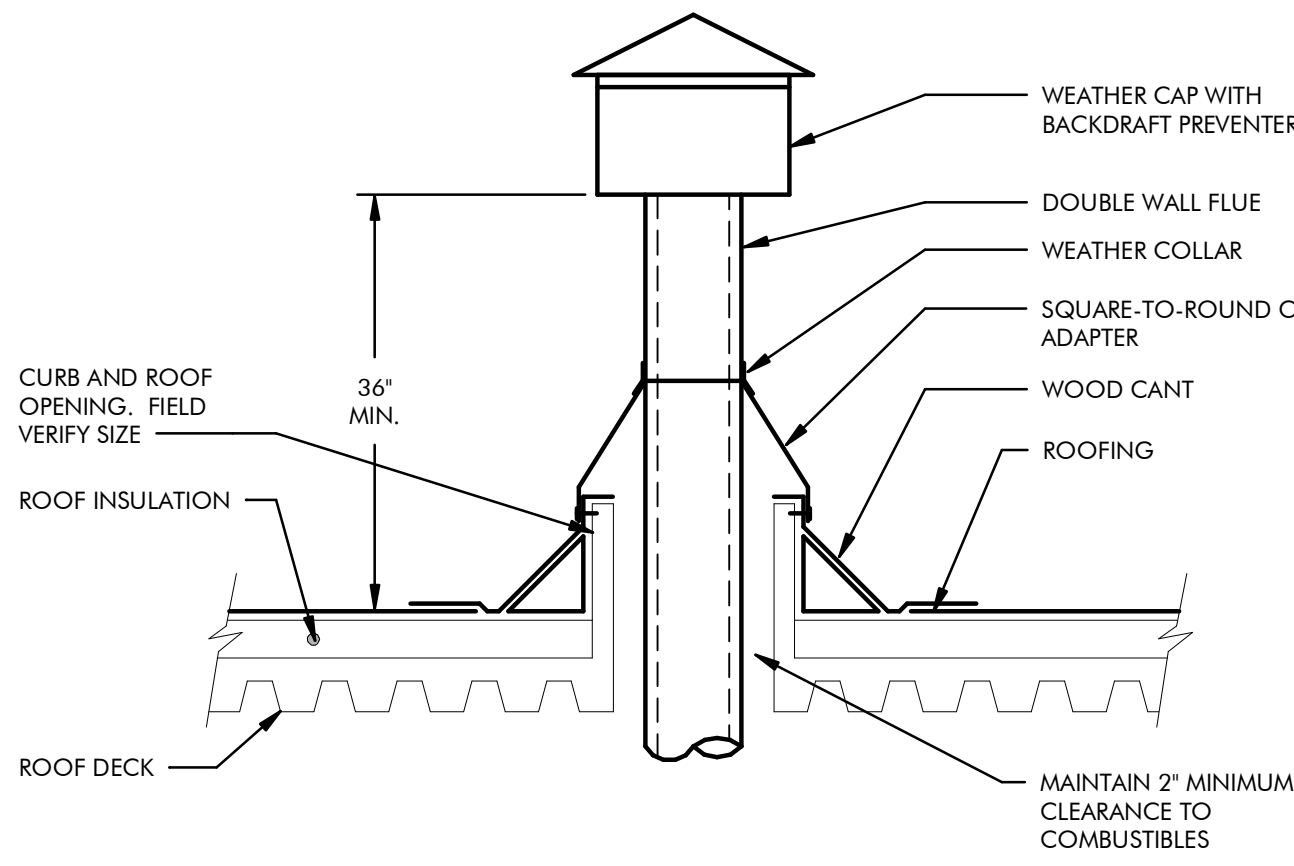
3 CONCRETE EQUIPMENT PAD
M6.1 SCALE : NONE



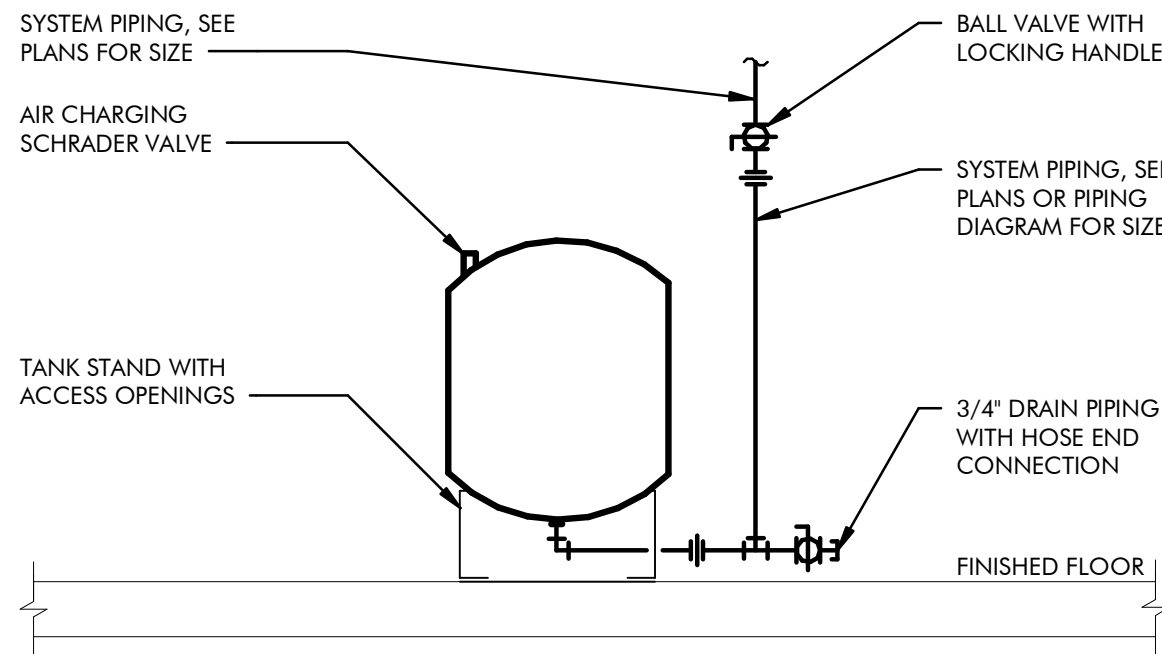
4 CHEMICAL FEED TANK DETAIL
M6.1 SCALE : NONE



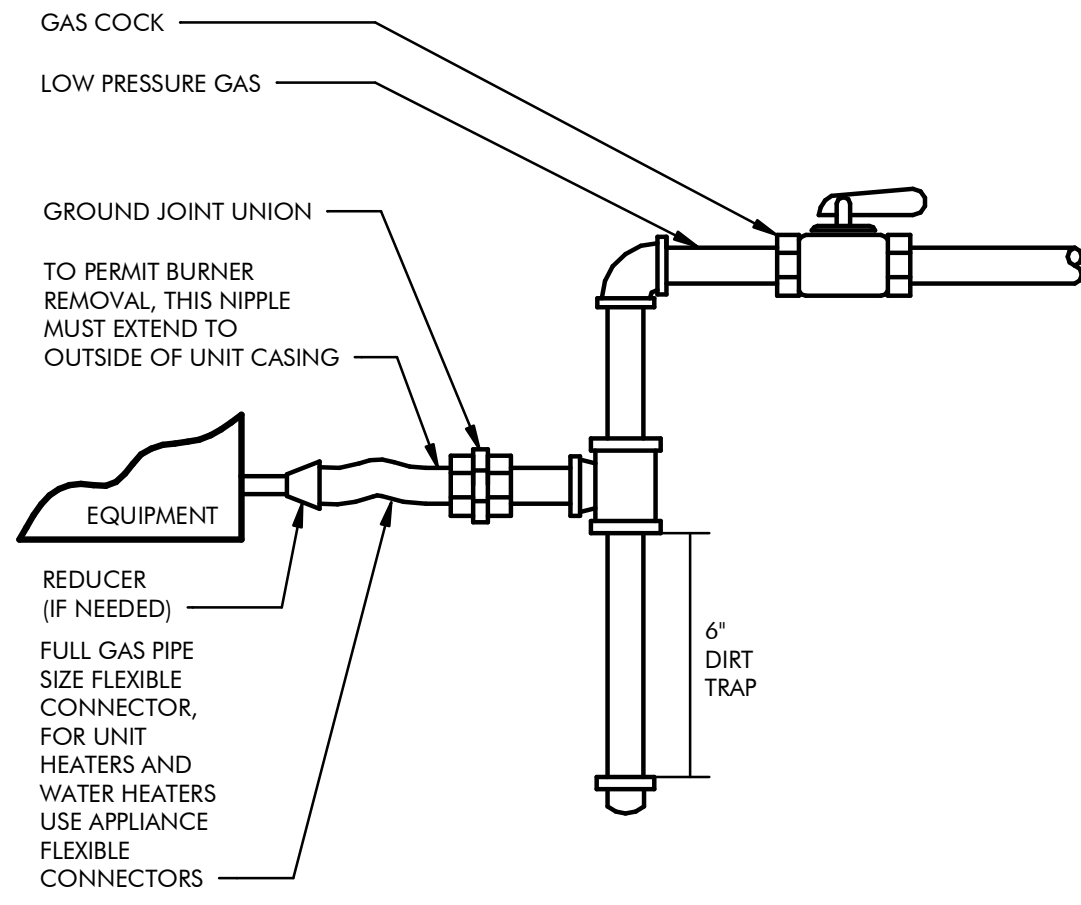
5 CONDENSING BOILER FLUE CONNECTION DETAIL
M6.1 SCALE : NONE



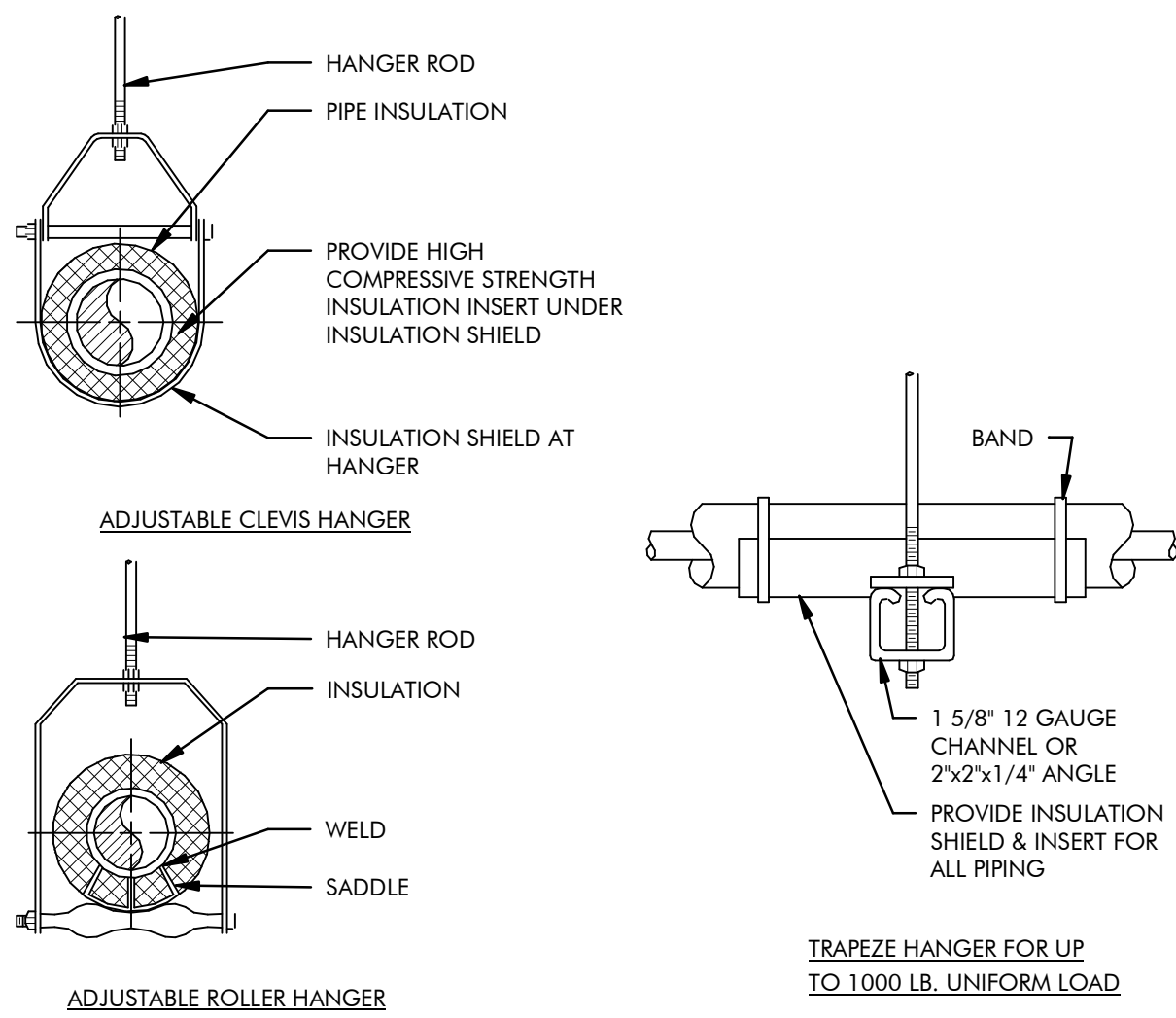
6 FLUE THROUGH ROOF DETAIL
M6.1 SCALE : NONE



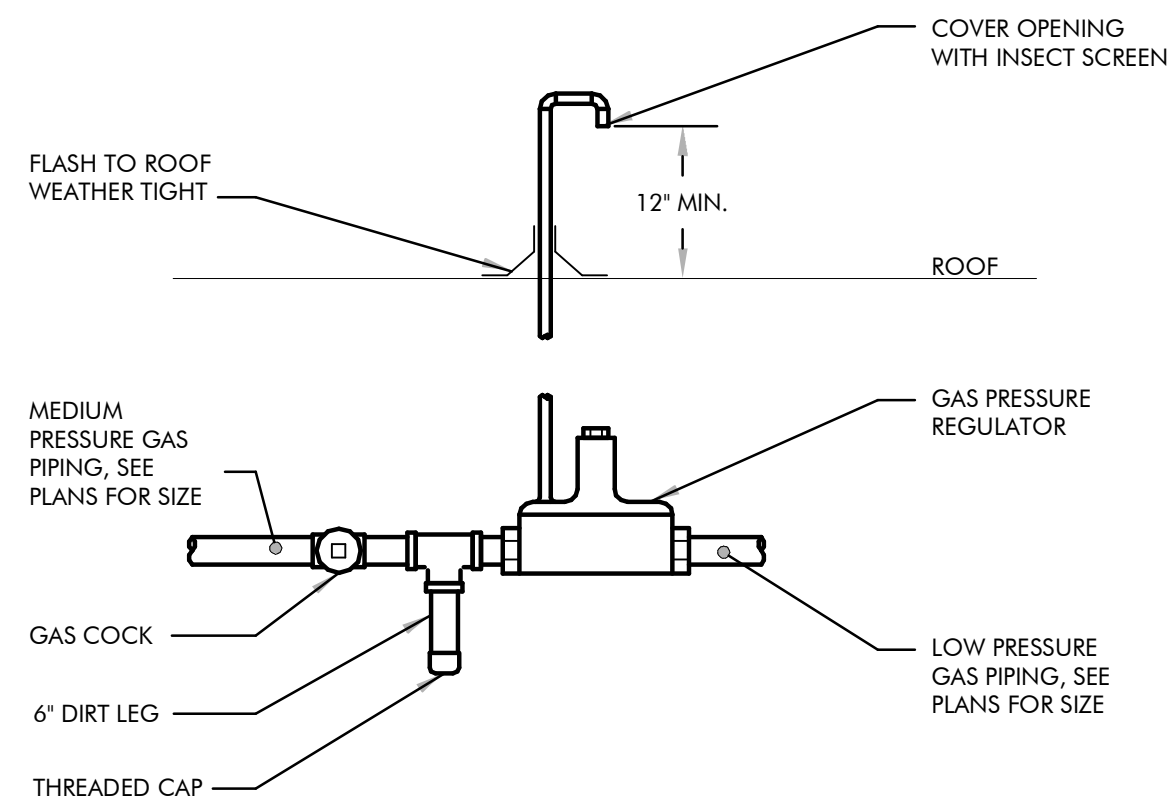
7 EXPANSION TANK DETAIL
M6.1 SCALE : NONE



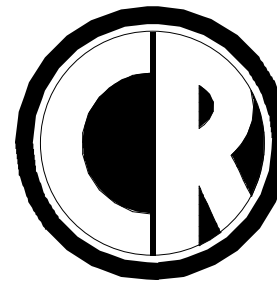
8 GAS CONNECTION DETAIL
M6.1 SCALE : NONE



9 TYPICAL PIPE HANGER DETAIL
M6.1 SCALE : NONE



10 GAS PRESSURE REGULATOR
M6.1 SCALE : NONE

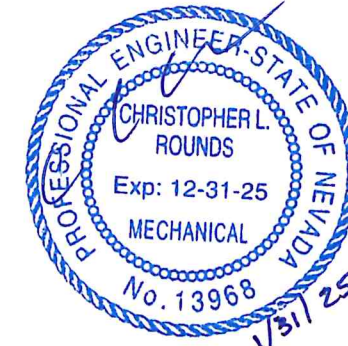


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MECHANICAL DETAILS

REVISIONS:

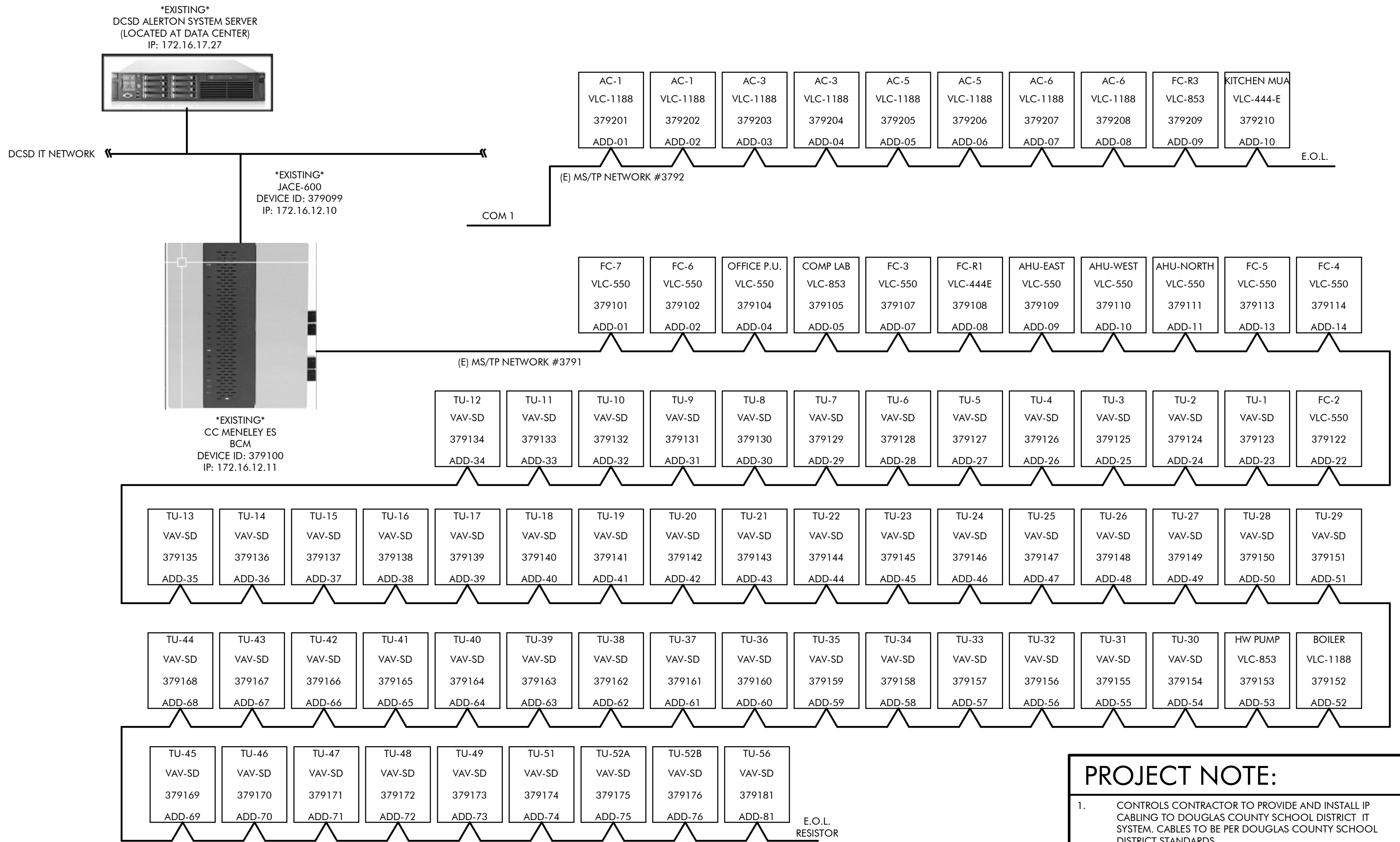
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DRAWN BY: RLT
DESIGNED BY: TF
CHECKED BY: CL
APPROVED BY: CLR
DATE: 1/31/2025
PROJECT NO: 158324

SHEET NUMBER:

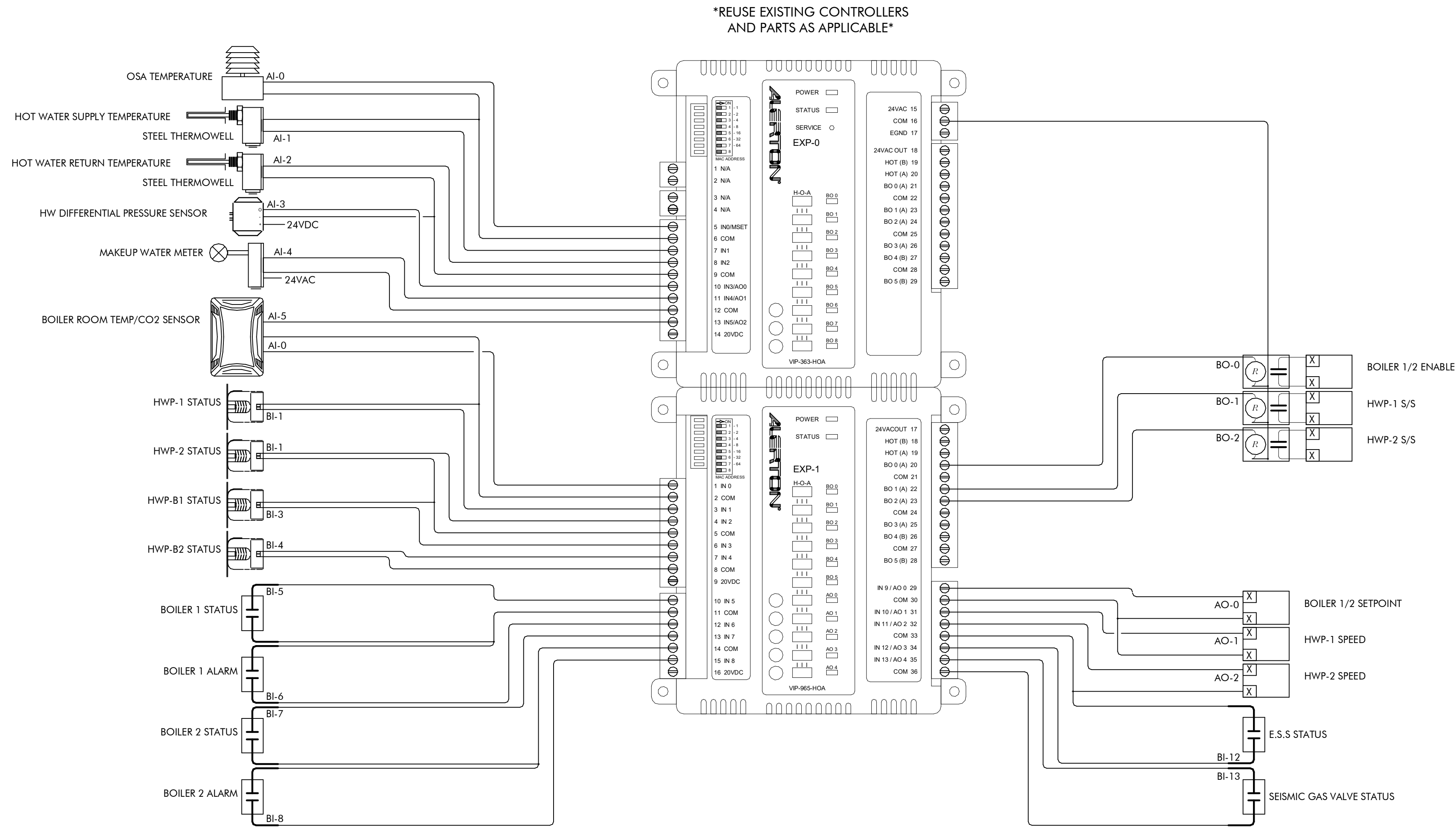
M6.1

PLOT DATE:



1 SYSTEM ARCHITECTURE

M7.1 SCALE: 12" = 1'-0"



2 BOILER PLANT CONTROL DIAGRAM

M7.1 SCALE: 12" = 1'-0"

CONTROLS SYMBOL LEGEND

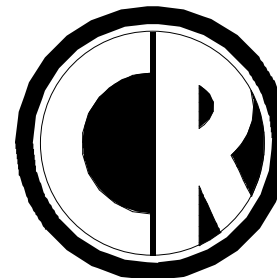
SYMBOL	ABBR.	DESCRIPTION
[AS]	AS	AVERAGING SENSOR
[BSP]	BSP	BUILDING STATIC PRESSURE SENSOR (WITH PROBES)
[CO]	CO ₂	CARBON DIOXIDE SENSOR
[CS]	CS	CURRENT SENSOR/SWITCH
[DP]	DP	DIFFERENTIAL PRESSURE SENSOR
[DSP]	DSP	DUCT STATIC PRESSURE SENSOR
[DS]	DS	DISCONNECT SWITCH (FUSED)
[ESD]	ESD	EMERGENCY SHUT-DOWN SWITCH (BREAK-GLASS TYPE)
[FSD]	FSD	COMBINATION FIRE/SMOKE DAMPER
[FMS]	FMS	FLOW MEASURING STATION
[FS]	FS	FLOW SWITCH
[HDS]	HDS	HIGH STATIC PRESSURE SENSOR
[M]	M	MOTORIZED ACTUATOR
[MS]	MS	MOTOR STARTER
[OA]	OA	OUTSIDE AIR TEMPERATURE/HUMIDITY SENSOR
[OS]	OS	OCCUPANCY SENSOR
[OSP]	OSP	OUTDOOR STATIC PRESSURE SENSOR
[R]	R	RELAY (POLES AND VOLTAGE AS REQUIRED)
[RTS]	RTS	ROOM TEMPERATURE SENSOR
[SD]	SD	SMOKE DAMPER
[S]	SD	SMOKE DETECTOR (PRODUCTS OF COMBUSTION DETECTOR)
[T]	TS	TEMPERATURE SENSOR (PENCIL TYPE)
[TSTAT]	TSTAT	THERMOSTAT OR TEMPERATURE SENSOR @ 48" AFF
[TX]	TX	TRANSFORMER (SIZE & VOLTAGE AS REQUIRED)
[E]		BY ELECTRICAL CONTRACTOR
[P]		BY PLUMBING CONTRACTOR
[M]		BY MECHANICAL CONTRACTOR
[OBD]	OBD	OPPOSED BLADE DAMPER
[PBD]	PBD	PARALLEL BLADE DAMPER
[TCV]	TCV	TEMPERATURE CONTROL VALVE (2-WAY OR 3-WAY)
[P T]		PRESSURE SENSOR, TEMPERATURE SENSOR WITH WELL
[P T]		PRESSURE GAUGE, TEMPERATURE GAUGE
[P]	P	PUMP
		POWER WIRING BY ELECTRICAL CONTRACTOR
		CONTROL WIRING

CONTROLS ABBREVIATIONS

AFF/AFG	ABOVE FINISHED FLOOR/GRADE
BSP	BUILDING STATIC PRESSURE SENSOR (WITH PROBES) CO CARBON MONOXIDE
DDC	DIRECT DIGITAL CONTROL SYSTEM
EA	EXHAUST AIR
HPS/HPR	HEAT PUMP WATER SUPPLY/RETURN PIPING
MAX	MAXIMUM
MOD	MODULATING ACTUATOR (SPRING RETURN - U.N.O.)
MIN	MINIMUM
NC	NORMALLY CLOSED
NO	NORMALLY OPEN
OA	OUTSIDE AIR
RA	RETURN AIR
SA	SUPPLY AIR
TCP	TEMPERATURE CONTROL PANEL
TYP	TYPICAL
UNO	UNLESS NOTED OTHERWISE
VFD	VARIABLE FREQUENCY DRIVE
2-POS	TWO-POSITION ACTUATOR (SPRING RETURN - U.N.O.)

CONTROL NOTES

- ALL WIRING TO BE IN CONDUIT. PLENUM RATED CABLE WITH J-HOOKS IS ALLOWED FOR ABOVE CEILING INSTALLATION.
- CONTROL SYSTEM CONTRACTOR SHALL PROVIDE A COMPLETE DIRECT DIGITAL CONTROL SYSTEM. PROVIDE AND INSTALL ALL NECESSARY WIRING TO MAKE SYSTEM OPERATIONAL. ALL WIRING SHALL BE IN CONDUIT WITH ANY SPLICES MADE IN JUNCTION BOXES. CONTROL DIAGRAMS AND SEQUENCE OF OPERATION ON REFER TO DRAWINGS.
- CONTROLS CONTRACTOR SHALL CONNECT NEW CONTROLLERS TO THE CONTROL NETWORK AND ADD NEW GRAPHICS. COORDINATE ALL WORK WITH LCSD MAINTENANCE PRIOR TO BID.
- THE THERMOGRAPHIC FLOOR PLAN SHALL BE UPDATED WITH THE NEW FLOOR PLAN AND ZONING, INCLUDING THE ROOM TEMPERATURE SENSORS.
- CONTROLS CONTRACTOR TO COORDINATE UNIT LABELING ON GRAPHICS, THERMOSTAT, AND CONTROLLER WITH LCSD MAINTENANCE PRIOR TO INSTALLATION.
- CONTROLS CONTRACTOR:
CERRIS SYSTEMS
4750 LONGLEY LANE #106
RENO, NV 89502

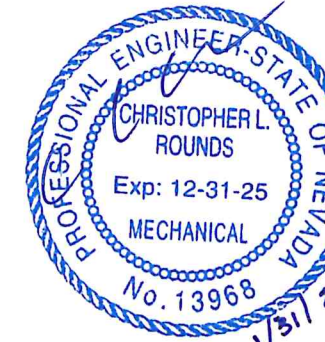


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CONSULTANT:

DOUGLAS COUNTY SCHOOL DISTRICT
CC MENELEY ELEMENTARY SCHOOL
BOILER REPLACEMENT
1446 MUIR DRIVE, GARDNERVILLE, NV 89460
MECHANICAL CONTROL DIAGRAMS AND
SEQUENCE OF OPERATION

REVISIONS:

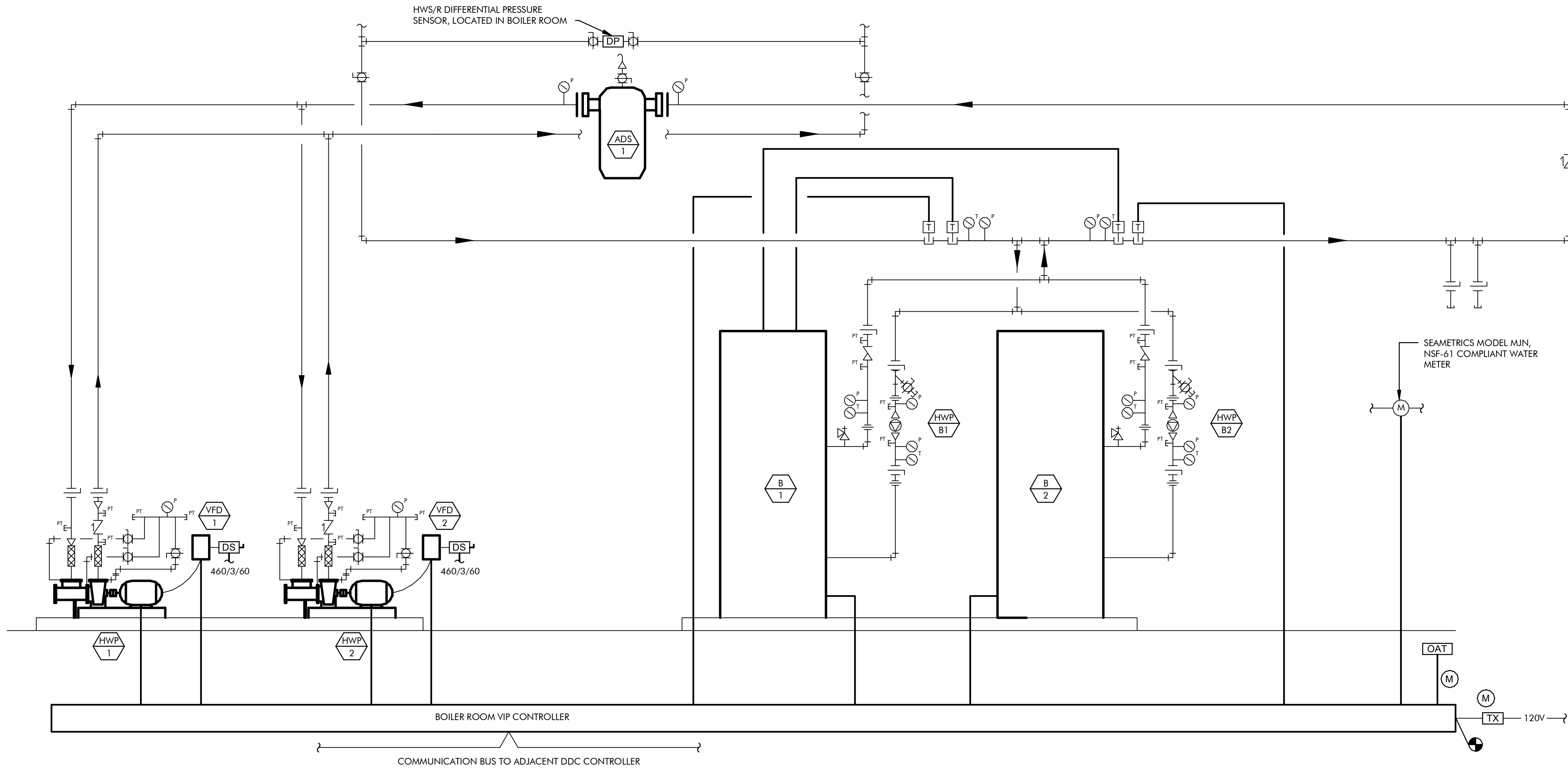
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DRAWN BY: RLT
DESIGNED BY: TF
CHECKED BY: CL
APPROVED BY: CLR
DATE: 1/31/2025
PROJECT NO: 158324

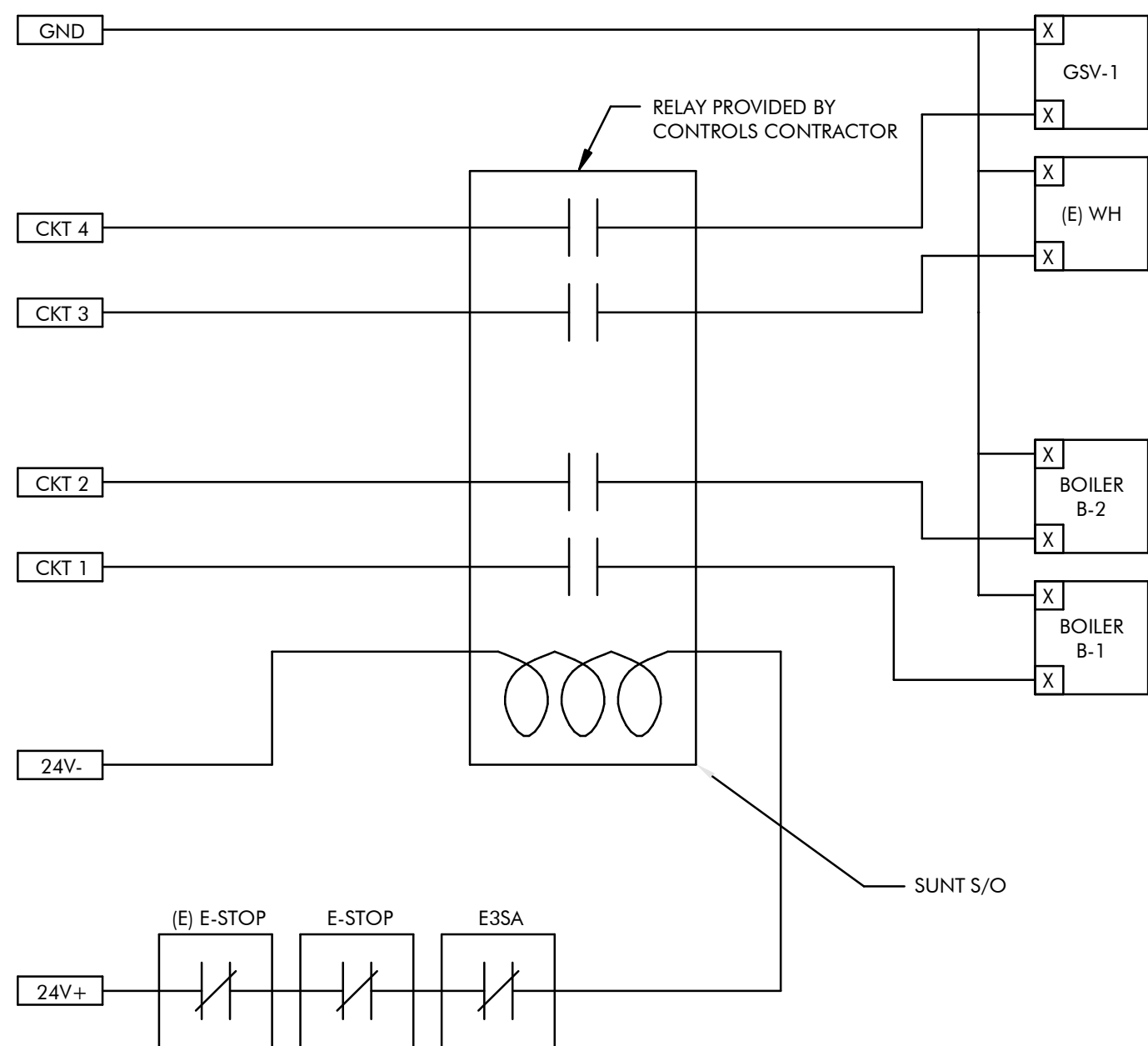
SHEET NUMBER:

M7.1

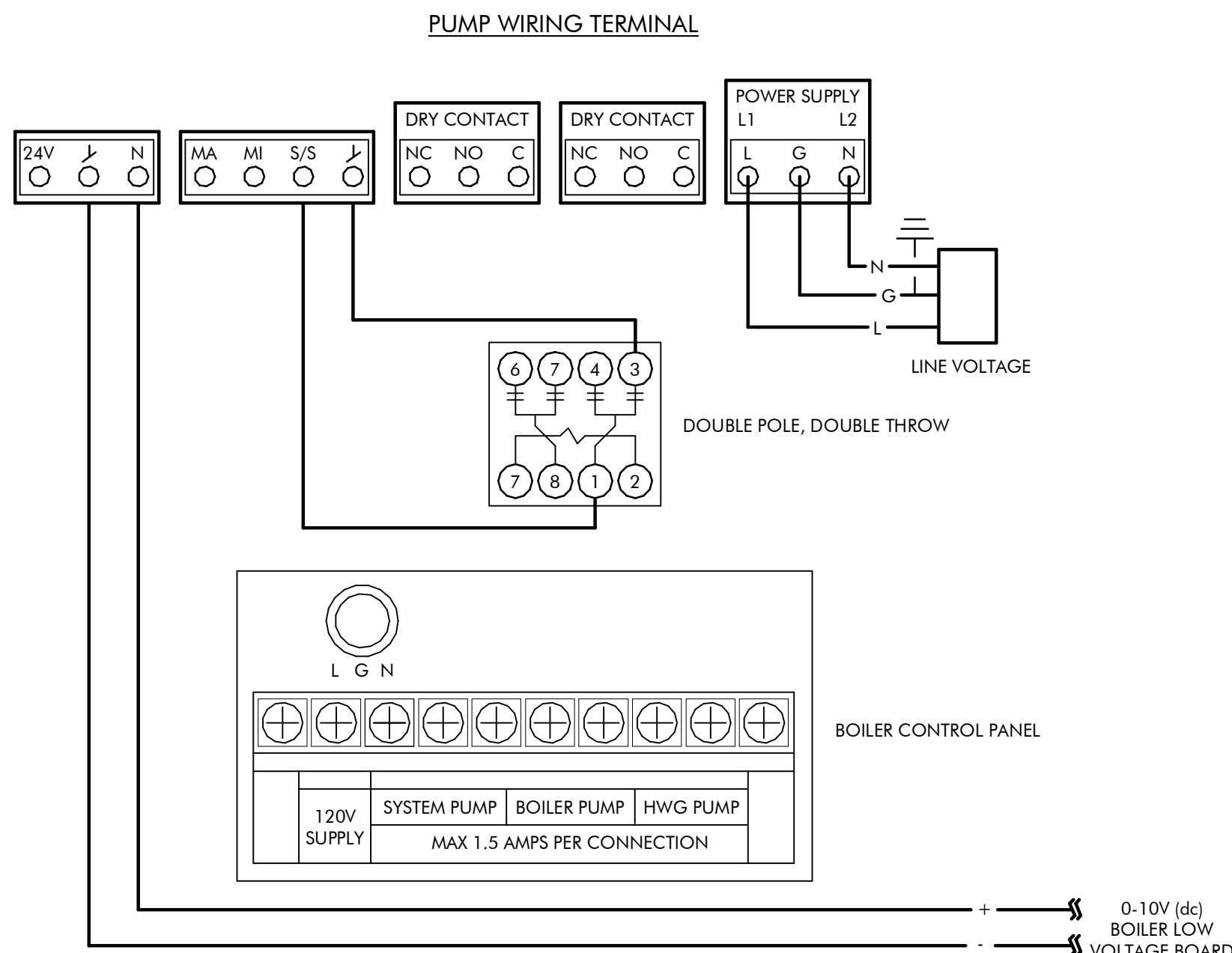
PLOT DATE:



1 HEATING HOT WATER CONTROL DIAGRAM
M7.2 SCALE : NONE



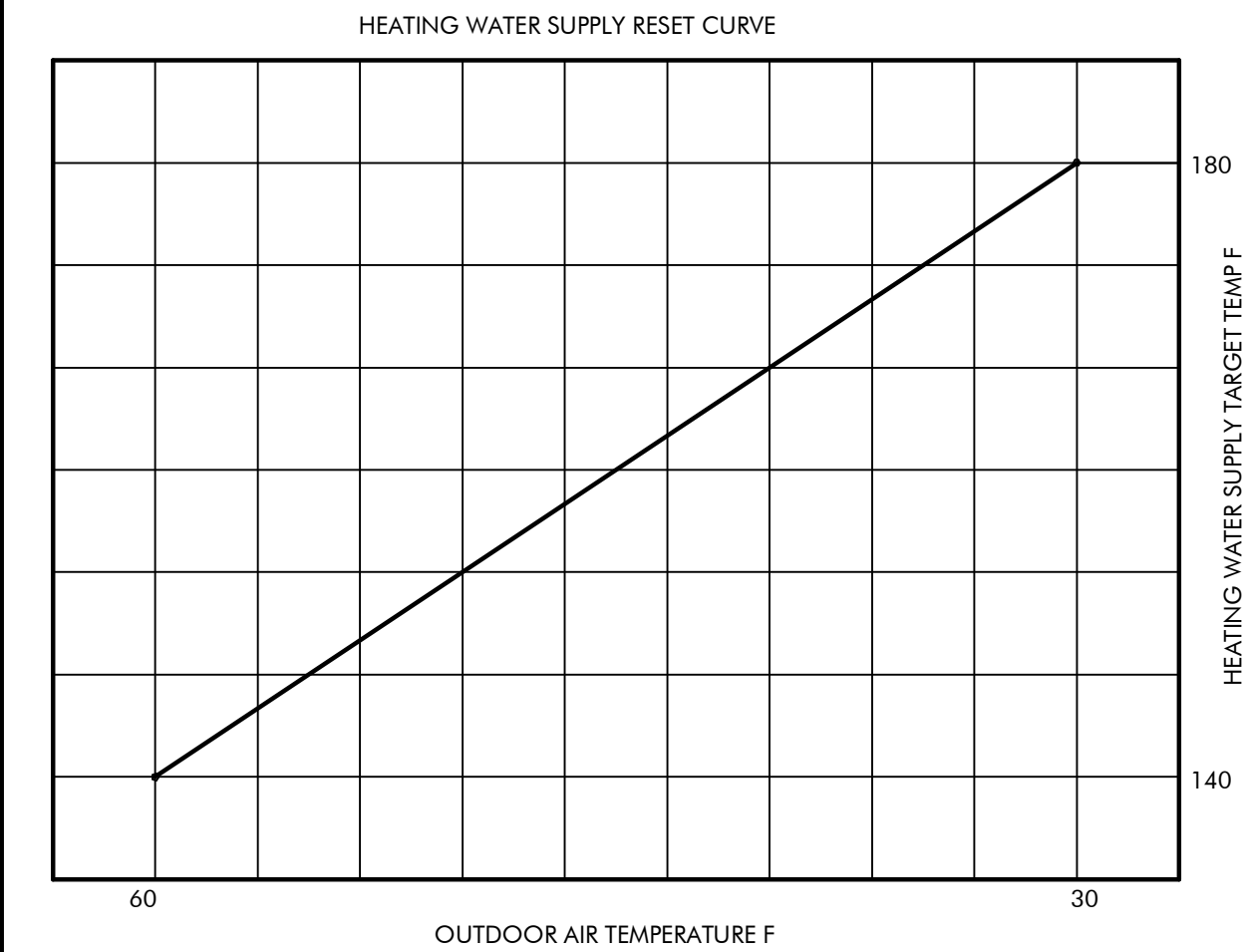
2 BOILER E-STOP CONTROL DIAGRAM
M7.2 SCALE : NONE



3 BOILER PUMP (HWP-B1, & HWP-B2) WIRING DIAGRAM
M7.2 SCALE : NONE

HEATING HOT WATER SYSTEM SEQUENCE OF OPERATION

- A. SETPOINTS
- HEATING SYSTEM SHALL BE ENABLED AT 60°F AND DISABLED AT 70°F (10°F DEADBAND) OR AS DIRECTED BY THE OWNER. ALL SETTINGS SHALL BE ADJUSTABLE.
 - THE HEATING WATER SUPPLY TEMPERATURE SHALL BE RE-SET BY THE BUILDING MANAGEMENT SYSTEM IN ACCORDANCE WITH THE FOLLOWING CURVE (INITIALLY 1:1 RATIO):



- B. BUILDING HEATING PUMPS (HWP-1, & HWP-2)
- WHEN HEATING SYSTEM IS ENABLED, THE BUILDING MANAGEMENT SYSTEM SHALL START LEAD BUILDING SUPPLY PUMP (HWP-1, & HWP-2)
 - UPON FAILURE OF THE LEAD PUMP, THE BUILDING MANAGEMENT SYSTEM SHALL ENERGIZE THE LAG (STANDBY) PUMP.
 - THE BUILDING MANAGEMENT SYSTEM SHALL ALTERNATE LEAD/LAG OF PUMPS WEEKLY.
- C. BOILERS (B-1 & B-2) AND ASSOCIATED BOILER PUMP (HWP-B1, & HWP-B2)
- THE BUILDING MANAGEMENT SYSTEM SHALL SEND SIGNAL TO MASTER BOILER CONTROLLER. THE BOILER CONTROLLER SHALL ENERGIZE LEAD BOILER (B-1 / B-2) AND START ASSOCIATED PUMP (HWP-B1 / HWP-B2) UTILIZING THE BOILERS INTERNAL LEAD/LAG CONTROL.
 - THE ASSOCIATED BOILER PUMP SHALL RUN CONTINUOUSLY WHEN BOILER IS IN OPERATION. THE BOILER CONTROLLER SHALL SHUT OFF THE PUMP 15 MINUTES AFTER BOILER SHUTDOWN TO PREVENT RESIDUAL HEAT FROM EXCEEDING BOILER HIGH LIMIT TEMPERATURE.
 - FLOW SWITCH AT BOILER DISCHARGE ALLOWS BOILERS TO ENERGIZE. BOILER INTEGRAL CONTROLS TO MODULATE BURNER TO MAINTAIN SYSTEM HEADER WATER TEMPERATURE SETPOINT.
 - THE BOILER CONTROLLER SHALL INDICATE ALARM CONDITION WHENEVER THE BOILER INDICATES FAILURE (THROUGH ALARM CONTACTS).
 - THE MANUAL RESET HIGH LIMIT CONTROL ON EACH BOILER SHALL BE SET INITIALLY AT APPROXIMATELY 210°F (ADJUSTABLE).
 - IF ANY SPACE TEMPERATURE SENSOR FALLS BELOW 50°F, THEN THE HEATING SYSTEM SHALL BE PLACED IN THE ENABLED MODE.
 - SAFETIES:
 - FLOW SWITCH SHALL DISABLE BOILER AND SET ALARM.
 - EMERGENCY SHUTDOWN SWITCH AT EACH BOILER ROOM EXIT SHALL DISCONNECT THE POWER TO ALL FUEL BURNING EQUIPMENT IN BOILER ROOM.
 - THE BUILDING MANAGEMENT SHALL SEND SIGNAL TO MASTER BOILER CONTROLLER, WHEN THE CONTROLLER ENERGIZES EITHER BOILERS, THE SUPPLY FAN (SF-1) SHALL ENERGIZE.

- D. OPERATOR'S TERMINAL
- SEE 'TEMPERATURE CONTROL AND EMCS GENERAL NOTES'.
 - HEATING WATER SUPPLY TEMPERATURE (°F).
 - HEATING WATER RETURN TEMPERATURE (°F).
 - BOILER SUPPLY TEMPERATURE (°F).
 - BOILER COMMAND (ENABLE/DISABLE).
 - BOILER STATUS (ON/OFF).
 - BOILER ALARM (ALARM/NORMAL).
 - HW PUMP COMMAND (START/STOP).
 - HW PUMP STATUS (ON/OFF).
 - HEATING WATER RESET TEMPERATURE (°F).

- E. SAFETIES
- EMERGENCY BOILER ROOM SHUT DOWN, SEE SEQUENCE BELOW
 - ROOM CARBON MONOXIDE (CO) DETECTOR SHALL ALARM IN ROOM AND ALSO BMS WHEN LEVELS ARE ABOVE 50 PPM (ADJUSTABLE THROUGH BMS)

BOILER ROOM EMERGENCY SHUTDOWN SEQUENCE OF OPERATION

- WHEN THE EMERGENCY SHUTDOWN BUTTON IS ENGAGED, BOTH BOILERS (B-1 AND B-2) WILL SHUT DOWN AND LOCKED OUT VIA THE AUXILIARY CONTACT LOCKOUT ON THE BOILERS. EXISTING UNIT HEATER SHALL ALSO SHUT DOWN. EXISTING WATER HEATER SHALL ALSO SHUT DOWN BY A NORMALLY CLOSED RELAY BETWEEN THE OUTLET AND POWER PLUG. IN ADDITION, THE GAS SHUT OFF VALVE (GSV-1) SHALL BE TRIPPED AND VALVE SHALL BE CLOSED.



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MECHANICAL CONTROL DIAGRAMS AND
SEQUENCE OF OPERATION

REVISIONS:

REV.	DESCRIPTION	DATE
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DRAWN BY: RLT
DESIGNED BY: TF
CHECKED BY: CL
APPROVED BY: CLR
DATE: 1/31/2025
PROJECT NO: 158324

SHEET NUMBER:

M7.2

ELECTRICAL SYMBOLS AND NOMENCLATURE

	SINGLE-OUTLET RECEPTACLE		SINGLE-PHASE, 1-POLE CIRCUIT PATH (1/2" CONDUIT, (2) - #10 CU, UNLESS OTHERWISE NOTED) BELOW FLOOR
	DOUBLE-OUTLET "DUPLEX" RECEPTACLE		SINGLE-PHASE, 2-POLE CIRCUIT PATH (1/2" CONDUIT, (3) - #10 CU, UNLESS OTHERWISE NOTED) BELOW FLOOR
	THREE-PHASE (3W) RECEPTACLE (CONFIGURATION AS NOTED)		THREE-PHASE, 1-POLE CIRCUIT PATH (1/2" CONDUIT, (4) - #10 CU, UNLESS OTHERWISE NOTED) BELOW FLOOR
	QUADRUPLE-OUTLET "QUAD" RECEPTACLE		RETURN CIRCUIT TO PANEL "HOMERUN" (CIRCUIT AS NOTED) ABOVE FLOOR
	SPECIAL RECEPTACLE (VOLTAGE/CONFIGURATION AS NOTED)		CIRCUIT BREAKER (AMPS/POLES AS NOTED)
	JUNCTION BOX		FUSE (AMPS/POLES AS NOTED)
	FLOOR MOUNT RECEPTACLE		SHEET NOTE INDICATOR
	THERMOSTAT		SHEET/EQUIPMENT NOTE INDICATOR
	SAFETY DISCONNECT SWITCH (SIZE/VOLTAGE/CONFIGURATION AS NOTED)		EQUIPMENT NOTE INDICATOR
	COMBINATION SAFETY SWITCH/MAGNETIC STARTER		REVISION "DELTA" NOTE INDICATOR
	TELEPHONE/DATA JUNCTION BACKBOX		FEEDER NOTE INDICATOR
	SINGLE-POLE TOGGLE SWITCH (VOLTAGE AS REQUIRED)	48"	48" MOUNTING HEIGHT AFF. (ACTUAL HEIGHT AS NOTED)
	MULTI-STATION "THREE-WAY" TOGGLE SWITCH (VOLTAGE AS REQUIRED)	AFF.	ABOVE FINISHED FLOOR
	SOLID STATE DIMMING SWITCH (VOLTAGE AS REQUIRED)	AFF.G.	ABOVE FINISHED GRADE
	MOTOR-RATED TOGGLE SWITCH (VOLTAGE AS REQUIRED)	A.T.S.	AUTOMATIC TRANSFER SWITCH
	KEYED TOGGLE SWITCH (VOLTAGE AS REQUIRED)	C	CONDUIT
	CABLE TELEVISION OUTLET	CB	CIRCUIT BREAKER
	PANELBOARD (NAME/AMP/PHASE/VOLTAGE/CONFIGURATION AS NOTED)	CC	CONTROLS CONTRACTOR
	TRANSFORMER (NAME/KVA RATING/PHASE/VOLTAGE AS NOTED)	CLG	CEILING
	INDICATES MECHANICAL EQUIPMENT	(E)	EXISTING
	PHOTO ELECTRIC CELL	EC	ELECTRICAL CONTRACTOR
	TIME CLOCK	FACP	FIRE ALARM CONTROL PANEL
	CONTACTOR (CONFIGURATION AS NOTED)	F.B.O.	FURNISHED BY OTHERS
	DUCT DETECTOR FIRE ALARM SYSTEM COMPONENT	GFI	GROUND FAULT INTERRUPTING TYPE
	SMOKE DETECTOR FIRE ALARM SYSTEM COMPONENT	HID	HIGH INTENSITY DISCHARGE
	HEAT DETECTOR FIRE ALARM SYSTEM COMPONENT	LTG	LIGHTING
	FLOW SWITCH FIRE ALARM SYSTEM COMPONENT	NTS	NOT TO SCALE
	TAMPER SWITCH FIRE ALARM SYSTEM COMPONENT	MC	MECHANICAL CONTRACTOR
	HORN/STROBE COMBINATION FIRE ALARM SYSTEM COMPONENT	MCB	MAIN CIRCUIT BREAKER
	MANUAL PULL STATION	MSB	MAIN SWITCH BOARD
	SINGLE-PHASE, 1-POLE CIRCUIT PATH (1/2" CONDUIT, (2) - #10 CU, UNLESS OTHERWISE NOTED) ABOVE FLOOR	(N)	NEW
	SINGLE-PHASE, 2-POLE CIRCUIT PATH (1/2" CONDUIT, (3) - #10 CU, UNLESS OTHERWISE NOTED) ABOVE FLOOR	NL	NIGHT LIGHT
	THREE-PHASE, 1-POLE CIRCUIT PATH (1/2" CONDUIT, (4) - #10 CU, UNLESS OTHERWISE NOTED) ABOVE FLOOR	TYP	TYPICAL
	RETURN CIRCUIT TO PANEL "HOMERUN" (CIRCUIT AS NOTED) ABOVE FLOOR	UG	UNDER GROUND
	MOTOR (HORSEPOWER AS NOTED)	UN	UNLESS OTHERWISE NOTED
	SHUNT TRIP STATION	WP	WEATHER PROOF
		XTMR	TRANSFORMER

MECHANICAL EQUIPMENT CONNECTION SCHEDULE:

MEQ #	DISCONNECTING MEANS	VOLTS / # / FLA	(E) CKT	LOAD kVA	(N) CKT	CONDUIT & WIRE	NOTE #3 & #4	NOTES
	LOCKABLE 20AMP MOTOR RATED SWITCH	120 / 1 / 13	'PIA'-1	156	'PIA'-1	1/2' C., (2) - #12 Cu & (1) - #12 Cu GND		--
	LOCKABLE 20AMP MOTOR RATED SWITCH	120 / 1 / 13	'PIA'-5	156	'PIA'-5	1/2' C., (2) - #12 Cu & (1) - #12 Cu GND		--
	PROVIDED BY M.C. & INSTALLED BY E.C.	480 / 3	SEE A/E03	--	SEE B/E03	1/2' C., (3) - #12 Cu & (1) - #12 Cu GND		5 HP
	PROVIDED BY M.C. & INSTALLED BY E.C.	480 / 3	SEE A/E03	--	SEE B/E03	1/2' C., (3) - #12 Cu & (1) - #12 Cu GND		5 HP
	VFD-1	480 / 3 / 16	--	631	VIA VFD-1	1/2' C., (3) - #12 Cu & (1) - #12 Cu GND		5 HP
	VFD-2	480 / 3 / 16	--	631	VIA VFD-2	1/2' C., (3) - #12 Cu & (1) - #12 Cu GND		5 HP
	LOCKABLE 20AMP MOTOR RATED SWITCH	120 / 1 / 6.4	'PIA'-3	0.16	'PIA'-3	1/2' C., (2) - #12 Cu & (1) - #12 Cu GND		3/4 HP
	LOCKABLE 20AMP MOTOR RATED SWITCH	120 / 1 / 6.4	'PIA'-9	0.16	'PIA'-9	1/2' C., (2) - #12 Cu & (1) - #12 Cu GND		3/4 HP
	JUNCTION BOX & HARDWIRE	120 / 1 / 1	--	0.12	'PIA'-16	1/2' C., (2) - #12 Cu & (1) - #12 Cu GND		--

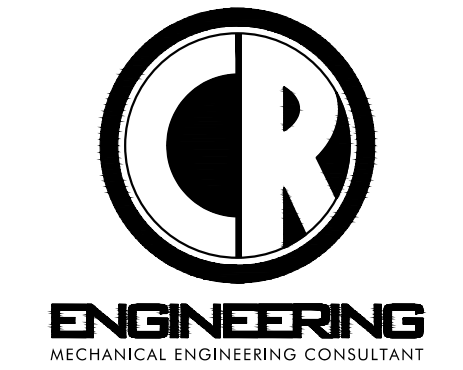
MECHANICAL EQUIPMENT CONNECTION SCHEDULE NOTES:

- CONTRACTOR SHALL DISCOVER AND FIELD VERIFY THE SERVING PANEL & BRANCH CIRCUIT AND UPDATE PANEL DIRECTORIES.
- SEE MECHANICAL PLANS FOR EXACT LOCATIONS OF MECHANICAL EQUIPMENT.
- CONTRACTOR'S BID SHALL INCLUDE NEW (OVERHEAD) CONDUITS AND PATHWAYS AS REQUIRED FOR ALL EQUIPMENT CONNECTIONS. NEVERTHELESS, CONTRACTOR MAY REUSE ANY EXISTING CONDUITS, BACK BOXES, AND PATHWAYS THAT ARE MADE AVAILABLE DURING THE DEMOLITION PHASE OF WORK.
- ALL BRANCH CIRCUIT WIRING SHALL BE & PROVIDED WITH PRINTED PERMANENT WIRE MARKERS WHICH CLEARLY IDENTIFY THE SERVING PANEL & CIRCUIT BREAKER.

3-Phase, 4-Wire, Y-Connected Electrical Panelboard Schedule by Jensen Engineering, Inc.																							
Project Name:		CC MENELEY ES BOILER REPLACEMENT			Line to Neutral Voltage:		120		Bus Material:		EXISTING		Short Circuit Rating:		New or Existing:		EXISTING						
Panel Name:		PIA			Line to Line Voltage:		208		Bus Rating:														
Panel Location:		AS SHOWN ON SHEET E1.0			Main Breaker or Lug Only:		EXISTING		Lug/Breaker Rating:						Mounting:		EXISTING						
Ckt. No.	Load (VA)	Description	Load Power Factor	One-Way Ckt Length (ft)	Wire Size (AWG)	Corrected Z' (Ω-to-Neutral)	VDROP (%)	Breaker Poles	Breaker Trip	Phase A	Phase B	Phase C	Breaker Poles	VDROP (%)	Corrected Z' (Ω-to-Neutral)	Wire Size (AWG)	One-Way Ckt Length (ft)	Load Power Factor	Description	Load (VA)	Ckt. No.		
1	1560	(N) B-1						1	20	●											2		
3	768	(N) HWP-B1						1	15	●	●										4		
5	1560	(N) B-2						1	20	●											6		
7	1200	(E) HWP						1	15	●	●										8		
9	768	(N) HWP-B2						1	15	●											10		
11	250	(E) TEMP CONTROL PANEL						1	20	●	●		20	1					(E) VAV CONTROLS E HALL SOUTH	1000	12		
13	2520	(E) FAN POWERED TERMINALS						1	30	●	●		20	1					(E) VAV CONTROLS E HALL NORTH	1000	14		
15	1200	(E) STAGE AMP						1	20	●	●		20	1					(N) GSV-1	120	16		
17	1200	(E) STAGE AMP						1	20	●	●										18		
19	1080	(E) STAGE REC WEST SIDE						1	20	●	●										20		
21	1000	(E) STAGE LIGHTS						1	20	●	●		60	3					(E) LOAD	5000	22		
23	1000	(E) STAGE LIGHTS						1	20	●	●									5000	24		
6360	3736	4010	Total Load (VA)		Notes:		1. Corrected impedance calculated using Neher-McGrath method for determining resistance in AC circuits. 2. Circuit length used for calculating voltage drop; not to be used for estimating or pricing. 3. Wire size used for calculating voltage drop; not to be used for estimating or pricing. See electrical drawing											Total Load (VA):		6000	5120	6000	
																			+25% of Lighting Load (VA):		0	0	0
																			+25% of Largest Motor Load (VA):		0	0	0
																			Combined Total Load (VA):		12360	8856	10010
																			Average Line Current (Amps):		103.00	73.80	83.42
																			Average Total Current (Amps):		86.78		
																			Total Connected Load (kVA):		31.23		

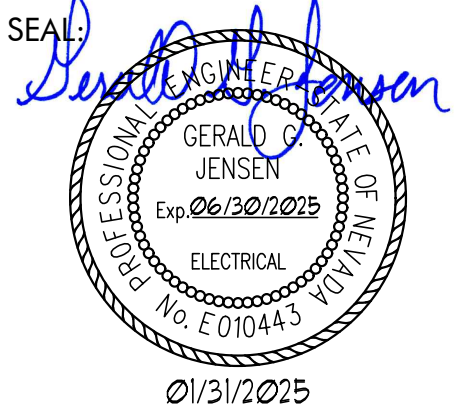
SHEET NOTES: (THIS SHEET ONLY)

- REMOVE AND RETIRE (E) IP, 15A BREAKER AND REPLACE WITH (N) IP, 20A BREAKER TO ACCOMMODATE (N) BOILER.

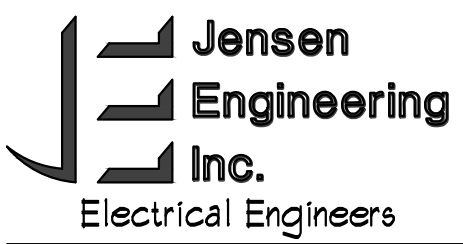


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DOUGLAS COUNTY SCHOOL DISTRICT
CC MENELEY ELEMENTARY SCHOOL
BOILER REPLACEMENT
1446 MUIR DRIVE, GARDNERVILLE, NV 89460
ELECTRICAL SYMBOLS & MECHANICAL EQUIPMENT CONNECTION SCHEDULE

REVISIONS:		
REV.	DESCRIPTION	DATE
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DRAWN BY: KPJ
DESIGNED BY: KPJ
CHECKED BY: GGJ
APPROVED BY: GGJ
DATE: 01/31/2025
PROJECT NO: N222JK

SHEET NUMBER:

E0.1

ELECTRICAL SPECIFICATIONS

- 1.0 GENERAL PROVISIONS
CONSIDER THE GENERAL AND SPECIFIC CONDITIONS OF THE CONTRACT AND THE COMPLETE SET OF DRAWINGS AS PART OF THIS DIVISION OF THE SPECIFICATIONS. WHERE REQUIREMENTS OF THIS DIVISION DO NOT CONCOIDE WITH GENERAL AND SPECIAL CONDITIONS, THE STRICTER REQUIREMENTS WILL GOVERN.
- 2.0 WORK INCLUDED
PROVIDE ALL LABOR, MATERIALS, TOOLS, EQUIPMENT, APPARATUS, ETC. INCLUDING THOSE REASONABLY INFERRED, AS REQUIRED FOR A COMPLETE INSTALLATION OF ANY ELECTRICAL WORK SHOWN WITHIN THESE ELECTRICAL CONSTRUCTION DOCUMENTS, OR DETAILED IN THE ELECTRICAL SPECIFICATIONS. ALL ELECTRICAL WORK SHALL BE PERFORMED BY LICENSED ELECTRICIANS AND TECHNICIANS. REPAIRS AND REPLACEMENTS FOR DEFECTIVE EQUIPMENT OR MATERIALS AS COVERED BY WARRANTY/GUARANTEE SHALL BE CONSIDERED WITHIN THE SCOPE OF WORK AND SHALL BE PERFORMED AT NO ADDITIONAL COST (EXCEPTION: LIGHTING LAMPS).
- 3.0 RELATED WORK SPECIFIED ELSEWHERE
ELECTRICAL CONSTRUCTION DOCUMENTS AND ELECTRICAL SPECIFICATION SECTION SHALL BE CONSIDERED AS A WHOLE. ALL ELECTRICAL WORK SHALL ACCOMMODATE THE REQUIREMENTS OF THIS DIVISION TO ENSURE PROPER PERFORMANCE OF ELECTRICAL WORK REQUIRED BY OTHER DIVISIONS.
- 4.0 SITE INVESTIGATION
ELECTRICAL CONTRACTOR SHALL THOROUGHLY INVESTIGATE ALL EXISTING CONDITIONS AT THE PROJECT SITE PRIOR TO SUBMITTING A BID.
- 5.0 REGULATIONS AND STANDARDS
5.1 ALL ELECTRICAL WORK SHALL BE PERFORMED IN ACCORDANCE WITH THE LATEST ADOPTED EDITIONS OF: UNR DESIGN AND CONSTRUCTION STANDARDS, THE 2017 NATIONAL ELECTRICAL CODE (NEC), NATIONAL FIRE PROTECTION AGENCY (NFPA) STANDARDS, INTERNATIONAL BUILDING CODE (IBC), INTERNATIONAL FIRE CODE (IFC), INTERNATIONAL ENERGY CONSERVATION CODE (IECC), NECA 1-2015 STANDARD FOR GOOD WORKMANSHIP IN ELECTRICAL CONSTRUCTION, AMERICANS WITH DISABILITIES ACT (ADA), OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA), THE REQUIREMENTS OF THE FIRE MARSHALL, AND ANY UTILITY COMPANY STANDARDS AS DETAILED IN UTILITY WORK ORDER DRAWINGS. ADDITIONALLY, ALL STATE AND LOCAL CODES AND ORDINANCES SHALL BE UPHOLD. CONTRACTOR SHALL NOT OMIT ANY COMPONENT OR PORTION OF THESE ELECTRICAL CONSTRUCTION DOCUMENTS WHICH MAY EXCEED THE LISTED STANDARDS. NO ELECTRICAL WORK DETAILED IN THE ELECTRICAL CONSTRUCTION DOCUMENTS OR ELECTRICAL SPECIFICATION SECTION SHALL BE INTERPRETED TO PERMIT WORK WHICH FAILS TO CONFORM TO THESE REQUIREMENTS. WHERE CONFLICTS OCCUR, HIGHER STANDARDS SHALL GOVERN. RULINGS AND INTERPRETATIONS BY GOVERNING AGENCIES SHALL BE CONSIDERED A PART OF THIS DIVISION IF COMMONLY IMPOSED UPON THE TRADE PRIOR TO SUBMISSION OF BID.
- 6.0 FEES
ELECTRICAL CONTRACTOR SHALL INCLUDE ALL FEES AND ROYALTIES FOR PERMITS, TESTS AND INSPECTIONS. UTILITY COMPANY CHARGES FOR PERMANENT CONNECTION TO ELECTRICAL SERVICE ARE NOT THE RESPONSIBILITY OF THE ELECTRICAL CONTRACTOR.
- 7.0 DRAWINGS AND SPECIFICATIONS
7.1 ELECTRICAL CONTRACTOR SHALL VERIFY THE EXACT LOCATIONS, ELEVATIONS, AND INSTALLATION REQUIREMENTS OF ALL ELECTRICAL EQUIPMENT PRIOR TO "ROUGH-IN" (INCLUDING RECEPTACLES, SWITCHES, CONDUITS, SWITCHBOARDS, PANELBOARD, ETC.). LOCATIONS SHALL BE VERIFIED FOR APPROPRIATE SPACE (LENGTH, WIDTH, AND HEIGHT) AND CLEARANCE PRIOR TO FABRICATING OR ORDERING ANY EQUIPMENT OR MATERIALS. ALL DISCREPANCIES SHALL BE REPORTED TO THIS ENGINEER IMMEDIATELY. FINAL CONNECTIONS SHALL BE MADE IN ACCORDANCE WITH MANUFACTURER'S APPROVED WIRING DIAGRAMS, DETAILS AND INSTRUCTIONS.
- 7.2 ELECTRICAL CONTRACTOR SHALL SUBMIT WRITTEN REQUEST-FOR-INFORMATION (RFI) DOCUMENTS TO THIS ENGINEER PRIOR TO PERFORMING ANY WORK WHERE AMBIGUITY ARISES. ELECTRICAL CONTRACTOR SHALL NOT PERFORM ANY FIELD MODIFICATIONS OR DEVIATIONS FROM THE ELECTRICAL CONSTRUCTION DOCUMENTS AND/OR SPECIFICATIONS WITHOUT APPROVED WRITTEN RESPONSE FROM THIS ENGINEER THROUGH AN APPROPRIATELY SUBMITTED RFI.
- 7.3 ELECTRICAL CONTRACTOR SHALL PERFORM ELECTRICAL WORK PER MANUFACTURER'S DIRECTIONS WHERE SAID DETAILS ARE NOT SPECIFICALLY COVERED OR INDICATED BY THESE ELECTRICAL CONSTRUCTION DOCUMENTS AND ELECTRICAL SPECIFICATIONS. WHEN CONFLICT ARISES, SECTION 7.2 OF THIS SPECIFICATION SHALL DICTATE PERFORMANCE.
- 7.4 ALL SERVICES RENDERED BY THIS ENGINEER ARE PROFESSIONAL OPINIONS AND RECOMMENDATIONS, ONLY. UNDER NO CIRCUMSTANCE IS IT THE INTENT OF THIS ENGINEER TO DIRECTLY CONTROL THE PHYSICAL ACTIVITIES OF THE CONTRACTOR OR HIS EMPLOYEES.
- 8.0 MATERIALS
8.1 APPEARANCE AND FINISH OF MATERIALS SHALL BE OF THE HIGHEST STANDARDS. ALL MATERIALS AND EQUIPMENT SHALL BE NEW, OPERATING NORMALLY, AND OF HIGHEST AVAILABLE QUALITY. ANY DEFECTIVE MATERIALS SHALL BE IDENTIFIED AND REMOVED FROM SITE IMMEDIATELY.
- 8.2 PROVIDE UNDERWRITERS LABORATORY (UL) LISTED MATERIALS AND EQUIPMENT WHEREVER STANDARDS FOR SAID ITEMS HAVE BEEN ESTABLISHED. UNLISTED DEVICES SHALL BE INSTALLED IN EQUIPMENT NORMALLY LISTED OR LABELED, AND SHALL CONFORM TO UL STANDARDS AS FAR AS POSSIBLE.
- 8.3 ALL CATALOG NUMBERS ARE GIVEN TO ASSTT IN IDENTIFYING THE BASIC REQUIREMENTS OF THIS PROJECT AND INDICATE THE MINIMUM LEVEL OF QUALITY. CATALOG NUMBERS WILL, GENERALLY, NOT SPECIFY COLOR AND ACCESSORIES. CONSULT OWNER AND ARCHITECT FOR COLOR AND ACCESSORY DETAILS.
- 9.0 CLEAN WORK
REGULARLY REMOVE DEBRIS FROM THE PROJECT SITE, AS REQUIRED, DURING CONSTRUCTION. CLEAN ALL RACEWAYS, FIXTURES, AND OTHER EQUIPMENT PRIOR TO FINAL ACCEPTANCE BY OWNER.
- 10.0 CLOSING IN OF UNINSPECTED WORK
ELECTRICAL CONTRACTOR SHALL NOT CLOSE IN OR CONCEAL ANY ELECTRICAL WORK PERFORMED PRIOR TO INSPECTION AND APPROVAL.
- 11.0 STANDARD FIELD TESTS
11.1 ELECTRICAL CONTRACTOR SHALL PERFORM THE FOLLOWING TESTS OF THE ELECTRICAL SYSTEM AND SHALL PROVIDE THE ENGINEER WITH TABULATED AND SIGNED TEST REPORTS FOR THE FOLLOWING TESTS:

CONDUCTOR INSULATION TESTING: TEST POWER CONDUCTORS USING A 500 VOLT DC INSULATION TESTER. TEST CONDUCTORS INSTALLED IN PLACE, DISCONNECTED AT BOTH ENDS, AND ACCORDING TO TEST EQUIPMENT MANUFACTURES INSTRUCTIONS. MINIMUM RESISTANCE VALUES SHALL BE AS RECOMMENDED BY TEST EQUIPMENT MANUFACTURES PUBLISHED VALUES BASED ON SPECIFIC SITE CONDITIONS.

GROUND RESISTANCE TEST: TEST MAIN GROUNDING ELECTRODE SYSTEM USING THREE POINT FALL OF POTENTIAL TESTER. PERFORM TEST ACCORDING TO TEST EQUIPMENT MANUFACTURES INSTRUCTIONS. MAXIMUM GROUND RESISTANCE OF THE GROUNDING ELECTRODE SYSTEM SHALL BE 10 OHMS. IF MEASURED GROUND RESISTANCE IS GREATER THAN 10 OHMS, CONTRACTOR SHALL PROVIDE AND INSTALL ONE 3/4" X 8" COPPER CLAD GROUND ROD WITH #2 CU CONNECTION TO THE GROUNDING ELECTRODE SYSTEM.

POLARITY TESTS: TEST ALL UTILIZATION EQUIPMENT, OUTLETS, AND RECEPTACLES FOR PROPER POLARITY. POLARITY SHALL COMPLY WITH N.E.C. REQUIREMENTS.

CHECK ALL MECHANICAL LUGS FOR PROPER TENSION. COMPLETE MECHANICAL LUG CONNECTIONS USING A CALIBRATED TORQUE WRENCH (OR SCREWDRIVER) ACCORDING TO LUG MANUFACTURES TIGHTENING RECOMMENDATIONS.
- 11.2 ANY WORK WHICH FAILS TO MEET THE REQUIREMENTS OF THESE ELECTRICAL CONSTRUCTION DOCUMENTS, OR ANY OF THE ABOVE-LISTED TESTING SHALL BE CONSIDERED DEFECTIVE AND SHALL BE PROMPTLY CORRECTED UNDER WARRANTY.
- 12.0 IDENTIFICATION
ELECTRICAL CONTRACTOR SHALL PROVIDE AND INSTALL PRINTED PHENOLIC WEATHERPROOF LABELS FOR ALL ELECTRICAL OUTLETS AND EQUIPMENT. LABELS SHALL INDICATE DEVICE DESIGNATION, EQUIPMENT SERVED, VOLTS/PHASE/WIRE, AND SOURCE FEEDING THE EQUIPMENT.

LABELS FOR ALL OUTDOOR EQUIPMENT SHALL BE WEATHERPROOF PHENOLIC ENGRAVED TYPED LABELS.

PROVIDE ALL PANELBOARDS WITH ACCURATE AND TYPED DIRECTORIES, INSTALLED UNDER CLEAR PLASTIC COVER. PROVIDE DIRECTORY INFORMATION TO OWNER FOR APPROVAL PRIOR TO FINALIZATION.
- 13.0 PENETRATIONS
13.1 PROVIDE AND INSTALL APPROVED UL LISTED ASSEMBLY AND EMPLOY ARCHITECTURALLY APPROVED METHODS FOR WATER-TIGHT PENETRATION OF EXTERIOR WALLS. CONSULT ARCHITECT FOR DETERMINATION OF PENETRATION LOCATIONS FOR EXTERIOR WALLS.

13.2 PROVIDE AND INSTALL APPROVED UL LISTED MATERIALS AND EMPLOY ARCHITECTURALLY APPROVED METHODS FOR PENETRATION OF FIRE-RATED ASSEMBLIES. ELECTRICAL CONTRACTOR SHALL NOT EXCEED THE MAXIMUM ALLOWABLE SURFACE PENETRATIONS. CONSULT ARCHITECT FOR DETERMINATION OF PENETRATION LOCATIONS INTO FIRE-RATED ASSEMBLIES.
- 14.0 EXCAVATION AND BACKFILL
14.1 PROVIDE ALL EXCAVATION, BACKFILL, TRENCHING, SHORING, PUMPING, COMPACTION, ETC. REQUIRED FOR ALL ELECTRICAL WORK DETAILED IN THE ELECTRICAL CONSTRUCTION DOCUMENTS AND THIS ELECTRICAL SPECIFICATION. CONFORM TO REQUIREMENTS OF EARTHWORK SECTION WHERE THIS SPECIFICATION DOES NOT DETAIL.

14.2 COORDINATE WITH EARTHWORK CONTRACTOR TO INSTALL RACEWAYS AND CONDUIT ROUTES PROMPTLY. ELECTRICAL CONTRACTOR SHALL PERFORM BACKFILL UPON INSPECTION AND APPROVAL.

14.3 UNDERGROUND ELECTRICAL WORK SHALL BE PERFORMED WITH CONSIDERATION FOR EXISTING SERVICES. ELECTRICAL CONTRACTOR SHALL PROMPTLY AND COMPLETELY REPAIR OR REPLACE ANY SYSTEMS DISRUPTED DURING ELECTRICAL INSTALLATION AND RETURN TO WORKING ORDER.

14.4 BACKFILL SHALL CONFORM TO REQUIREMENTS OF EARTHWORK SPECIFICATION SECTION AND SHALL BE FREE OF ROCKS OR OTHER DEBRIS, AND SHALL BE COMPACTED TO FINISHED GRADE.
- 15.0 SUPPORTS AND FASTENINGS
ELECTRICAL CONTRACTOR SHALL PROVIDE AND INSTALL SUPPORTS AND HANGARS FOR ALL RACEWAYS, CABINETS, BOXES, BACK-BOXES, AND ALL OTHER EQUIPMENT. DESIGN OF SUPPORTS AND FASTENERS SHALL BE MADE USING PRE-ENGINEERED AND MANUFACTURED COMPONENTS DESIGNED FOR THE INTENDED USE. SUPPORTS AND FASTENERS SHALL BE INSTALLED PER MANUFACTURERS INSTRUCTIONS AND IN GENERAL CONFORMANCE WITH THE RECOMMENDATIONS OF NECA STANDARD 1-2015 AND NECA STANDARD 101-2013. ANCHORS, BOLTS, SUPPORT SYSTEMS, HANGERS, ETC. SHALL FEATURE ADEQUATE CORROSION RESISTANCE FOR THE APPLICATION. RACEWAY SUPPORTS SHALL BE TRAPEZE TYPE WITH BEAM CLAMPS, THREADED RODS, AND STRUCTURAL CHANNELS. SELECTION OF SUPPORTS AND FASTENING METHODS SHALL BE BASED ON SIZE AND WEIGHT OF COMPONENTS SUPPORTED, AS WELL AS SAFETY AND ACCESSIBILITY. ALL SUPPORTS AND HANGARS SHALL BE RATED FOR FIVE (5) TIMES THE ACTUAL LOAD.
- 16.0 TRADE COORDINATION
ELECTRICAL CONTRACTOR SHALL COORDINATE THE ELECTRICAL INSTALLATION WORK WITH ALL OTHER CONTRACTORS, REFER TO PLANS AND SPECIFICATIONS OF OTHER TRADES. ELECTRICAL CONTRACTOR SHALL CONSULT OTHER CONTRACTORS TO ENSURE TIMELY AND APPROPRIATE CONNECTIONS AND INTERFACE WITH PLUMBING, MECHANICAL, FIRE/SMOKE DAMPERS, OR OTHER EQUIPMENT. ALL REQUIRED WIRING AND CONTROL COMPONENTS SHALL BE CONSIDERED PART OF THE SCOPE OF WORK.
- 17.0 RECORD DRAWINGS
ELECTRICAL CONTRACTOR SHALL PROVIDE A NEAT AND COMPLETE SET OF "AS-BUILT" RECORD DRAWINGS TO THE OWNER WITHIN TEN (10) DAYS OF FINAL ACCEPTANCE OF WORK. RECORD DRAWINGS SHALL INDICATE ALL DEVIATIONS FROM THE ELECTRICAL CONSTRUCTION DOCUMENTS, LOCATIONS OF STUB-OUTS AND CONCEALED ITEMS (PER FIELD DIMENSIONS) RECORD DRAWINGS SHALL BE OF EQUAL TO OR HIGHER QUALITY THAN THESE ELECTRICAL CONSTRUCTION DOCUMENTS (INCLUDING SIZE, CLARITY AND MEDIUM). ALL MAINTENANCE AND OPERATING MANUALS AS WELL AS ANY ADDITIONAL INSTRUCTIONS, SHALL BE CONSIDERED A PART OF THE RECORD DRAWINGS.
- 18.0 ELECTRICAL SUBMITTALS
ELECTRICAL CONTRACTOR SHALL SUBMIT ELECTRONIC COPY OF FACTORY SHOP-DRAWINGS FOR ALL ELECTRICAL COMPONENTS PROPOSED FOR THIS PROJECT TO THIS ENGINEER, AND TO THE OWNER. ELECTRICAL CONTRACTOR SHALL OBTAIN WRITTEN APPROVAL FROM THIS ENGINEER, AND THE OWNER, OF ALL PROVIDED MANUFACTURER'S DATA SHEETS FOR ALL SWITCHGEAR, LIGHTING FIXTURES, WIRING DEVICES, FIRE ALARM SYSTEM COMPONENTS, MOTOR CONTROL CENTERS, PANELBOARDS, ETC. ANY PROPOSED SUBSTITUTIONS SHALL MEET THE PROJECT REQUIREMENTS EXACTLY, AND SHALL BE OF EQUAL OR GREATER QUALITY IN ALL RESPECTS, AND REQUIRE THIS ENGINEER'S APPROVAL. SUBSTITUTION PROPOSALS MUST BE SUBMITTED NO LESS THAN TEN (10) WORKING DAYS PRIOR TO BID ACCEPTANCE. ELECTRICAL CONTRACTOR SHALL ORDER AND/OR RELEASE ANY MATERIALS PROMPTLY AFTER SUBMITTAL APPROVAL. NO SUBSTITUTIONS OR ALTERNATE METHODS SHALL BE ACCEPTED AS A RESULT OF UNTIMELY WORK.
- 19.0 FIRE ALARM SYSTEM
ELECTRICAL CONTRACTOR SHALL RETAIN A LICENSED SPECIALTY FIRE ALARM SUB CONTRACTOR TO PROVIDE AND INSTALL A COMPLETE, TESTED AND TAGGED, AUTOMATIC FIRE DETECTION AND ALARM SYSTEM AS REQUIRED BY THE FIRE MARSHALL. PROVIDE AND INSTALL ALL COMPONENTS AS REQUIRED TO COMPLY WITH ALL REQUIREMENTS OF THE LOCAL FIRE MARSHALL. ELECTRICAL CONTRACTOR SHALL COORDINATE THE SPECIFIC PROJECT REQUIREMENTS, AND SHALL PROVIDE DETAILED PLANS, CLEARLY INDICATING ALL METHODS TO BE USED, FOR APPROVAL OF THE FIRE MARSHALL.
- 20.0 ELECTRICAL DEMOLITION
ELECTRICAL DEMOLITION AS REQUIRED FOR THE ELECTRICAL SCOPE OF WORK SHALL BE CONSIDERED A PART OF THE SCOPE OF WORK. REMOVE AND RETIRE ALL ELECTRICAL COMPONENTS WHERE IN CONFLICT WITH NEW CONSTRUCTION OR DESIGN. EXISTING CONCEALED CONDUITS MAY BE ABANDONED IN PLACE WHERE THIS DOES NOT CAUSE CONFLICT. REMOVE ALL CONDUCTORS FROM ABANDONED OR DEMOLISHED CONDUITS/RACEWAYS. PROVIDE AND INSTALL ANY COMPONENTS REQUIRED FOR COMPLETE RECONNECTION OF CIRCUITS WHERE DEMOLITION HAS CAUSED INTERRUPTION. RELOCATE AND RECONFIGURE EXISTING EQUIPMENT AS REQUIRED TO ACCOMMODATE CONDITIONS. ALL EXISTING EQUIPMENT REMOVED DURING THE COURSE OF THIS PROJECT SHALL BE OFFERED TO THE OWNER FOR SALVAGE. ANY EQUIPMENT SELECTED BY THE OWNER SHALL BE DELIVERED TO THE OWNER ON SITE. ALL REMAINING EQUIPMENT BECOMES THE PROPERTY OF THE CONTRACTOR AND SHALL BE REMOVED FROM THE SITE AND DISPOSED OF IN A SAFE AND LEGAL MANNER.
- 21.0 OWNERSHIP OF DOCUMENTS
THESE ELECTRICAL CONSTRUCTION DOCUMENTS AND SPECIFICATIONS CONSTITUTE THE INTELLECTUAL PROPERTY OF JENSEN ENGINEERING, INC. AND ALL RIGHTS ARE RESERVED BY JENSEN ENGINEERING, INC.. THESE MATERIALS SHALL REMAIN AS THE INTELLECTUAL PROPERTY OF JENSEN ENGINEERING, INC. AND MAY NOT BE REPRODUCED, DISTRIBUTED, OR USED FOR ANY OTHER PURPOSE, EXCEPT FOR THE PROJECT FOR WHICH THEY ARE INTENDED, WITHOUT THE EXPLICIT WRITTEN CONSENT OF JENSEN ENGINEERING, INC.
- 22.0 ONGOING OPERATIONS
ELECTRICAL CONSTRUCTION WORK SHALL BE PERFORMED WITH ALL DUE CONSIDERATION FOR ONGOING OPERATIONS AT THE PROJECT SITE AND SHALL MINIMIZE DISRUPTIONS IN EVERY RESPECT. PROVIDE AND INSTALL BARRICADES, DUST CONTAINMENT, NOISE ABATEMENT, ETC. TO ENSURE SAFETY AND COMFORT OF NON-CONSTRUCTION PERSONNEL ON THE PROJECT SITE. ANY INTERRUPTIONS TO EXISTING FIRE-ALARM, DATA/COMMUNICATION, OR ELECTRICAL SERVICES SHALL BE COORDINATED WITH THE OWNER AND THIS ENGINEER PRIOR TO ENGAGEMENT. DISRUPTIONS SHALL BE TEMPORARY AND MUST BE SCHEDULED 48 HOURS IN ADVANCE.
- 23.0 TEMPORARY POWER
ELECTRICAL CONTRACTOR SHALL PROVIDE TEMPORARY POWER SERVICE AND DISTRIBUTION FOR ALL TRADES WHICH REQUIRE SERVICE DURING CONSTRUCTION. TEMPORARY POWER SERVICE SHALL COMPLY WITH THE REQUIREMENTS OF THE NEC, AS WELL AS OSHA. COSTS OF TEMPORARY POWER ARE NOT THE RESPONSIBILITY OF THE ELECTRICAL CONTRACTOR.
- 24.0 MATCH EXISTING
ELECTRICAL CONTRACTOR SHALL COMPLETELY IDENTIFY ANY COMPONENTS WHERE DIRECTED TO MATCH EXISTING, AND SHALL PROVIDE AND INSTALL THE ITEM(S) EXACTLY. WHERE EXACT REPLACEMENT IS NOT AVAILABLE, NEW EQUIPMENT SHALL MATCH EXISTING EQUIPMENT IN FUNCTION AND APPEARANCE, AND MUST BE OF EQUAL OR GREATER QUALITY THAN EXISTING EQUIPMENT. WHERE SCOPE OF WORK OCCURS AT AN EXISTING FACILITY, ALL MATERIALS AND WORKMANSHIP SHALL BE OF GREATER QUALITY THAN EXISTING. TRANSITIONS FROM NEW WORK AREAS TO EXISTING AREAS SHALL BE SEAMLESS IN APPEARANCE AND FUNCTION.
- 25.0 CONDUCTORS
25.1 ALL CONDUCTORS SHALL CONFORM TO THE REQUIREMENTS STATED UNDER SECTION 5.0 OF THIS ELECTRICAL SPECIFICATION, AND UL LISTING STANDARDS.
ALL CONDUCTORS SHALL BE COPPER, STANDARD AMERICAN WIRE GAUGE, SOFT-DRAWN, CONCEALED IN CONDUIT. CONDUCTORS SIZED #10 AWG AND SMALLER MAY BE SOLID OR STRANDED. CONDUCTORS SIZED #8 AWG AND LARGER SHALL BE STRANDED. MINIMUM WIRE SIZE SHALL BE #12 AWG (UNLESS OTHERWISE NOTED).
CONDUCTOR INSULATION SHALL BE TYPE THHN-2/THWN-2 600 VOLT RATED.
CONDUCTORS SHALL BE CONTINUOUS FROM ORIGIN TO EQUIPMENT WITHOUT SPLICES, PER NEC. WHERE REQUIRED, SPLICES SHALL OCCUR IN SPICE BOXES PER THIS SPECIFICATION.
WIRE/CABLE SHALL BE HANDLED TO AVOID DAMAGE TO BOTH CONDUCTOR AND INSULATION. WIRE/CABLE SHALL BE DELIVERED IN STANDARD COILS OR REELS WITH SUITABLE PROTECTION FROM WEATHER AND DAMAGE DURING STORAGE, HANDLING, AND INSTALLATION.
ELECTRICAL CONTRACTOR SHALL COLOR CODE CONDUCTORS CONSISTENTLY THROUGHOUT THE PROJECT ACCORDING TO THE FOLLOWING OUTLINE:
- | VOLTAGE | PHASE A | PHASE B | PHASE C | NEUTRAL | GROUND |
|----------|---------|---------|---------|---------|------------------------------|
| 120/208V | BLACK | RED | BLUE | WHITE | GREEN |
| 277/480V | BROWN | ORANGE | YELLOW | GRAY | GREEN OR GREEN/YELLOW STRIPE |
- 25.2 EACH 120V OR 277V CIRCUIT SHALL HAVE A DEDICATED NEUTRAL CONDUCTOR.
25.3 SHARING OF NEUTRALS IS SHALL NOT BE ALLOWED.
- 26.0 CONDUIT SYSTEMS
26.1 CONDUIT AND CONDUCTOR ROUTES SHALL BE DETERMINED BY THE ELECTRICAL CONTRACTOR AT THE TIME OF INSTALLATION AND ARE SHOWN ON THESE PLANS FOR EXPLANATORY PURPOSES. PROVIDE AND INSTALL A CODE SIZED GREEN INSULATED GROUNDING WIRE IN ALL CONDUITS.
26.2 TYPE RMC AND IMC (NEC ART. 344 - RIGID METALLIC CONDUIT, & NEC ART. 342 - INTERMEDIATE METALLIC CONDUIT): SHALL BE PERMITTED, AS ALLOWED BY CODE, FOR ALL LOCATIONS INCLUDING EXPOSED TO PHYSICAL DAMAGE OR EXTERIOR ELEMENTS. ALL CONDUIT RUN EXPDED ON ROOFS SHALL BE TYPE RMC OR IMC.
26.3 TYPE PVC (NEC ART. 352 - RIGID PVC CONDUIT) SHALL BE PERMITTED, AS ALLOWED BY CODE, FOR UNDERGROUND AND UNDER CONCRETE SLAB APPLICATIONS. UNDERGROUND CONDUITS SHALL BE BURIED IN SAND ENVELOPE, MINIMUM OF 24" (TWO FEET) BELOW FINISHED GRADE. PROVIDE AND INSTALL GREEN INSULATED GROUNDING WIRE IN ALL NON-METALLIC CONDUITS. ALL ELBOWS AND EXPOSED RISERS SHALL BE RMC (GRS) AND SHALL BE PVC COATED OR HALF-LAP WRAPPED WITH SCOTCH 50 TAPE.
26.4 TYPE EMT (NEC ART. 358 - ELECTRICAL METALLIC TUBING) SHALL BE PERMITTED, AS ALLOWED BY CODE, FOR ALL INTERIOR LOCATIONS WHERE NOT SUBJECT TO PHYSICAL DAMAGE. ALL INTERIOR HOMERUNS SHALL BE TYPE EMT. ALL FITTINGS SHALL BE STEEL. ALL CONNECTORS SHALL HAVE INSULATED THROATS.
26.5 TYPE FMC (NEC ART. 348 - FLEXIBLE METAL CONDUIT) SHALL BE USED FOR SHORT CONNECTIONS TO MOTORS AND EQUIPMENT FOR INDOOR LOCATIONS. TYPE FMC SHALL BE STEEL AND SHALL BE PROVIDED WITH STEEL (INSULATED THROAT) FITTINGS. THE MAXIMUM LENGTH OF TYPE FMC SHALL BE 48".
26.6 TYPE LFMC (NEC ART. 350 - LIQUIDTIGHT FLEXIBLE METAL CONDUIT) SHALL BE USED FOR SHORT CONNECTIONS TO MOTORS AND EQUIPMENT IN WET OR OUTDOOR LOCATIONS. THE MAXIMUM LENGTH OF TYPE LFMC SHALL BE 48".
26.7 TYPE MC (NEC ART. 330 - METAL-CLAD CABLE) OR TYPE AC CABLES SHALL NOT BE USED.
26.8 TYPE LFNC (NEC ART. 356 - LIQUIDTIGHT FLEXIBLE NONMETALLIC CONDUIT) SHALL NOT BE USED.
26.9 TYPE ENT (NEC ART. 362 - ELECTRICAL NONMETALLIC TUBING) SHALL NOT BE USED.
26.10 TYPE NM, NMC, AND NMS (NEC ART. 334 - NONMETALLIC-SHEATHED CABLES) SHALL NOT BE USED.
- 27.0 TERMINATIONS AND SPLICES
WIRE CONNECTORS FOR WIRE SIZES #14 AWG THROUGH #8 AWG SHALL BE SCOTCHLOK OR APPROVED EQUAL. FOR WIRE SIZES #14 AWG THROUGH #8 AWG, USE SOLDERLESS, FULLY ANNULAR PRESURE TYPE CONNECTORS WITH HEAT SHRINK COVERING FOR ALL OTHERS.
- 28.0 RECEPTACLES, SWITCHES, WIRING DEVICES, AND PLATES
PROVIDE AND INSTALL COMMERCIAL GRADE RECEPTACLES, SWITCHES, AND OTHER WIRING DEVICES AS INDICATED IN THE ELECTRICAL CONSTRUCTION DOCUMENTS AND ELECTRICAL SPECIFICATIONS. WIRING DEVICE TERMINALS SHALL TENSIONED TO MANUFACTURERS PUBLISHED TORQUE VALUES USING A (CALIBRATED) ADJUSTABLE TORQUE SCREWDRIVER. GROUNDING TYPE RECEPTACLES WITH NEMA CONFIGURATIONS: "W" PROVIDE WEATHERPROOF "W" IN-USE" COVERS WITH CASKETED SPRING LIFT DOORS FOR EXTERIOR AND WET-LOCATIONS. PROVIDE STAMPED STEEL INDUSTRIAL COVERS FOR WIRING DEVICES IN EXPOSED WORK AREAS. PROVIDE ONE PIECE COVERS AND GANG OUTLETS TO SUIT THE DEVICES AT A LOCATION.
- 29.0 SWITCHGEAR AND DISTRIBUTION EQUIPMENT
ALL ELECTRICAL SWITCHGEAR EQUIPMENT SHALL BE OF THE SAME MANUFACTURER. ACCEPTABLE MANUFACTURES ARE: EATON, ABB-GE, SIEMENS, OR SQUARE-D, (NO SUBSTITUTES). SERVICE EQUIPMENT SHALL BE FULLY ENCLOSED, FACTORY ASSEMBLED, AND SHALL OPERATE PER SERVING ELECTRICAL UTILITY STANDARDS. SWITCHBOARDS AND PANELBOARDS SHALL HAVE COPPER BUSBARS (UNLESS NOTED OTHERWISE). PANELBOARDS SHALL USE BOLT-IN TYPE CIRCUIT BREAKERS (THIN 1/2" WIDE CIRCUIT BREAKERS ARE NOT PERMITTED). ALL EQUIPMENT AND BREAKERS SHALL BE PROVIDED WITH TERMINATION LUGS RATED 75 DEGREE C. OR HIGHER. CONTRACTOR SHALL PROVIDE AND INSTALL 4" CONCRETE HOUSE-KEEPING PAD FOR ALL FREE STANDING ELECTRICAL EQUIPMENT (SWITCHBOARDS, TRANSFORMERS, ETC.).
- 30.0 SAFETY DISCONNECT SWITCH
ALL FUSED AND NON-FUSED SAFETY DISCONNECT SWITCHES SHALL BE OF THE SAME MANUFACTURER. SAFETY DISCONNECT SWITCHES SHALL BE HEAVY DUTY, FULLY ENCLOSED, FACTORY ASSEMBLED, AND LOCKABLE.
- 31.0 SHORT CIRCUIT PROTECTION
AVAILABLE FAULT CURRENT (A.F.C.) VALUES, AS INDICATED ON THESE ELECTRICAL CONSTRUCTION DOCUMENTS, REFER TO THE EXPECTED MAXIMUM (3~ SYM) SHORT CIRCUIT CURRENT AVAILABLE AT THE POINT IDENTIFIED ON THE POWER DISTRIBUTION DIAGRAMS. ALL ELECTRICAL EQUIPMENT SHALL BE PROVIDED WITH SHORT CIRCUIT WITHSTAND LEVELS AND INTERRUPTING CAPACITY RATINGS GREATER THAN THE AVAILABLE FAULT CURRENT AT THE POINT WHERE THE EQUIPMENT IS LOCATED.

SERIES RATING OF THE OVER-CURRENT DEVICES IS ONLY ALLOWED WHERE PERMITTED BY CODE AND IF ADEQUATELY SUPPORTED BY MANUFACTURER'S LISTED EQUIPMENT DATA. ANY PROPOSED SERIES RATING OF ELECTRICAL EQUIPMENT SHALL BE CLEARLY IDENTIFIED IN THE SHOP DRAWING SUBMITTALS INCLUDING SUPPORTING DOCUMENTS WHICH IDENTIFY HOW THE SERIES RATED OCPD DEVICES COORDINATE WITHIN THE SYSTEM.
- 32.0 VANDAL PROTECTION
ALL ELECTRICAL WORK THAT IS ACCESSIBLE TO THE PUBLIC SHALL BE TAMPER-PROOF AND VANDAL RESISTANT. ALL EQUIPMENT WITH OPERABLE-DOOR ENCLOSURES SHALL BE LOCKING TYPE, OR PAD-LOCKING.
- 33.0 GROUNDING AND BONDING
PROVIDE AND INSTALL GROUNDING AND BONDING OF ALL EQUIPMENT AND SYSTEM NEUTRAL AS REQUIRED BY NEC ARTICLE 250 AND AS SHOWN ON THE CONSTRUCTION DOCUMENTS.
- 34.0 FINAL OBSERVATION
UPON ACCEPTANCE OF OPERATION AND MAINTENANCE INSTRUCTIONS AND RECORD DRAWINGS, THIS ENGINEER SHALL MAKE A FINAL OBSERVATION OF THE PROJECT AND GENERATE A LIST OF UNACCEPTABLE ITEMS. FINAL PROJECT ACCEPTANCE SHALL NOT BE CONSIDERED COMPLETE UNTIL ALL ITEMS IN THIS LIST HAVE BEEN CORRECTED.

- 35.0 ELEVATOR
CONTRACTOR SHALL COORDINATE ALL ELEVATOR ELECTRICAL WORK AND REQUIREMENTS WITH ELEVATOR CONTRACTOR. ELEVATOR SYSTEM SHALL CONFORM TO ALL LOCAL, STATE, NATIONAL CODES AND REQUIREMENTS. ELEVATOR SHUNT-TRIP MAIN-LINE BREAKER SHALL BE A UL LISTED PRODUCT AND SINGLE PIECE OF EQUIPMENT, EATON ES SERIES CONTROLLER OR APPROVED EQUIVALENT ONLY.
ELEVATOR SWITCH SHALL HAVE CONNECTIONS FOR THE FOLLOWING:
1. FUSED MAIN LINE DISCONNECTING SWITCH
2. MAIN LINE SHUNT TRIP BREAKER OR FIRE SAFETY INTERFACE DISCONNECTING RELAY (IF PERMITTED BY AHA)
3. SURGE PROTECTION
4. (2) - NO/NC AUXILIARY CONTACT SETS
- 36.0 PRELIMINARY OPERATION
IF THE OWNER DEMANDS THAT ANY PORTION OF THE ELECTRICAL SYSTEM BE OPERATED PRIOR TO FINAL COMPLETION AND ACCEPTANCE OF THE WORK, THE CONTRACTOR SHALL CONSENT, AND SUCH OPERATION SHALL BE PERFORMED UNDER SUPERVISION AND DIRECTION OF THE CONTRACTOR. ALL OPERATING EXPENSE THEREOF SHALL BE PAID BY THE OWNER. PRELIMINARY OPERATION AND PAYMENT THEREOF SHALL NOT BE CONSTRUED AS ACCEPTANCE OF WORK.
- 37.0 INDEMNIFICATION
37.1 ELECTRICAL CONTRACTOR SHALL INDEMNIFY, AND HOLD HARMLESS, THE OWNER AND THIS ENGINEER, AND THEIR AGENTS AND EMPLOYEES, FROM AND AGAINST ALL CLAIMS, DAMAGES, LOSSES AND EXPENSES, INCLUDING ATTORNEY'S FEES, ARISING OUT OF, OR RESULTING FROM, THE PERFORMANCE OF THE WORK, PROVIDED THAT ANY SUCH CLAIM, DAMAGE, LOSS OR EXPENSE (a) IS ATTRIBUTED TO BODILY INJURY, SICKNESS, DISEASE OR DEATH, OR INJURY TO, OR DESTRUCTION OF, OF TANGIBLE PROPERTY (OTHER THAN THE WORK ITSELF) INCLUDING THE LOSS OF USE RESULTING THEREFROM (b) IS CAUSED IN WHOLE OR IN PART BY ANY NEGLIGENT ACT OR OMISSION BY THE CONTRACTOR, ANY SUB-CONTRACTOR, ANYONE DIRECTLY OR INDIRECTLY EMPLOYED BY ANY OF THEM, OR ANYONE FOR WHOSE ACTS ANY OF THEM MAY BE LIABLE, REGARDLESS OF WHETHER OR NOT IT IS CAUSED IN PART BY A PARTY INDEMNIFIED HEREUNDER.
- 37.2 IN ANY AND ALL CLAIMS AGAINST THE OWNER, OR THE ENGINEER, OR ANY OF THEIR AGENTS OR EMPLOYEES, BY ANY EMPLOYEE OF THE CONTRACTOR, ANY SUB-CONTRACTOR, ANYONE DIRECTLY OR INDIRECTLY EMPLOYED BY ANY OF THEM OR ANYONE WHOSE ACTS ANY OF THEM MAY BE LIABLE, THE INDEMNIFICATION OBLIGATION SHALL NOT BE LIMITED IN ANY WAY BY ANY LIMITATION ON THE AMOUNT OR TYPE OF DAMAGE, COMPENSATION OR BENEFITS PAYABLE BY OR FOR THE CONTRACTOR, OR ANY SUB-CONTRACTOR, UNDER WORKMEN'S COMPENSATION ACTS, DISABILITY BENEFIT ACTS, OR OTHER EMPLOYEE BENEFIT ACTS.
- 37.3 THE INDEMNIFICATION OBLIGATIONS OF THE CONTRACTOR SHALL NOT EXTEND TO THE LIABILITY OF THE ENGINEER, HIS AGENTS OR EMPLOYEES, ARISING OUT OF (a) THE PREPARATION OR APPROVAL OF MAPS, DRAWINGS, OPINIONS, REPORTS, SURVEYS, CHANGE ORDERS, DESIGNS OR SPECIFICATIONS OR (b) THE GIVING OF OR THE FAILURE TO GIVE DIRECTIONS OR INSTRUCTIONS BY THE ENGINEER, HIS AGENTS OR EMPLOYEES, PROVIDED SUCH GIVING OR FAILURE TO GIVE IS THE PRIMARY CAUSE OF INJURY OR DAMAGE.
- 38.0 WARRANTY/GUARANTEE
ELECTRICAL CONTRACTOR SHALL PROVIDE A GUARANTEE OF THE ELECTRICAL WORK TO BE FREE FROM DEFECTS IN MATERIALS AND WORKMANSHIP FOR A PERIOD OF ONE YEAR FROM DATE OF FINAL ACCEPTANCE. LIGHTING LAMPS ARE EXEMPT FROM THIS REQUIREMENT, HOWEVER, LAMPS SHALL BE NEW AND IN PERFECT OPERATING CONDITION AT THE TIME OF FINAL ACCEPTANCE.
- 39.0 THROUGH PENETRATION IN RATED WALLS AND FLOORS
39.1 WALL ASSEMBLY - THE 1, 2, 3 OR 4 HR FIRE-RATED GYPSUM WALLBOARD/STUD WALL ASSEMBLY SHALL BE CONSTRUCTED OF THE MATERIALS AND IN THE MANNER DESCRIBED IN THE INDIVIDUAL USDO OR U400 SERIES WALL OR PARTITION DESIGNS IN THE UL FIRE RESISTANCE DIRECTORY AND SHALL INCLUDE THE FOLLOWING CONSTRUCTION FEATURES:
A. STUDS WALL FRAMING MAY CONSIST OF EITHER WOOD STUDS (MAX 2 HR FIRE RATED ASSEMBLIES) OR STEEL CHANNEL STUDS. WOOD STUDS TO CONSIST OF NOM 2 BY 4 IN. (51 BY 102 MM) LUMBER SPACED 16 IN. (406 MM) OC WITH NOM 2 BY 4 IN. (51 BY 102 MM) LUMBER END PLATES AND CROSS BRACES. STEEL STUDS TO BE MIN 3-5/8 IN. (92 MM) WIDE BY 1-3/8 IN. (35 MM) DEEP CHANNELS SPACED MAX 24 IN. (610MM) OC.
B. GYPSUM BOARD* - NOM 1/2 OR 5/8 IN. (13 OR 16 MM) THICK, 4 FT. (122 CM) WIDE WITH SQUARE OR TAPERED EDGES. THE GYPSUM WALLBOARD TYPE, THICKNESS, NUMBER OF LAYERS, FASTENER TYPE AND SHEET ORIENTATION SHALL BE AS SPECIFIED IN THE INDIVIDUAL USDO OR U400 SERIES DESIGN IN THE UL FIRE RESISTANCE DIRECTORY. MAX DIAM OF OPENING IS 26 IN. (660 MM).
39.2 THROUGH PENETRANT - ONE METALLIC PIPE, CONDUIT OR TUBING INSTALLED EITHER CONCENTRICALLY OR ECCENTRICALLY WITHIN THE FIRESTOP SYSTEM. THE ANNUAL SPACE BETWEEN PIPE, CONDUIT OR TUBING AND PERIPHERY OF OPENING SHALL BE MIN OF 0 IN. (0 MM) (POINT CONTACT) TO MAX 2 IN. (51 MM). PIPE, CONDUIT OR TUBING TO BE RIGIDLY SUPPORTED ON BOTH SIDES OF WALL ASSEMBLY. THE FOLLOWING TYPES AND SIZES OF METALLIC PIPES, CONDUITS OR TUBING MAY BE USED:
A. STEEL PIPE - NOM 24 IN. (610 MM) DIAM (OR SMALLER) SCHEDULE 10 (OR HEAVIER) STEEL PIPE.
B. IRON PIPE - NOM 24 IN. (610 MM) DIAM (OR SMALLER) SERVICE WEIGHT (OR HEAVIER) CAST IRON SOIL PIPE, NOM 12 IN. (305 MM) DIAM (OR SMALLER) OR CLASS 50 (OR HEAVIER) DUCTILE IRON PRESSURE PIPE.
C. CONDUIT - NOM 6 IN. (152 MM) DIAM (OR SMALLER) STEEL CONDUIT OR NOM 4 IN. (102 MM) DIAM (OR SMALLER) STEEL ELECTRICAL METALLIC TUBING.
D. COPPER TUBING - NOM 6 IN. (152 MM) DIAM (OR SMALLER) TYPE L (OR HEAVIER) COPPER TUBING.
E. COPPER PIPE - NOM 6 IN. (152 MM) DIAM (OR SMALLER) REGULAR (OR HEAVIER) COPPER PIPE.
F. THROUGH PENETRATING PRODUCT* - FLEXIBLE METAL PIPING - THE FOLLOWING TYPES OF STEEL FLEXIBLE METAL GAS PIPING MAY BE USED:
NOM 2 IN. (51 MM) DIAM (OR SMALLER) STEEL FLEXIBLE METAL GAS PIPING. PLASTIC COVERING ON PIPING MAY OR MAY NOT BE REMOVED ON BOTH SIDES OF FLOOR OR WALL ASSEMBLY.
NOM 1 IN. (25 MM) DIAM (OR SMALLER) STEEL FLEXIBLE METAL GAS PIPING. PLASTIC COVERING ON PIPING MAY OR MAY NOT BE REMOVED ON BOTH SIDES OF FLOOR OR WALL ASSEMBLY.
NOM 1 IN. (25 MM) DIAM (OR SMALLER) STEEL FLEXIBLE METAL GAS PIPING. PLASTIC COVERING ON PIPING MAY OR MAY NOT BE REMOVED ON BOTH SIDES OF FLOOR OR WALL ASSEMBLY.
- 39.3 FILL, VOID OR CAVITY MATERIAL* - CAULK OR SEALANT - MIN 5/8, 1-1/4, 1-7/8 AND 2-1/2 IN. (16, 32, 48 AND 64 MM) THICKNESS OF CAULK FOR 1, 2, 3 AND 4 HR RATED ASSEMBLIES, RESPECTIVELY, APPLIED WITHIN ANNULUS, FLUSH WITH BOTH SURFACES OF WALL. MIN 1/4 IN. (6 MM) DIAM BEAD OF CAULK APPLIED TO GYPSUM BOARD/PENETRANT INTERFACE AT POINT CONTACT LOCATION ON BOTH SIDES OF WALL. THE HOURLY F RATING OF THE FIRESTOP SYSTEM IS DEPENDENT UPON THE HOURLY FIRE RATING OF THE WALL ASSEMBLY IN WHICH IT IS INSTALLED, AS SHOWN IN THE FOLLOWING TABLE. THE HOURLY F RATING OF THE FIRESTOP SYSTEM IS DEPENDENT UPON THE TYPE OR SIZE OF THE PIPE OR CONDUIT AND THE HOURLY FIRE RATING OF THE WALL ASSEMBLY IN WHICH IT IS INSTALLED, AS TABULATED BELOW.

MAX PIPE DIAMETER	F RATING HR	T RATING HR
1 OR 2	0	0
3 OR 4	0	0
6	0	0
12	0	0

* NOTE
THIS MATERIAL WAS EXTRACTED BY 3M FIRE PROTECTION PRODUCTS FROM THE UL FIRE RESISTANCE DIRECTORY.

SYSTEM NO.W-L-1001
F RATINGS-1, 2, 3 AND 4 HR (SEE ITEMS 2 AND 3)
T RATINGS-0, 1, 2, 3, AND 4 HR (SEE ITEM 3)
L RATING AT AMBIENT-LESS THAN 1 CFM/SQ FT
L RATING AT 400 F-LESS THAN 1 CFM/SQ FT

SECTION A-A

SECTION A-A

SECTION A-A

SECTION A-A

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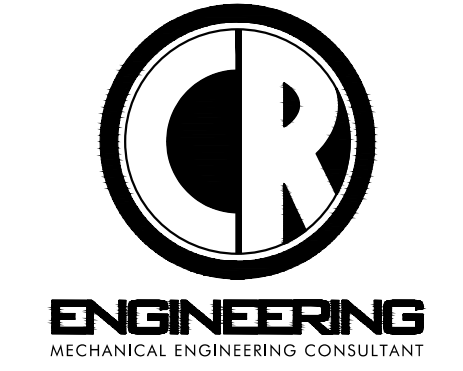
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SECTION A-A

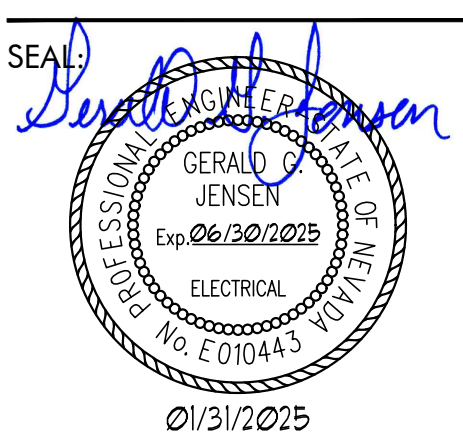
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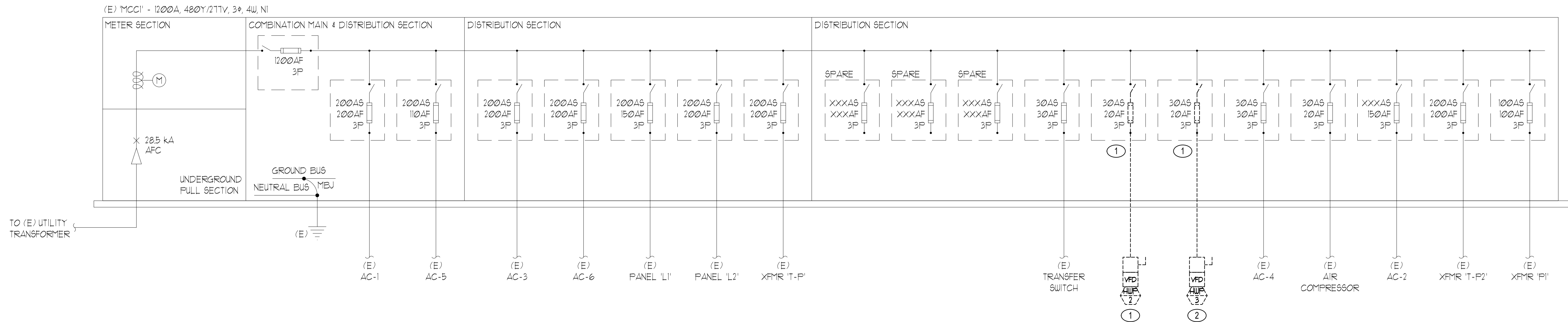
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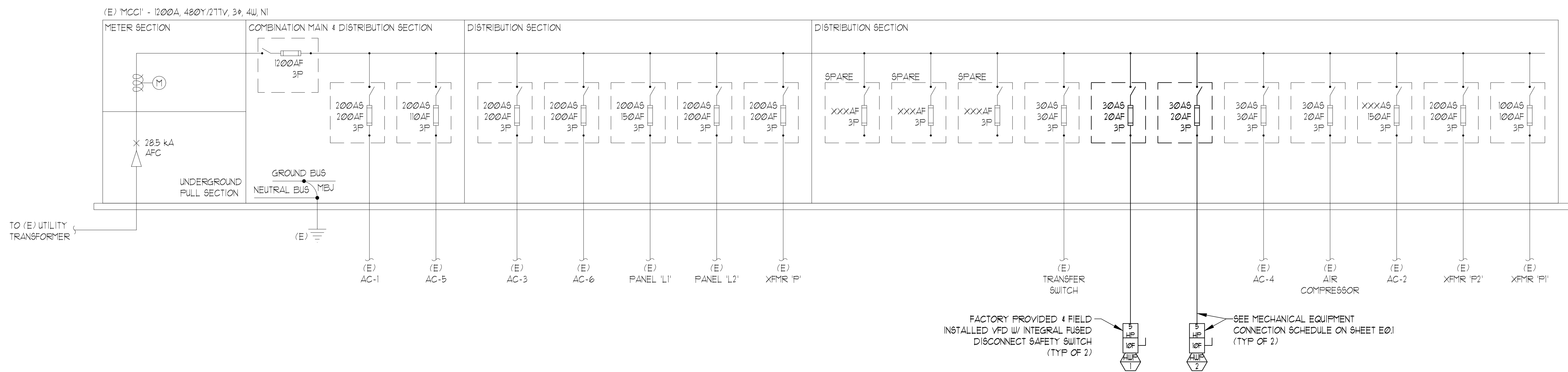
SHEET NOTES: (SINGLE LINE DIAGRAM ONLY)

- 1 (E) HUP-2 IS TO BE REMOVED AND RETIRED. THE (E) FUSED SWITCH POSITION SHALL REMAIN IN PLACE AS IS AND TO BE MODIFIED AS PER B/E03.
- 2 (E) HUP-3 IS TO BE REMOVED AND RETIRED. THE (E) FUSED SWITCH POSITION SHALL REMAIN IN PLACE AS IS AND TO BE MODIFIED AS PER B/E03.

DEMOLITION SINGLE-LINE DIAGRAM

NOT TO SCALE

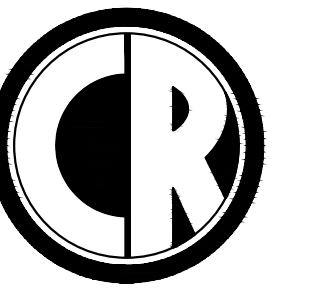
A
E03



PROPOSED SINGLE-LINE DIAGRAM

NOT TO SCALE

B
E03



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SEALED
Professional Engineer
Jensen
Exp. 06/30/2025
ELECTRICAL
No. E010443
01/31/2025

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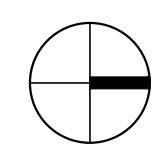
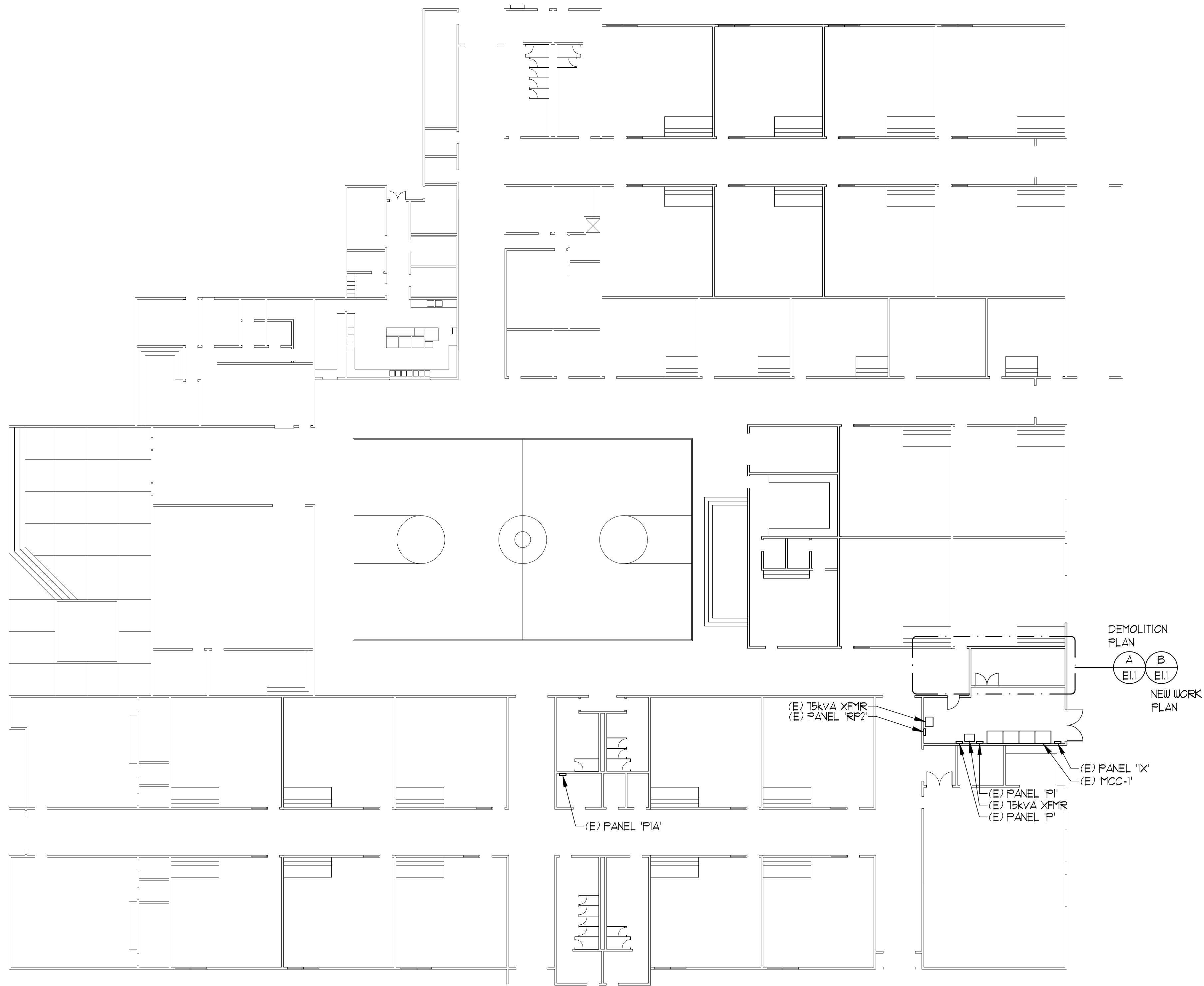
DOUGLAS COUNTY SCHOOL DISTRICT
CC MENELEY ELEMENTARY SCHOOL
BOILER REPLACEMENT
1446 MUIR DRIVE, GARDNERVILLE, NV 89460
SINGLE-LINE
DIAGRAMS

REVISIONS:		
REV.	DESCRIPTION	DATE
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-	-	-
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DESIGNED BY: KPJ
CHECKED BY: GGJ
APPROVED BY: GGJ
DATE: 01/31/2025
PROJECT NO: N222JK

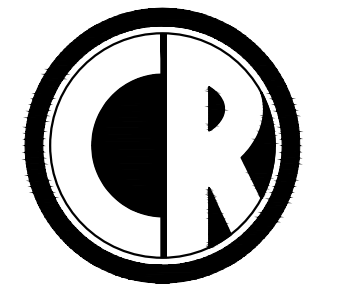
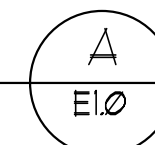
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E0.3



OVERALL ELECTRICAL FLOOR PLAN

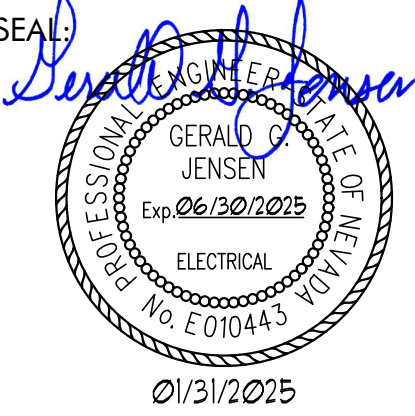
SCALE: 1/16" = 1'-0"



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DOUGLAS COUNTY SCHOOL DISTRICT
CC MENELEY ELEMENTARY SCHOOL
BOILER REPLACEMENT
1446 MUIR DRIVE, GARDNERVILLE, NV 89460
OVERALL ELECTRICAL FLOOR PLAN

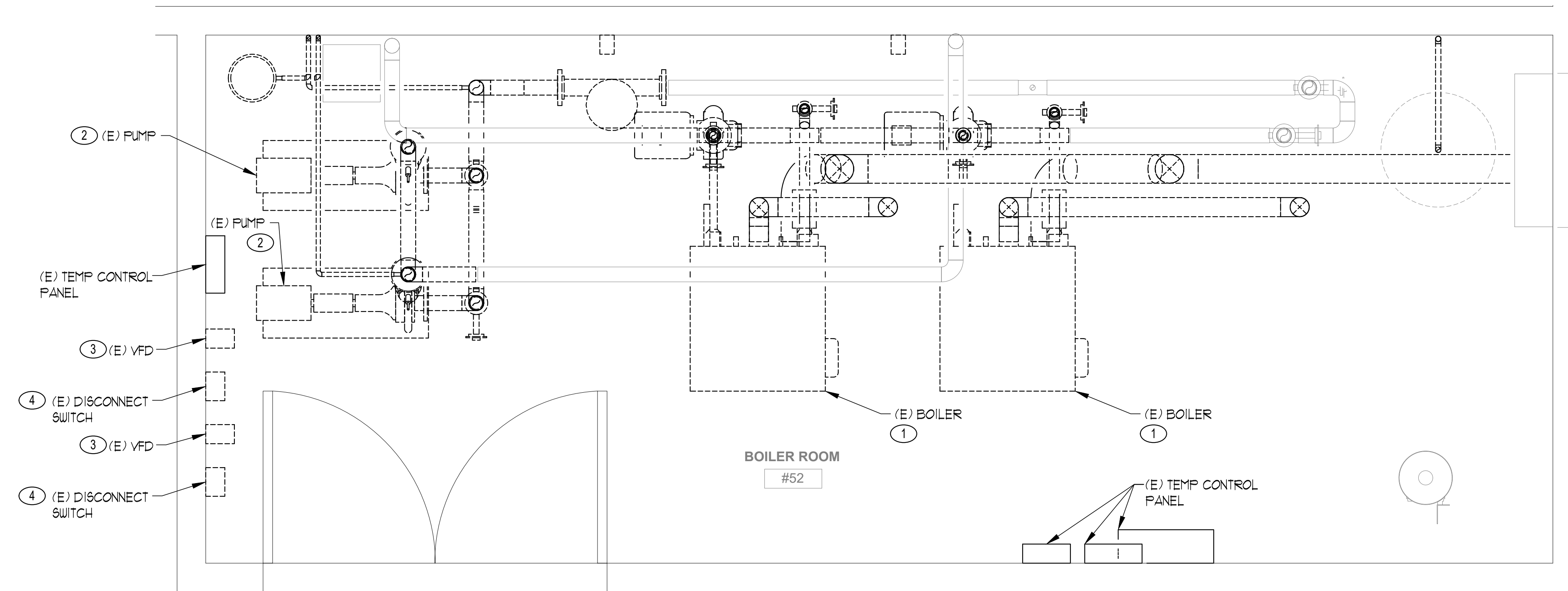
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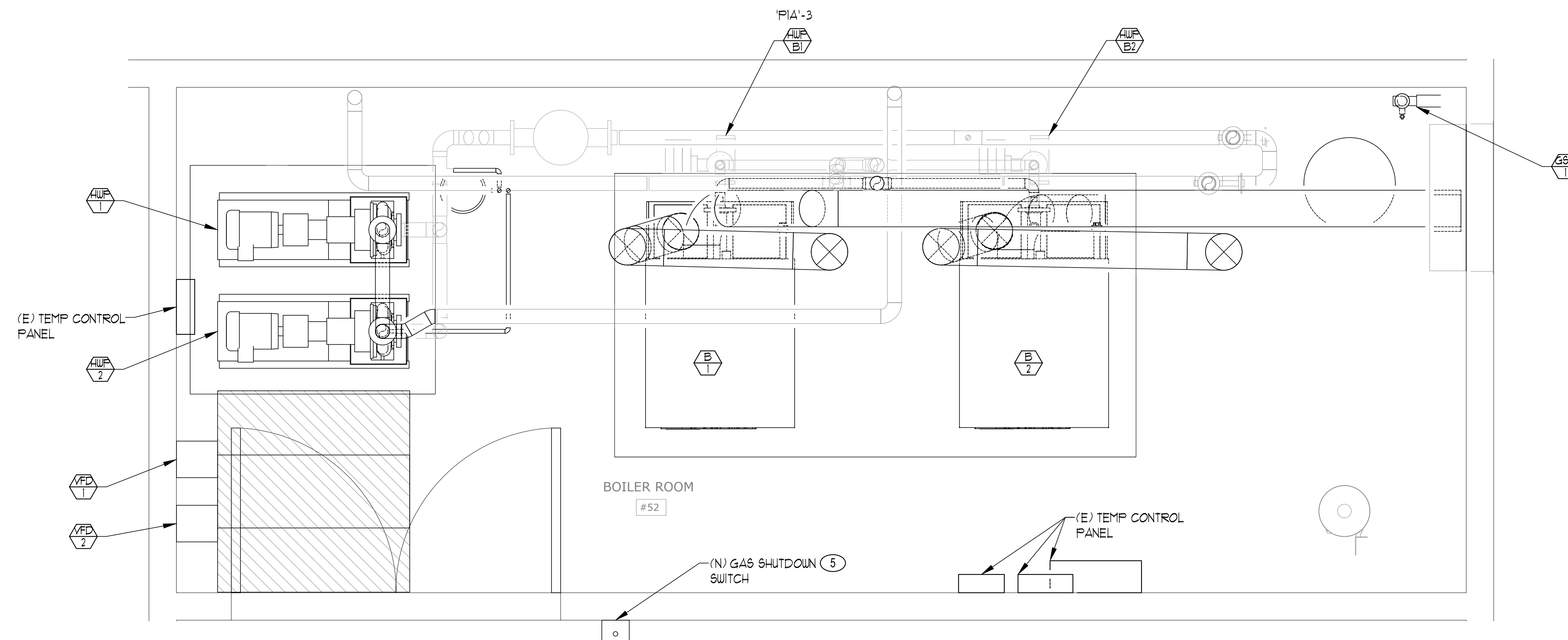
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DESIGNED BY: KPJ
CHECKED BY: GGJ
APPROVED BY: GGJ
DATE: 01/31/2025
PROJECT NO: N222JK

SHEET NUMBER:

E1.0



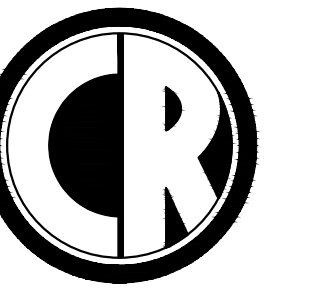
ENLARGED BOILER ROOM DEMOLITION FLOOR PLAN
SCALE: 3/4" = 1'-0"
A
E11



ENLARGED BOILER ROOM ELECTRICAL FLOOR PLAN
SCALE: 3/4" = 1'-0"
B
E11

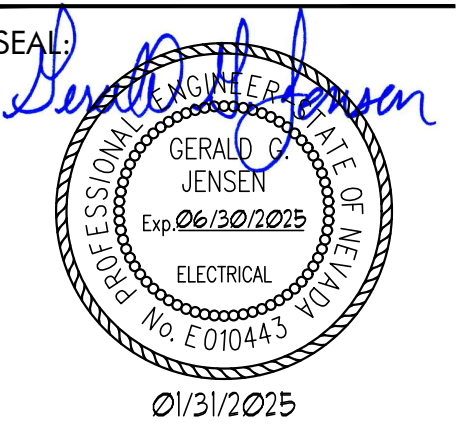
SHEET NOTES: (THIS SHEET ONLY)

- 1 REMOVE AND RETIRE (E) CONDUIT AND CONDUCTORS TO (E) BOILER.
- 2 REMOVE AND RETIRE (E) CONDUIT AND CONDUCTORS TO (E) PUMP.
- 3 REMOVE AND RETIRE (E) CONDUIT AND CONDUCTORS TO (E) VFD.
- 4 REMOVE AND RETIRE (E) CONDUIT AND CONDUCTORS TO (E) DISCONNECT SWITCH.
- 5 COORDINATE WITH MECHANICAL AND CONTROL DRAWINGS FOR REQUIREMENTS WITH (N) AND (E) SHUTDOWN SWITCHES.



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DOUGLAS COUNTY SCHOOL DISTRICT
CC MENELEY ELEMENTARY SCHOOL
BOILER REPLACEMENT
1446 MUIR DRIVE, GARDNERVILLE, NV 89460
ENLARGED BOILER ROOM ELECTRICAL
DEMOLITION & NEW WORK PLAN

REVISIONS:		
REV.	DESCRIPTION	DATE

DRAWN BY: KPJ
DESIGNED BY: KPJ
CHECKED BY: GGJ
APPROVED BY: GGJ
DATE: 01/31/2025
PROJECT NO: N222JK
SHEET NUMBER:

E1.1

MINDEN ELEMENTARY SCHOOL
BOILER REPLACEMENT

1170 BALER STREET
MINDEN, NV 89423
FOR
DOUGLAS COUNTY SCHOOL DISTRICT
1126 AIRPORT ROAD, BUILDING E-1
MINDEN, NV 89423
PWP-DO-2025-166

Douglas County
School District

VICINITY MAP

LOCATION MAP

DIRECTORY

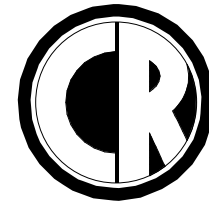
OWNER

DOUGLAS COUNTY SCHOOL DISTRICT
1126 AIRPORT ROAD, BUILDING E-1
MINDEN, NV 89423

CONTACTS: PHIL DEMUS
FACILITIES DIRECTOR
(775) 782-5134

CONSULTANTS

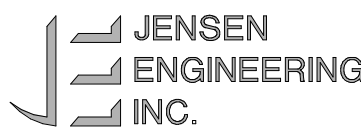
MECHANICAL



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CONTACT: CHUN LEE, P.E.
PROJECT MANAGER

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CONTACT: KYLE JENSEN
PROJECT MANAGER

GENERAL NOTES

- THE PROJECT SPECIFICATIONS AND DRAWINGS ARE A DOCUMENT SET AND SHOULD NOT BE SEPARATED. INFORMATION AND REFERENCES ARE CONTAINED IN ALL SPECIFICATIONS AND DRAWINGS.
- IT IS THE CONTRACTOR'S RESPONSIBILITY TO FULLY UNDERSTAND THE COMPLETE SET OF SPECIFICATIONS AND THE DRAWINGS FOR THIS PROJECT. IT IS THE CONTRACTOR'S RESPONSIBILITY TO REVIEW ALL OF THE INFORMATION CONTAINED IN THE SPECIFICATIONS AND DRAWINGS, INCLUDING ALL OTHER DISCIPLINES (ARCHITECTURAL, ELECTRICAL, STRUCTURAL, ETC.) PRIOR TO BID AND CONSTRUCTION.
- THE CONTRACTOR SHALL INSTALL THE NEW EQUIPMENT, AND PIPING AROUND ALL EXISTING OBSTACLES INCLUDING: ELECTRICAL CONDUIT, DOMESTIC WATER PIPING, WASTE AND VENT PIPING, CHILLED AND HEATING WATER PIPING, AND FIRE SPRINKLER PIPING. PROVIDE OFFSETS TO AVOID RELOCATION OF OTHER UTILITIES. RELOCATE UTILITIES IF THEY ARE IN CONFLICT WITH THE MECHANICAL SYSTEM INSTALLATION, CAUSE DEVIATIONS IN THE DESIGN INTENT, UNSATISFACTORY OPERATION, NOISY CONDITIONS, OR INTERFERE WITH MAINTENANCE. IT IS THE MECHANICAL CONTRACTOR'S RESPONSIBILITY TO COORDINATE ANY UTILITY RELOCATION WITH THE APPROPRIATE SUBCONTRACTOR.
- THE INFORMATION INDICATED ON THESE DRAWINGS AS EXISTING IS BASED UPON INFORMATION TAKEN FROM AS-BUILT DRAWINGS, FIELD INVESTIGATION, AND INFORMATION OBTAINED FROM SUBMITTAL DATA, ETC. THE PLANS DO NOT GUARANTEE ACCURACY BUT ARE ONLY AN INDICATION OF EXISTING CONDITIONS. IT IS THE CONTRACTOR'S RESPONSIBILITY TO FIELD VERIFY EXACT CONDITIONS SUCH AS EQUIPMENT PLACEMENT, DUCTWORK (SIZE, ROUTING, AND ELEVATION), PIPING (SIZE, ROUTING, AND ELEVATION), ETC. THE DRAWINGS ARE INTENDED TO PROVIDE THE CONTRACTOR AN INDICATION OF THE SYSTEM INSTALLED IN THE FACILITY TO DATE. IT WILL BE THE CONTRACTOR'S RESPONSIBILITY TO MAKE ADJUSTMENTS TO THE INSTALLATION AS REQUIRED TO MATCH EXISTING FIELD CONDITIONS.
- ALL ROOF-MOUNTED EQUIPMENT OR PENETRATIONS ASSOCIATED WITH THIS PROJECT ARE TO BE FLASHED BY A LICENSED ROOFING CONTRACTOR. THE ROOFING CONTRACTOR SHALL HAVE EXPERIENCE WITH THE EXISTING ROOFING MEMBRANE. NEW FLASHING MATERIALS SHALL BE INSTALLED TO COMPLY WITH THE MEMBRANE MANUFACTURER'S SPECIFICATIONS OR DETAILS PUBLISHED BY THE NATIONAL ROOFING CONTRACTORS ASSOCIATION WATERPROOFING MANUAL. IN ACCEPTANCE OR REJECTION OF THE WORK, THE OWNER WILL MAKE NO ALLOWANCE FOR LACK OF SKILL ON THE PART OF THE CONTRACTOR.

SHEET INDEX

GENERAL INFORMATION

T0.1 TITLE SHEET

MECHANICAL

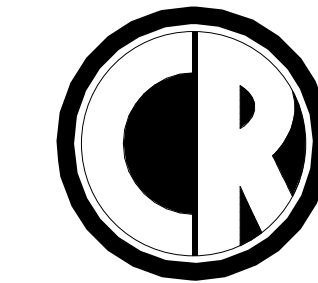
- | | |
|------|--|
| M0.1 | MECHANICAL ABBREVIATIONS, LEGEND, CALCULATIONS, AND GAS ISOMETRICS |
| M0.2 | MECHANICAL SCHEDULES |
| M0.3 | MECHANICAL COMPLIANCE CERTIFICATE |
| M1.0 | OVERALL MECHANICAL FLOOR PLAN |
| M1.1 | ENLARGED BOILER ROOM MECHANICAL DEMOLITION FLOOR PLAN |
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ELECTRICAL

- | | |
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| E0.1 | ELECTRICAL SYMBOLS & MECHANICAL EQUIPMENT CONNECTION SCHEDULE |
| E0.2 | ELECTRICAL SPECIFICATIONS |
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| E1.0 | OVERALL ELECTRICAL FLOOR PLAN |
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BUILDING CODES

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



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SEAL:



CONSULTANT:

DOUGLAS COUNTY SCHOOL DISTRICT
MINDEN ELEMENTARY SCHOOL
BOILER REPLACEMENT
1170 BALER STREET, GARDNERVILLE, NV 89423

TITLE SHEET

REVISIONS:

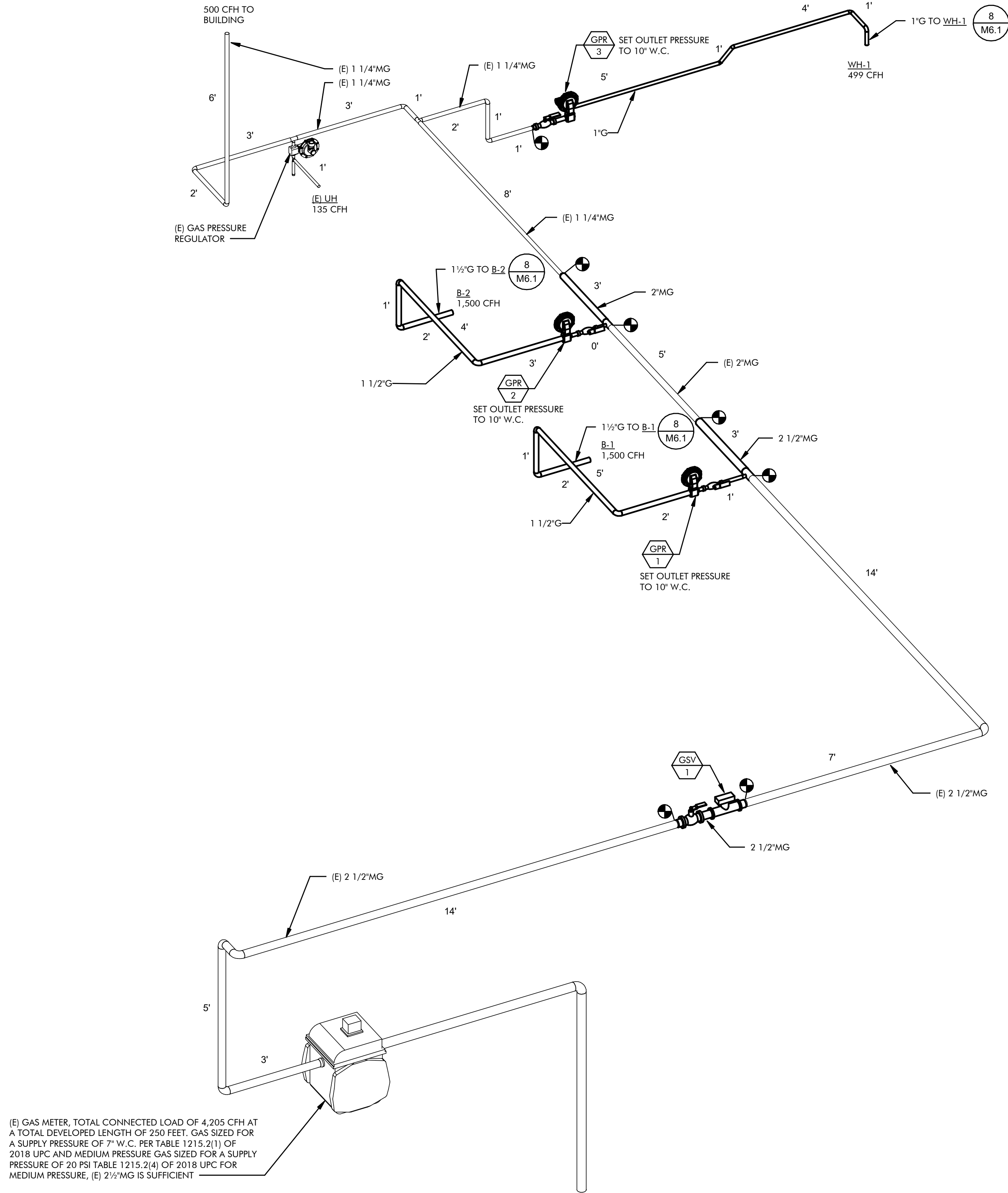
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DRAWN BY:	RLT
DESIGNED BY:	CL
CHECKED BY:	CL
APPROVED BY:	CLR
DATE:	1/31/2025
PROJECT NO:	158324

SHEET NUMBER:

T0.1

PLOT DATE:



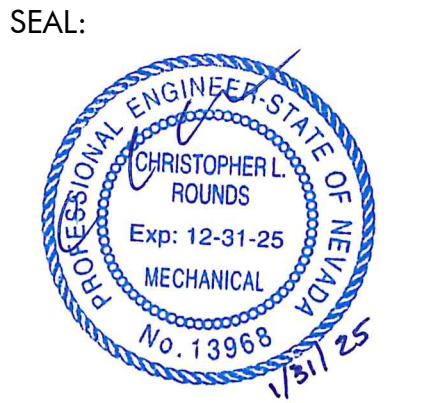
1 GAS ISOMETRIC
M0.1 SCALE : NONE

MECHANICAL ABBREVIATIONS	
ACFM	ACTUAL CUBIC FEET PER MINUTE
AF	AIR FILTER
AFF/AFG	ABOVE FINISHED FLOOR/GRADE
A	AMPERE
APD	AIR PRESSURE DROP
BFF/BFG	BELOW FINISHED FLOOR/GRADE
BHP	BRAKE HORSEPOWER
BTUH	BRITISH THERMAL UNITS PER HOUR
CFM	CUBIC FEET PER MINUTE
COP	COEFFICIENT OF PERFORMANCE
Cv	VALVE FLOW COEFFICIENT
(D)	DEMOLISH
DB,WB	DRY BULB, WET BULB TEMPERATURE
DG	DOOR GRILLE
DIA	DIAMETER
DN	DOWN
DP	DIFFERENTIAL PRESSURE
(E)	EXISTING
EAT/LAT	ENTERING/LEAVING AIR TEMPERATURE
ESP	EXTERNAL STATIC PRESSURE
EWT/LWT	ENTERING/LEAVING WATER TEMPERATURE
FLA	FULL LOAD AMPERES
FPM	FEET PER MINUTE
FT	FOOT
FT²	SQUARE FOOT
FT³	CUBIC FOOT
GA	GAUGE
GPM	GALLONS PER MINUTE
HP	HORSEPOWER
HZ	HERTZ
IN	INCH
IN²	SQUARE INCH
IN³	CUBIC INCH
KW	KILOWATT
LBS	POUNDS
LRA	LOCKED ROTOR AMPERES
MAX	MAXIMUM
MBH	THOUSAND BRITISH THERMAL UNITS PER HOUR
MCA	MINIMUM CIRCUIT AMPACITY
MIN	MINIMUM
MOC	MAXIMUM OVERCURRENT PROTECTION
(N)	NEW
PSI	POUNDS PER SQUARE INCH
PSIG	POUNDS PER SQUARE INCH GAUGE
R	REGISTER
RPM	REVOLUTIONS PER MINUTE
TDH	TOTAL DYNAMIC HEAD
TG	TRANSFER GRILLE
TSP	TOTAL STATIC PRESSURE
TYP	TYPICAL
V	VOLTS
W	WATT
WC/WG	WATER COLUMN/GAUGE

MECHANICAL SYMBOL LEGEND		
SYMBOL	ABBR.	DESCRIPTION
	SA	SUPPLY AIR
	RA	RETURN AIR
	EA	EXHAUST AIR
	OA	OUTSIDE AIR
		POSITIVE PRESSURE DUCT SECTION - FIRST SIZE IS TOP
		NEGATIVE PRESSURE DUCT SECTION - FIRST SIZE IS TOP
		DUCT SIZE - FIRST SIZE IS SIDE SHOWN
		FLEXIBLE DUCT
		FLEXIBLE DUCT CONNECTOR
	MVD	MANUAL VOLUME DAMPER
	OBD	OPPOSED BLADE DAMPER
		MOTORIZED ACTUATOR
	TSTAT	THERMOSTAT OR TEMPERATURE SENSOR @ 48" AFF
	SW	SIDE WALL DIFFUSER
	BFP	BACKFLOW PREVENTER
	BV	BALL VALVE
	BFV	BUTTERFLY VALVE
	CV	CHECK VALVE
	FCV	FLOW CONTROL (BALANCE) VALVE
	PRV	PRESSURE REDUCING VALVE
	PTRV	PRESSURE AND TEMPERATURE RELIEF VALVE
	TCV	TEMPERATURE CONTROL VALVE (2-WAY OR 3-WAY)
	TDV	TRIPLE DUTY VALVE
	STR	STRAINER
		UNION
		PIPE BREAK
		PIPE CAP OR PLUG
	ELL	PIPE ELBOW
		PIPE ELBOW DOWN
		PIPE ELBOW UP
		PIPE TEE
		PIPE RISER
		PIPE DROP
		PIPE BRANCH, TOP CONNECTION
		PIPE BRANCH, BOTTOM CONNECTION
	FLEX	FLEXIBLE PIPE CONNECTOR
		WATER METER
		PRESSURE SENSOR, TEMPERATURE SENSOR WITH WELL
		PRESSURE GAUGE, TEMPERATURE GAUGE
	P	PUMP
	HWS/R	HOT WATER SUPPLY/RETURN PIPING
	D	EQUIPMENT OR CONDENSATE DRAIN PIPING
	CW	DOMESTIC COLD WATER
	DHW	DOMESTIC HOT WATER
	DHWR	DOMESTIC HOT WATER RETURN
	G	NATURAL GAS
	POC	POINT OF CONNECTION
	POC	POINT OF DISCONNECT

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CONSULTANT:

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MINDEN ELEMENTARY SCHOOL
BOILER REPLACEMENT
1170 BALER STREET, GARDNERVILLE, NV 89423
MECHANICAL ABBREVIATIONS, LEGEND,
CALCULATIONS, AND GAS ISOMETRICS

REVISIONS:		
REV.	DESCRIPTION	DATE
-	-	-
-	-	-
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DRAWN BY: RLT
DESIGNED BY: CL
CHECKED BY: CL
APPROVED BY: CLR
DATE: 1/31/2025
PROJECT NO: 158324

SHEET NUMBER:

M0.1

PLOT DATE:

CONDENSING BOILER SCHEDULE																				
UNIT GENERAL DATA						ELECTRICAL			OUTPUT DATA											
	SERVICE	MANUFACTURER	MODEL	OPERATING WEIGHT (LBS)	WATER CONTENT (GALLONS)	VOLTS/Ø/Hz	FLA	MOCP	INPUT (BTUH)	OUTPUT AT ELEVATION (BTUH)	FLUID	FLUID FLOW (GPM)	LWT (°F)	EWI (°F)	MAX WPD (FT WC)	VENT SIZE (IN)	VENT MATERIAL	COMBUSTION AIR SIZE (IN)	COMBUSTION AIR MATERIAL	UNIT OPTION
1	HEATING HOT WATER SYSTEM	CLEAVER BROOKS	CFCE 1500	2,800	110	120/1/60	15	20	1,500,000	1,275,000	WATER	85	180	150	5	8	UL 1738	8	GALVANIZED	A,B,C,D,E,F,G,H,I,J,K,L,M,N,O,P,Q
2	HEATING HOT WATER SYSTEM	CLEAVER BROOKS	CFCE 1500	2,800	110	120/1/60	15	20	1,500,000	1,275,000	WATER	85	180	150	5	8	UL 1738	8	GALVANIZED	A,B,C,D,E,F,G,H,I,J,K,L,M,N,O,P,Q
GENERAL NOTES:						OPTIONS/FEATURES:														
1. DESCRIPTION: FULLY MODULATING, STAINLESS STEEL HEAT EXCHANGER, CONDENSING NATURAL GAS FIRED BOILER.						A. MODULATING BURNER W/10:1 FIRING TURN DOWN RATIO.						J. CONTACTS ON ANY FAILURE.								
2. OUTPUT IS SHOWN FOR 4,700 FT ELEV.						B. SPARK IGNITION.						K. MANUFACTURER'S CAPSULE TYPE CONDENSATE NEUTRALIZATION KIT.								
3. COMBUSTION AIR AND FLUE TO BE SIZED PER MANUFACTURER'S CALCULATION. INDICATED COMBUSTION AIR AND FLUE SIZES ARE SHOWN FOR SPECIFIED BOILER ONLY. CONTRACTOR TO INCLUDE MANUFACTURER'S FLUE AND COMBUSTION AIR CALCULATION WITH SUBMITTALS.						C. ADJUSTABLE HIGH LIMIT AND MANUAL RESET TEMPERATURE CONTROL.						L. FACTORY SYSTEM HEADER SENSOR WITH IMMERSION WELL.								
4. SPECIFIED BOILER DOES NOT REQUIRE ALTITUDE DERATE PER THIRD PARTY TESTING IN ACCORDANCE TO ANSI Z21.13. IF SPECIFIED BOILER IS NOT PROVIDED, CONTRACTOR TO PROVIDE LETTER FROM MANUFACTURER INDICATING SUBSTITUTE BOILER HAS BEEN THIRD PARTY TESTED IN ACCORDANCE TO ANSI Z21.13 OR CONTRACTOR IS TO PROVIDE BOILER WITH THE SPECIFIED OUTPUT. LARGER INPUT MAY REQUIRE LARGER GAS PIPING, FLUE, AND COMBUSTION AIR.						D. MANUFACTURER'S LOW-WATER CUTOFF WITH MANUAL RESET, SO THAT BOILER IS COMPLIANT WITH CSD-1 AND NEVADA BOILER CODE.						M. FACTORY TRAINING AND AUTHORIZED START-UP.								
5. FLUE MATERIAL TO BE UL1738 COMPLIANT STAINLESS STEEL. COMBUSTION AIR TO BE GALVANIZED SHEET METAL DUCT. PAINT EXTERIOR PORTION OF DUCT TO MATCH BUILDING						E. ASME RATED PRESSURE RELIEF VALVE, SET AT 75 PSI.						N. MANUFACTURER'S SEISMIC ANCHORING KIT								
						F. SEQUENTIAL AND DIAGNOSTIC CONTROL PANEL.						O. INTEGRATED BOILER DRAIN VALVE.								
						G. DIGITAL DISPLAY WITH ALARM AND STATUS ON A TOUCH SCREEN.						P. MANUFACTURER'S UL LISTED FLUE ROOF TERMINATION OUTLET								
						H. VENT MATERIAL SHALL BE UL 1738 COMPLIANT, 444 STAINLESS STEEL						Q. MANUFACTURER'S SEISMIC ANCHORING KIT								
						I. 87% OPERATING THERMAL EFFICIENCY AT 150°F RETURN WATER TEMPERATURE AND 100% INPUT														

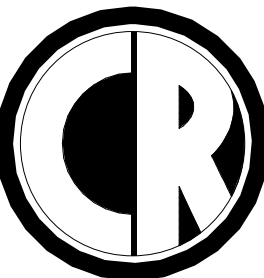
VFD SCHEDULE								
	EQUIPMENT SERVED	MANUFACTURER	MODEL	ELECTRICAL				OPTIONS
				HP	VOLTS	PHASE	HZ	
1	HWP-1	ABB	ACH580	15	460	3	60	A,B,C,D
2	HWP-2	ABB	ACH580	15	460	3	60	A,B,C,D
GENERAL NOTES: 1. ALL DRIVES TO BE SUPPLIED BY CONTROLS CONTRACTOR AND WIRED BY ELECTRICAL CONTRACTOR. CONTROLS CONTRACTOR TO COORDINATE WITH EQUIPMENT MANUFACTURER FOR INSTALLATION AND START-UP REQUIREMENTS 2. COORDINATE EXACT LOCATION WITH ELECTRICAL DRAWINGS.								
OPTIONS A. MANUFACTURER'S INTERNAL 5% INPUT LINE REACTORS B. PROVIDE AND INSTALL BACNET COMMUNICATION CARDS C. MANUFACTURER'S CIRCUIT BREAKER TYPE DISCONNECT D. MANUFACTURER'S INTERNAL DC LINE CHOKE								

PUMP SCHEDULE																							
UNIT GENERAL DATA																							
	SERVICE	MANUFACTURER	MODEL	OPERATING WEIGHT (LBS)	SIZE	TYPE	FLOW (GPM)	TDH (FT)	FLUID	IMP. DIA. (IN)	MIN EFF. (%)	SUCTION (IN)	DISCH. (IN)	TRIPLE DUTY VALVE MODEL	TRIPLE DUTY VALVE SIZE (IN)	TRIPLE DUTY PRESS DROP (PSI)	SUCTION DIFFUSER MODEL	FRAME SIZE	HP	FLA	V/Ph/Hz	RPM	UNIT OPTION
HWP-1	HEATING HOT WATER SYSTEM	TACO	3011D	650	3 x 3	INLINE	150	110	WATER	11	64	3	3	N/A	N/A	N/A	SDS30030-5	254TC	15	N/A	460/3/60	1,760	A,B,C,D,E
HWP-2	HEATING HOT WATER SYSTEM	TACO	3011D	650	3 x 3	INLINE	150	110	WATER	11	64	3	3	N/A	N/A	N/A	SDS30030-5	254TC	15	N/A	460/3/60	1,760	A,B,C,D,E
HWP-B1	B-1	GRUNDFOS	MAGNA 3 50-150F N	50	N/A	INLINE	85	20	WATER	N/A	75	2	2	MPV	2½	3.0	N/A	N/A	1	5.7	120/1/60	3,600	A,B,D
HWP-B2	B-2	GRUNDFOS	MAGNA 3 50-150F N	50	N/A	INLINE	85	20	WATER	N/A	75	2	2	MPV	2½	3.0	N/A	N/A	1	5.7	120/1/60	3,600	A,B,D
INFORMATION FOR INLINE MOUNTED PUMPS SCHEDULED ABOVE							INFORMATION FOR INLINE MOUNTED BOILER PUMPS SCHEDULED ABOVE										OPTIONS FOR PUMPS SCHEDULED ABOVE						
GENERAL							GENERAL										A. ODP, PREMIUM EFFICIENCY, INVERTER DUTY MOTOR						
1. DESCRIPTION: MAINTENANCE FREE, INLINE, SPLIT-COUPLED, HORIZONTAL POSITION, CAST IRON CENTRIFUGAL PUMP.							1. DESCRIPTION: MAINTENANCE FREE, INLINE, CLOSE COUPLED, VERTICAL OR HORIZONTAL POSITION, CAST IRON CENTRIFUGAL PUMP										B. PROVIDE WITH TWIN CITY HOSE (OR APPROVED EQUAL) STAINLESS STEEL FLEX CONNECTOR.						
PUMP							PUMP										C. PUMPS TO BE LASER ALIGNED BY MANUFACTURERS REPRESENTATIVE. PROVIDE REPORT WITH CLOSE OUT DOCUMENT.						
1. PUMP SHALL BE CLASS 30 CAST IRON WITH FLANGE CONNECTIONS.							1. PUMP SHALL BE CLASS 30 CAST IRON WITH FLANGE CONNECTIONS.										D. TUNGSTEN CARBIDE OR SILICONE CARBIDE SEAL, SUITABLE FOR USE IN GLYCOL SYSTEMS.						
2. IMPELLER SHALL BE CAST BRONZE, DYNAMICALLY BALANCED, KEYED TO SHAFT, AND SECURED BY A LOCKING CAPSCREW.							2. IMPELLER SHALL BE CAST BRONZE, DYNAMICALLY BALANCED, KEYED TO SHAFT, AND SECURED BY A LOCKING CAPSCREW.										E. PROVIDE AND INSTALL AEGIS SHAFT GROUNDING RINGS						
MOTOR							MOTOR																
1. TOTALLY ENCLOSED FAN COOLED (TEFC) FOR OUTDOOR APPLICATION.							1. ELECTRONICALLY COMMUTATED MOTOR (ECM)																
2. MOTOR SHALL MEET NEMA SPECIFICATIONS AND BE NON-OVERLOADING FOR ENTIRE PUMP CURVE.							2. MOTOR SHALL MEET NEMA SPECIFICATIONS AND BE NON-OVERLOADING FOR ENTIRE PUMP CURVE.																
3. MOTOR SHALL BE INVETER-DUTY.																							

EQUIPMENT SCHEDULE	
	CHEMICAL FEED TANK NU-CALGON MODEL 20L (OR APPROVED EQUAL) FLAT BOTTOM, MILD STEEL, 2-GALLON CHEMICAL FEEDER WITH 3½" QUARTER-TURN CAP AND 3/4" NPT PORTS. PROVIDE AND INSTALL MANUFACTURER'S FLOW INDICATOR AND FILTER. PROVIDE WITH MANUFACTURER'S WALL BRACKET.
	GAS SHUT-OFF VALVE WHS MODEL WWS212-120 (OR APPROVED EQUAL) NORMALLY CLOSED, POWERED OPEN GAS SHUT OFF VALVE. VALVE TO BE CONSTRUCTED OF CAST ALUMINUM WITH STAINLESS STEEL CORES AND SPRINGS. VALVE TO BE CSA CERTIFIED AND UL LISTED FOR NATURAL GAS USE. VALVE TO BE 2½". ELECTRICAL: 120V/1/60, FLA: 1.0 A
	GAS PRESSURE REGULATOR AMERICAN METER COMPANY MODEL #1813B (OR APPROVED EQUAL) 1½" OUTLET WITH AN INLET PRESSURE OF 2.0 PSI AND OUTLET PRESSURE OF 11"W.C. REGULATOR TO INCLUDE STEEL DIAPHRAGM CHAMBER, AND BUNA-N SEAL DISC. PIPE SECTION TO BE CAST IRON. REGULATOR PRESSURE RATING OF 125 PSIG. REGULATOR TO PROVIDE UP TO 2,000 CFH OF NATURAL GAS. GAS REGULATOR SHALL INCLUDE, PRESSURE TAPS, FULL CAPACITY RELIEF VALVE, AND UNIVERSAL SAFETY-OFF ASSEMBLY. USE 5/8" ORIFICE AND 8.5-14" W.C SPRING. GAS INLET TO BE 1½", GAS OUTLET TO BE 1½", AND VENT TO BE 2".
	GAS PRESSURE REGULATOR AMERICAN METER COMPANY MODEL #1813C (OR APPROVED EQUAL) 3/4" OUTLET WITH AN INLET PRESSURE OF 2.0 PSI AND OUTLET PRESSURE OF 10"W.C. REGULATOR TO INCLUDE STEEL DIAPHRAGM CHAMBER, AND BUNA-N SEAL DISC. PIPE SECTION TO BE CAST IRON. REGULATOR PRESSURE RATING OF 125 PSIG. REGULATOR TO PROVIDE UP TO 650 CFH OF NATURAL GAS. GAS REGULATOR SHALL INCLUDE, PRESSURE TAPS, FULL CAPACITY RELIEF VALVE, AND UNIVERSAL SAFETY-OFF ASSEMBLY. USE 1/2" ORIFICE AND 6-15" W.C SPRING. GAS INLET TO BE 1", GAS OUTLET TO BE 3/4", AND VENT TO BE 1".
	WATER HEATER LOCHINVAR CONDENSING COMMERCIAL ASME GAS WATER HEATER MODEL #SWA500 (OR APPROVED EQUAL). HEATER SHALL HAVE AN INPUT OF 500,000 BTUH, AND A MINIMUM RECOVERY OF 582 GPH AT 100°F TEMPERATURE RISE. TANK SHALL BE 110 GALLONS WITH NON-CFC FOAM INSULATION, GLASS LINED STEEL TANK, AND STAINLESS STEEL HEAT EXCHANGER. PROVIDE COMPLETE WITH ELECTRONIC CONTROLS, MAGNESIUM ANODE ROD, DIELECTRIC FITTINGS, BRASS DRAIN VALVE, TRIPLE PASS FLUE SYSTEM, HAND HOLE CLEAN OUT, BUILT-IN POWER CORD, AND RELIEF VALVE. SET THERMOSTAT AT 140°F. UNIT SHALL HAVE A MINIMUM EFFICIENCY OF 96.0%. WATER HEATER SHALL HAVE 5 TO 1 MODULATION. PROVIDE AND INSTALL POLYPROPYLENE MANUFACTURER'S CONCENTRIC VENT KIT, LOW WATER CUT-OFF, AND MANUFACTURER'S CONDENSATE NEUTRALIZATION KIT. WT: 2,000 LBS ELEC: 120V/1Ø/60Hz
	WATER METER SEAMETRICS MODEL MINR-100-16-07 (OR APPROVED EQUAL) BRASS WATER METER WITH REED SWITCH WITH 1 GALLON PER PULSE. PROVIDE AND INSTALL MANUFACTURER'S CONTROL CONNECTOR.

AIR/DIRT SEPARATOR SCHEDULE										
UNIT GENERAL DATA					FLOW DATA					
	SERVICE	MANUFACTURER	MODEL	OPERATING WEIGHT (LBS)	OPERATING FLOW (GPM)	MAXIMUM FLOW (GPM)	PRESS. DROP (FT WC)	INLET (IN)	OUTLET (IN)	OPTIONS
1	HEATING HOT WATER	TACO	4904ADMR-125	275	150	204	5	4	4	A
GENERAL NOTES:			CONSTRUCTION				OPTIONS			
1. DESCRIPTION: COALESCING TYPE AIR ELIMINATOR			1. SHELL SHALL BE CONSTRUCTED OF EPOXY COATED STEEL.				A. MANUFACTURER'S ON/OFF MAGNETIC CONTROLS			
DESIGN PRESSURE AND TEMPERATURE			2. UNIT SHALL HAVE AN AUTOMATIC AIR VENT AT THE TOP OF THE SHELL.							
1. AIR/DIRT SEPARATOR SHALL BE RATED FOR 125 PSIG @ 250°F			3. COALESCING MEDIUM SHALL BE STAINLESS STEEL.							
2. UNIT SHALL BE ASME STAMPED			4. UNIT SHALL HAVE A BLOW DOWN VALVE AND SKIM VALVE.							

EXPANSION TANK SCHEDULE													
UNIT GENERAL DATA													
	SERVICE	MANUFACTURER	MODEL	OPERATING WEIGHT (LBS)	TANK VOLUME (GALLONS)	MINIMUM ACCEPT. VOLUME (GALLONS)	OPERATING PRESSURE (PSI)			OPERATING TEMP (°F)		ESTIMATED SYSTEM VOLUME (GALLONS)	OPTIONS
							MIN	MAX	ATM	MIN	MAX		
1	HEATING HOT WATER	TACO	CA300-125	1,000	79	40	20	60	12.5	40	200	950	A,B
2	DOMESTIC HOT WATER	AMTROL	ST-12C-DD	75	6.4	2	20	60	12.5	40	150	N/A	
GENERAL NOTES (HEATING HOT WATER): 1. HEATING HOT WATER EXPANSION TANK TO BE REMOVABLE BLADDER TYPE, PRE-CHARGED, THERMAL EXPANSION TANK FOR HYDRONIC SYSTEMS.													
DESIGN PRESSURE AND TEMPERATURE 1. UNIT TO BE DESIGNED FOR 150 PSI WORKING PRESSURE AND 240°F WORKING TEMPERATURE.													
OPTIONS A. MANUFACTURER'S SIGHT GLASS B. MANUFACTURER'S ANCHOR CLIP													
GENERAL NOTES (DOMESTIC HOT WATER): 1. DOMESTIC HOT WATER EXPANSION TANK TO BE REMOVABLE BLADDER TYPE, PRE-CHARGED, THERMAL EXPANSION TANK FOR DOMESTIC POTABLE SYSTEMS. TO BE NSF-61 RATED.													
BLADDER 1. REMOVABLE HEAVY BUTYL RUBBER BLADDER.													
TANK 1. TANK SHALL HAVE A BOTTOM NPT STAINLESS STEEL SYSTEM CONNECTION AND A .302"-32 CHARGING VALVE CONNECTION (STANDARD TIRE VALVE) TO FACILITATE THE ON-SITE CHARGING OF THE TANK TO MEET SYSTEM REQUIREMENTS.													
CONSTRUCTION 1. TANK SHALL BE CONSTRUCTED IN ACCORDANCE WITH SECTION VII OF THE ASME BOILER AND PRESSURE VESSEL CODE AND STAMPED 150 PSI WORKING PRESSURE.													



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MINDEN ELEMENTARY SCHOOL
BOILER REPLACEMENT
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MECHANICAL SCHEDULES

REVISIONS:

REV.	DESCRIPTION	DATE
-	-	-
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DRAWN BY: RLT
DESIGNED BY: CL
CHECKED BY: CL
APPROVED BY: CLR
DATE: 1/31/2025
PROJECT NO: 158324

SHEET NUMBER:

M0.2

COMcheck Software Version COMcheckWeb
Mechanical Compliance Certificate

Project Information

Energy Code: 2018 IECC
Project Title: 158324 Minden ES
Location: Minden, Nevada
Climate Zone: S0
Project Type: Alteration

Construction Site: 1170 Baler Street
Minden, NV 89423

Owner/Agent: Phil Demus
Douglas County School District
1126 Airport Road, E-1
Minden, NV 89423

Designer/Contractor: Chris Rounds, P.E.
CR Engineering
5434 Langley Ln
Reno, NV 89511

Mechanical Systems List

Quantity System Type & Description

- 1 B-1: Heating: Hot Water Boiler, Capacity 1500 kWhuff, Gas
Proposed efficiency: 85.00 % Et, Required Efficiency: 80.00 % Et
- 1 B-2: Heating: Hot Water Boiler, Capacity 1500 kWhuff, Gas
Proposed efficiency: 85.00 % Et, Required Efficiency: 80.00 % Et
- 1 WH-1: Gas Storage Water Heater, Capacity: 110 gallons, Input Rating: 500 kWhuff w/ Heat Trace Tape Installed
Proposed efficiency: 80.00 % Et, Required Efficiency: 80.00 % Et

Mechanical Compliance Statement

Compliance Statement: The proposed mechanical alteration project represented in this document is consistent with the building plans, specifications, and other calculations submitted with this permit application. The proposed mechanical systems have been designed to meet the 2018 IECC requirements in COMcheck Version COMcheckWeb and to comply with any applicable mandatory requirements listed in the Inspection Checklist.

CHRIS ROUNDS, P.E. 1/31/2025
Name - Title Signature Date

COMcheck Software Version COMcheckWeb
Inspection Checklist

Energy Code: 2018 IECC

Requirements: 0.0% were addressed directly in the COMcheck software
Text in the "Comments/Assumptions" column is provided by the user in the COMcheck Requirements screen. For each requirement, the user certifies that a code requirement will be met and how that is documented, or that an exception is being claimed. Where compliance is itemized in a separate table, a reference to that table is provided.

Section # & Req.ID	Plan Review	Complies?	Comments/Assumptions
C103.2 (F162)*	Plans, specifications, and/or calculations provide all information with which compliance can be determined for the mechanical systems and equipment and document where exceptions to the standard are claimed. List calculations per acceptable engineering standards and handbooks.	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	
C103.2 (F163)*	Plans, specifications, and/or calculations provide all information with which compliance can be determined for the service water heating systems and equipment and document where exceptions to the standard are claimed. Hot water system sized per manufacturer's sizing guide.	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	

Additional Comments/Assumptions:

Section # & Req.ID	Footing / Foundation Inspection	Complies?	Comments/Assumptions
C403.12.2 (F093)*	Snow/ice melting system and freeze protection systems have sensors and controls configured to limit service for pavement temperature and outdoor temperature, future connection to controls.	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	

Additional Comments/Assumptions:

Section # & Req.ID	Plumbing Rough-In Inspection	Complies?	Comments/Assumptions
C404.5.1 (F167)*	Heated water supply piping conforms to pipe length and volume requirements. Refer to section details.	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	
C404.6.3 (F17)*	Pumps that circulate water between a heater and storage tank have controls that limit operation from startup to <= 5 minutes after end of heating cycle.	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	
C404.7 (F18)*	Demand recirculation water systems have controls that start the pump upon receiving a signal from the action of a user of a fixture or appliance and limits the temperature of the water entering the cold-water piping to 104°F.	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	

Additional Comments/Assumptions:

Section # & Req.ID	Mechanical Rough-In Inspection	Complies?	Comments/Assumptions
C402.2.6 (ME41)*	Thermally ineffective panel surfaces of sensible heating panels have insulation >= R-5.	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	
C403.12.1 (ME71)*	Systems that heat outside the building envelope are radiant heat systems controlled by an occupancy sensing device or timer switch.	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	
C403.2.2 (ME35)*	Natural or mechanical ventilation is provided in accordance with the International Mechanical Code Chapter 4. Mechanical ventilation has capability to reduce outdoor air supply to minimum per IMC Chapter 4.	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	
C403.7.1 (ME59)*	Demand control ventilation provided for spaces >500 ft2 and >25 people/1000 ft2 occupant density and served by systems with air side economizer, auto modulating outside air damper control, or design airflow >3,000 cfm.	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	
C403.7.2 (ME115)*	Enclosed parking garage ventilation has automatic contaminant detection and capacity to stage or modulate fans to 50% or less of design capacity.	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	
C403.7.6 (ME116)*	HVAC systems serving guestrooms in Group R-3 buildings with > 50 guestrooms. Each guestroom is provided with controls that automatically manage temperature setpoints and ventilation (see sections C403.7.6.1 and C403.7.6.2).	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	
C403.7.4 (ME37)*	Exhaust air energy recovery on systems meeting Table C403.7.4(1) and C403.7.4(2).	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	
C403.7.5 (ME116)*	Kitchen exhaust systems comply with replacement air and conditioned supply air limitations, and satisfy hood rating requirements and maximum exhaust rate criteria.	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	
C403.11.1 (ME60)*	HVAC ducts and plenums insulated in accordance with C403.11.1 and constructed in accordance with C403.11.2. Verification may need to occur during Foundation Inspection.	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	
C403.4.3 (ME63)*	The heating of fluids in hydronic systems that have been previously mechanically cooled, and the cooling of fluids that have been previously mechanically heated are limited in accordance with Sections C403.4.3.1-C403.4.3.3. Single boiler systems >500,000 Btu/h have multistaged or modulating burner.	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	
C403.4.4 (ME68)*	Hydronic systems greater than 200,000 Btu/h designed for variable fluid flow. See section language for full details.	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	

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Section # & Req.ID	Mechanical Rough-In Inspection	Complies?	Comments/Assumptions
C403.3.4 (ME107)*	System shutdown requirement met through multiple single-input boilers, one or more modulating boilers, or a combination of single-input and modulating boilers. Boiler input between 5.0 MBtu/h and 9 MBtu/h has 3:1 turndown ratio, boiler input between 9.0 MBtu/h and 15 MBtu/h has 4:1 turndown ratio, boiler input > 10.0 MBtu/h has 5:1 turndown ratio.	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	See the Mechanical Systems list for values.
C403.4.1 (ME63)*	Heating for vestibules and air curtains with integral heating include automatic controls that shut off the heating system when outdoor air temperatures > 45°F. Vestibule heating and cooling systems controlled by a thermostat in the vestibule with heating setpoint <= 65°F and cooling setpoint >= 80°F.	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	
C404.2.1 (ME111)*	Gas-fired water-heating equipment installed in new buildings where a singular piece of water-heating equipment >= 1,000 kWhuff serves the entire building, thermal efficiency >= 90 ft. Where multiple pieces of water-heating equipment serve the building with combined rating >= 1,000 kWhuff, the combined input capacity-weighted average thermal efficiency >= 90 ft. Exclude input rating of equipment in individual dwelling units and equipment <= 100 kWhuff.	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	
C408.2.2.1 (ME33)*	Air outlets and zone terminal devices have means for air balancing.	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	
C403.5.1 (ME123)*	Refrigerated display cases, walk-in coolers or walk-in freezers served by remote compressors and remote condensers not located in a condensing unit, have fan-powered condensers that comply with Sections C403.5.1 and refrigeration compressor systems that comply with C403.5.2.	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	

Additional Comments/Assumptions:

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Section # & Req.ID	Rough-In Electrical Inspection	Complies?	Comments/Assumptions
C405.6 (EL26)*	Low-voltage dry-type distribution electric transformers meet the minimum efficiency requirements of Table C405.6.	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	
C405.7 (EL27)*	Electric motors meet the minimum efficiency requirements of Tables C405.7(1) through C405.7(4). Efficiency verified through certification under an approved certification program or the equipment efficiency rating shall be provided by motor manufacturer (where certification programs do not exist).	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	
C405.8.2 (EL28)*	Escalators and moving walks comply with ASME A17.1/CSA B44 and have automatic controls configured to reduce speed to the minimum permitted speed in accordance with ASME A17.1/CSA B44 or applicable local code when not conveying passengers.	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	
C405.9 (EL29)*	Total voltage drop across the combination of feeders and branch circuits <= 5%.	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	

Additional Comments/Assumptions:

Project Title: 158324 Minden ES
Data Filename: 1/31/2025
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Section # & Req.ID	Final Inspection	Complies?	Comments/Assumptions
C303.3.1 (F18)*	Furnished O&M manuals for HVAC systems within 90 days of system acceptance.	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	
C403.2.2 (F12)*	HVAC systems and equipment capacity does not exceed calculated loads.	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	
C403.4.1 (F13)*	Thermostatic controls have a 5 °F deadband.	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	
C403.2.4.1 (F13)*	Temperature controls have setpoint overlap restrictions.	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	
C403.2.4.2 (F13)*	Each zone equipped with setback controls using automatic time clock or programmable control system.	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	
C403.2.4.2.1 (F13)*	Automatic Controls: Setback to 55°F (heated) and 55°F (cooled); 7-day clock, 2-hour occupant override, 10-hour backup.	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	
C403.3 (F11)*	Heat traps installed on supply and discharge piping of non-circulating systems.	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	
C404.4 (F13)*	All piping insulated in accordance with section details and Table C403.11.3.	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	
C408.1.1 (F15)*	Building operations and maintenance documents will be provided to the owner. Documents will cover manufacturers' information, specifications, programming procedures and means of illustrating to owner how building, equipment and systems are intended to be installed, maintained, and operated.	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	
C408.2.1 (F128)*	Commissioning plan developed by registered design professional or approved agency.	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	
C408.2.3 (F13)*	HVAC equipment has been tested to ensure proper operation.	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	

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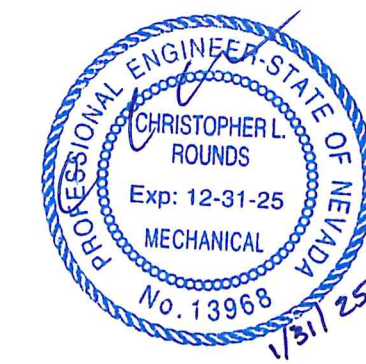
Section # & Req.ID	Final Inspection	Complies?	Comments/Assumptions
C408.2.3 (F110)*	HVAC control systems have been tested to ensure proper operation, calibration and adjustment of controls.	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	
C408.2.4 (F129)*	Preliminary commissioning report completed and certified by registered design professional or approved agency.	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	
C408.2.5.1 (F17)*	Furnished HVAC as-built drawings submitted within 90 days of system acceptance.	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	
C408.2.5.2 (F143)*	An air and/or hydronic system balancing report is provided for HVAC systems.	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	
C408.2.5.3 (F140)*	Final commissioning report due to building owner within 90 days of receipt of certificate of occupancy.	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	

Additional Comments/Assumptions:

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MECHANICAL COMPLIANCE CERTIFICATE

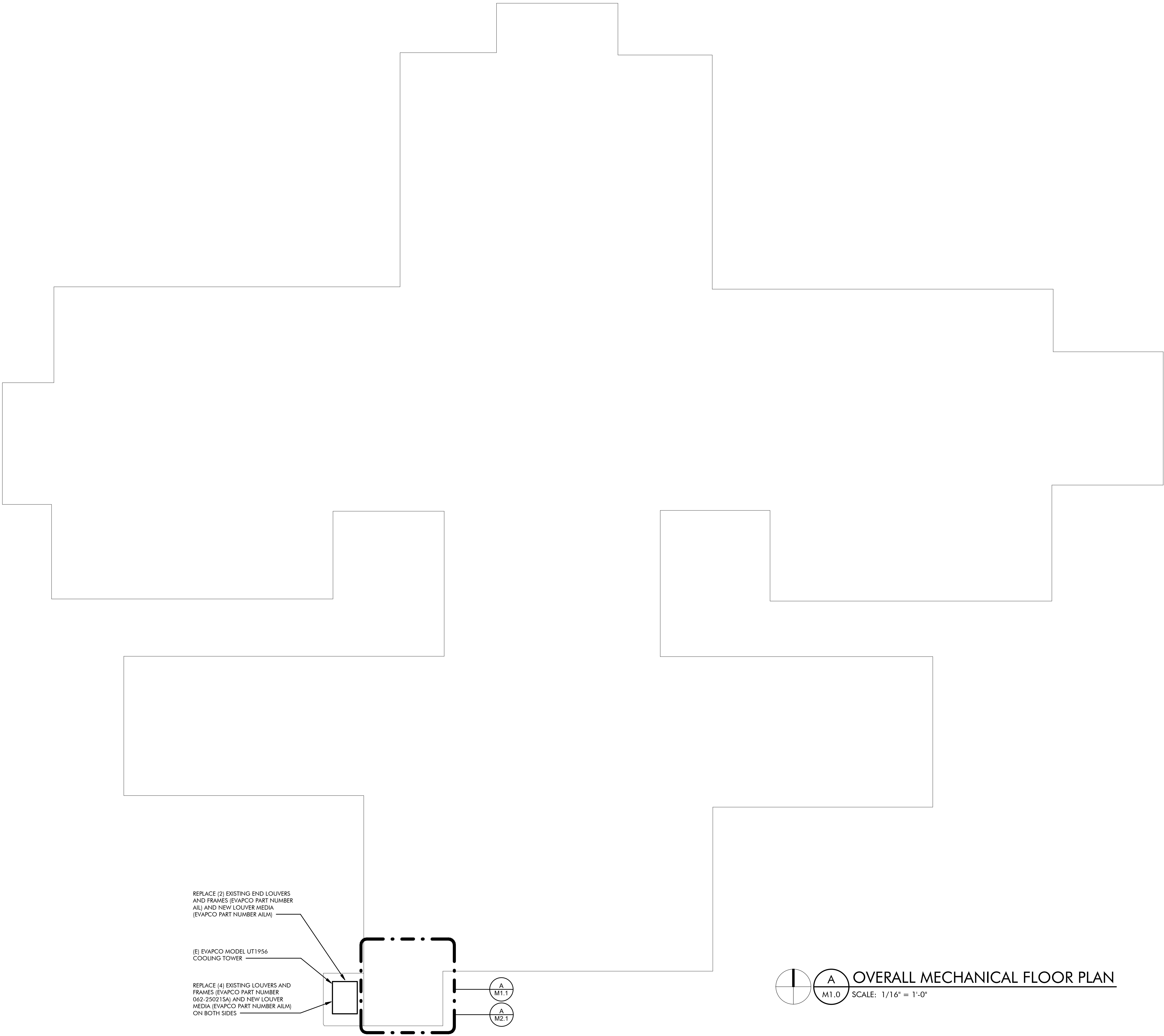
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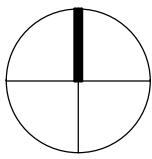
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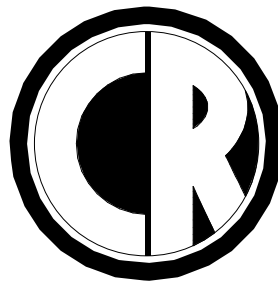
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PROJECT NO: 158324

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PLOT DATE:



 **A**
M1.0 SCALE: 1/16" = 1'-0" **OVERALL MECHANICAL FLOOR PLAN**



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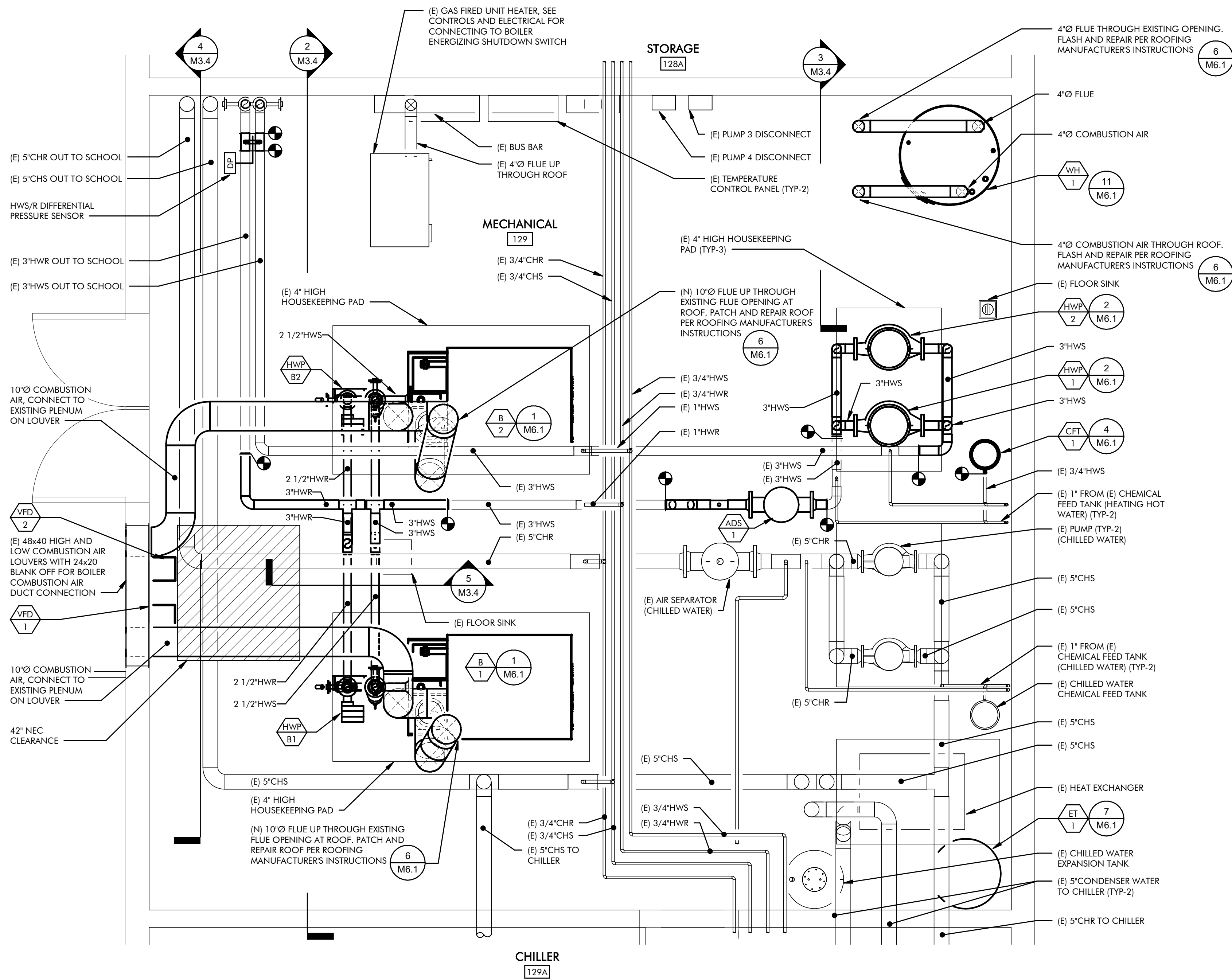
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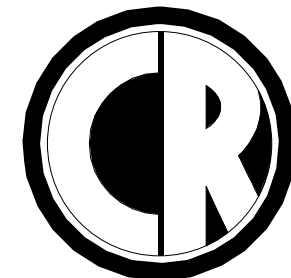
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PLOT DATE:



MECHANICAL BOILER FLOOR PLAN
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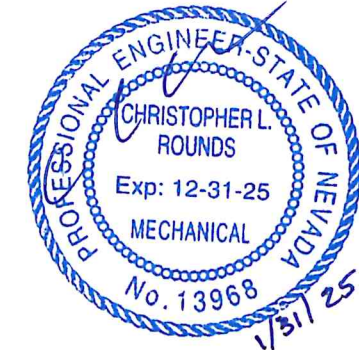


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ENLARGED BOILER ROOM MECHANICAL
FLOOR PLAN

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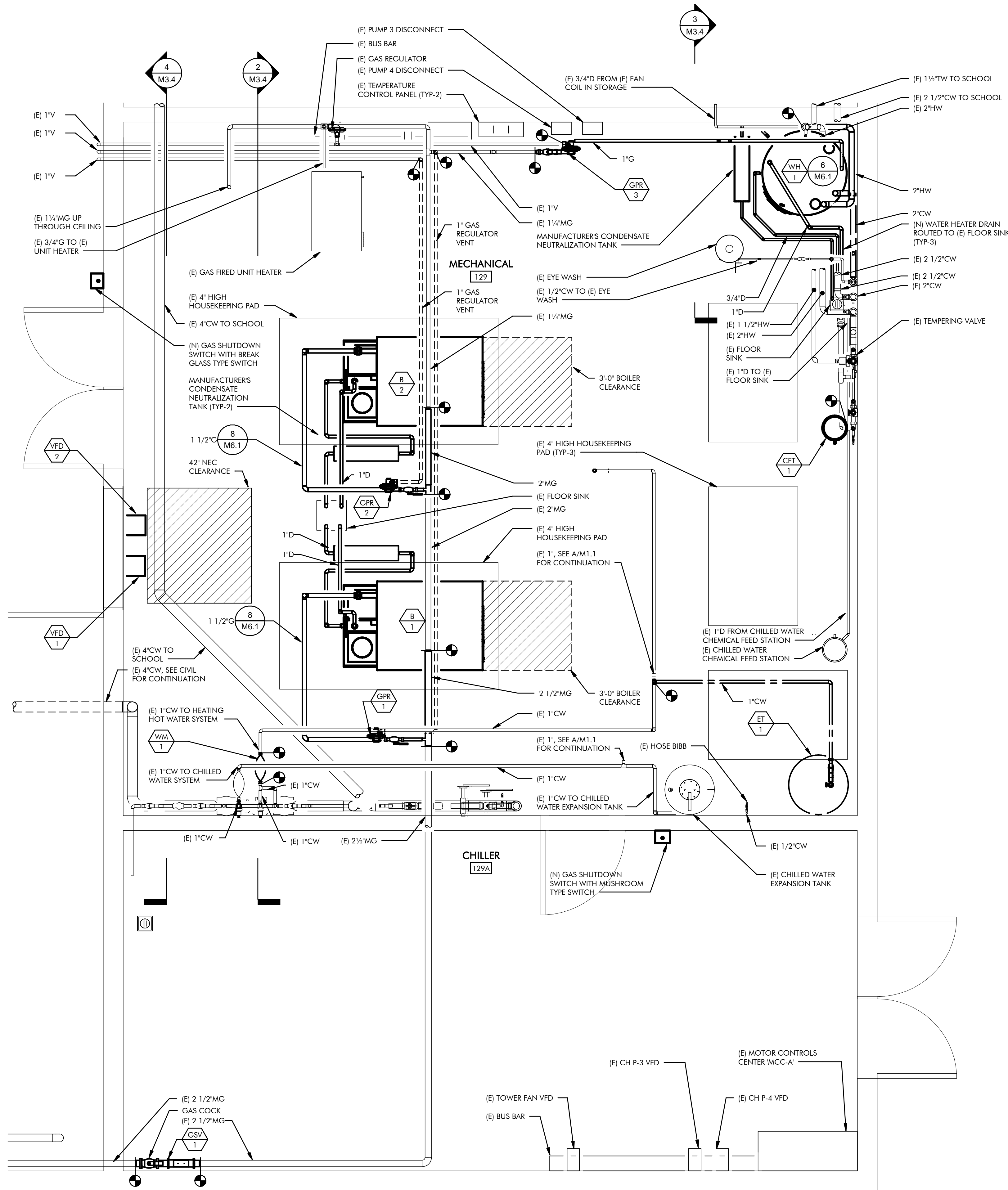
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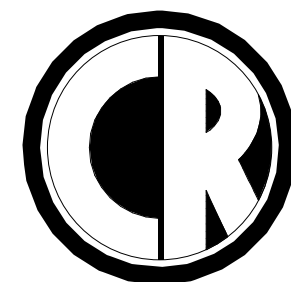
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PLOT DATE:



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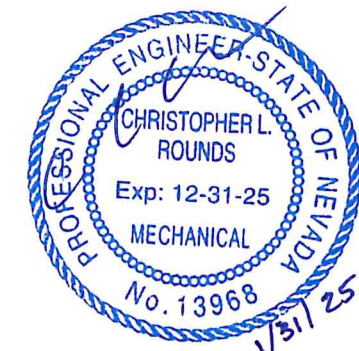


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ENLARGED BOILER ROOM MECHANICAL
WATER, GAS, & DRAIN FLOOR PLAN

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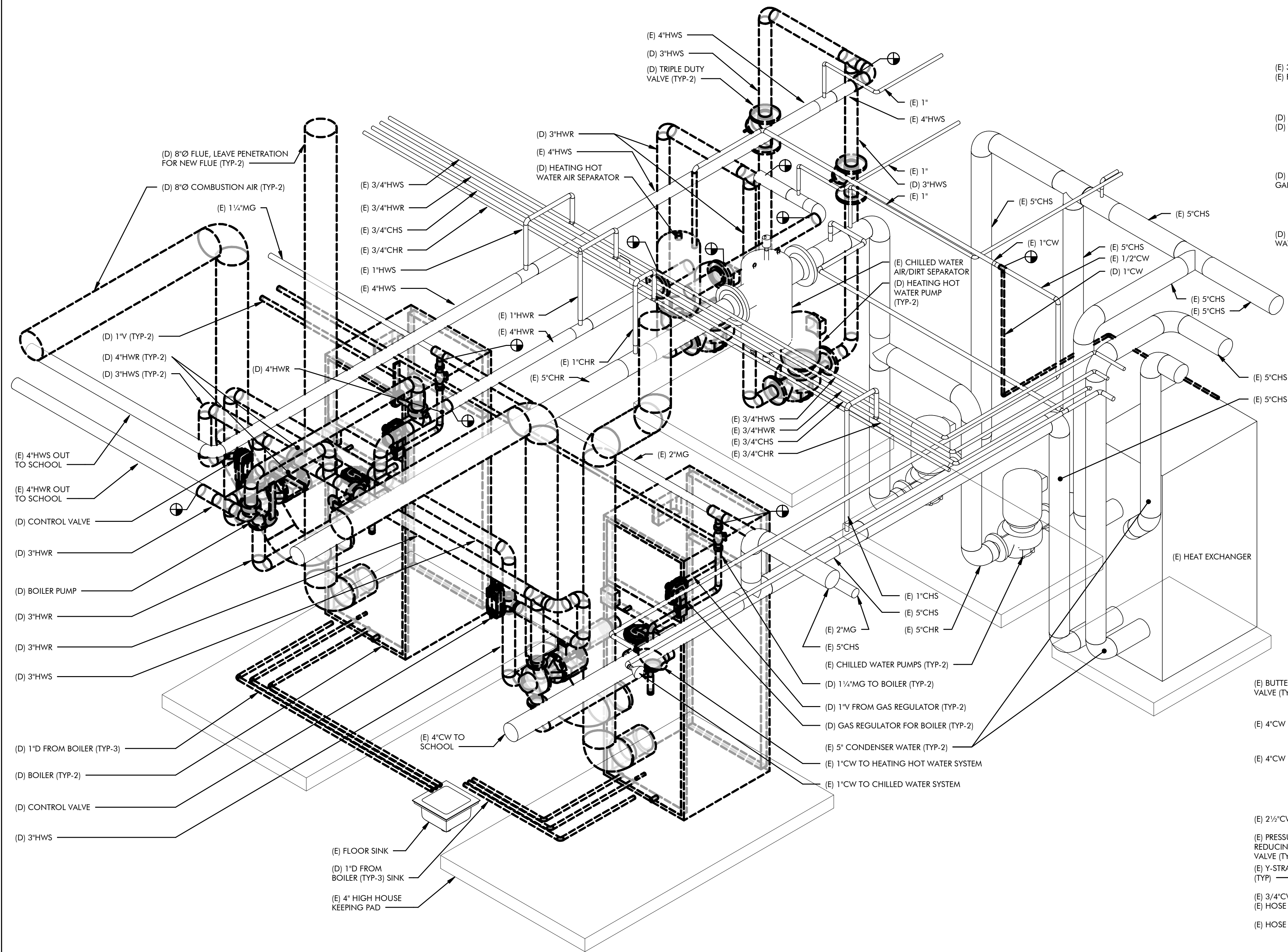
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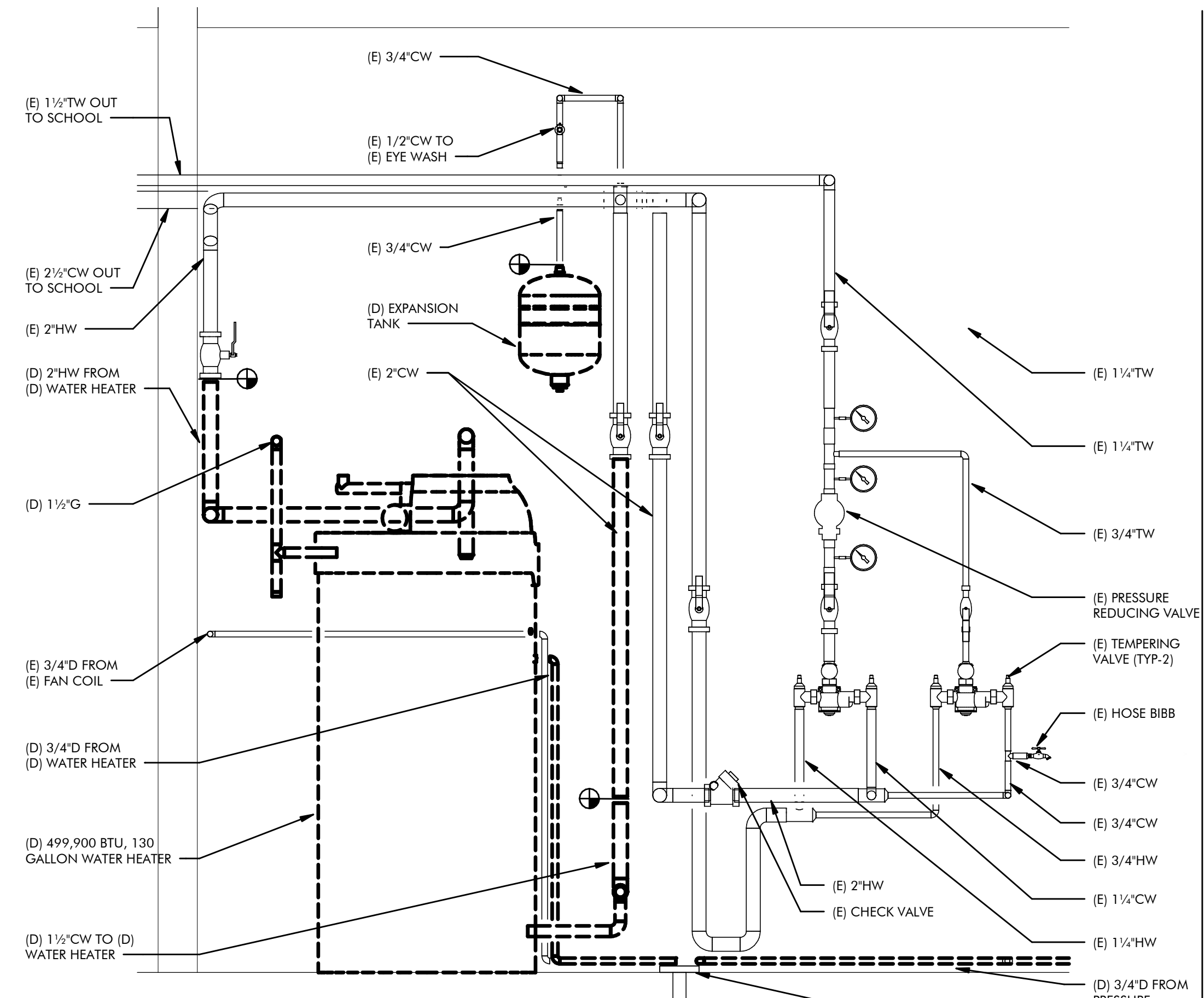
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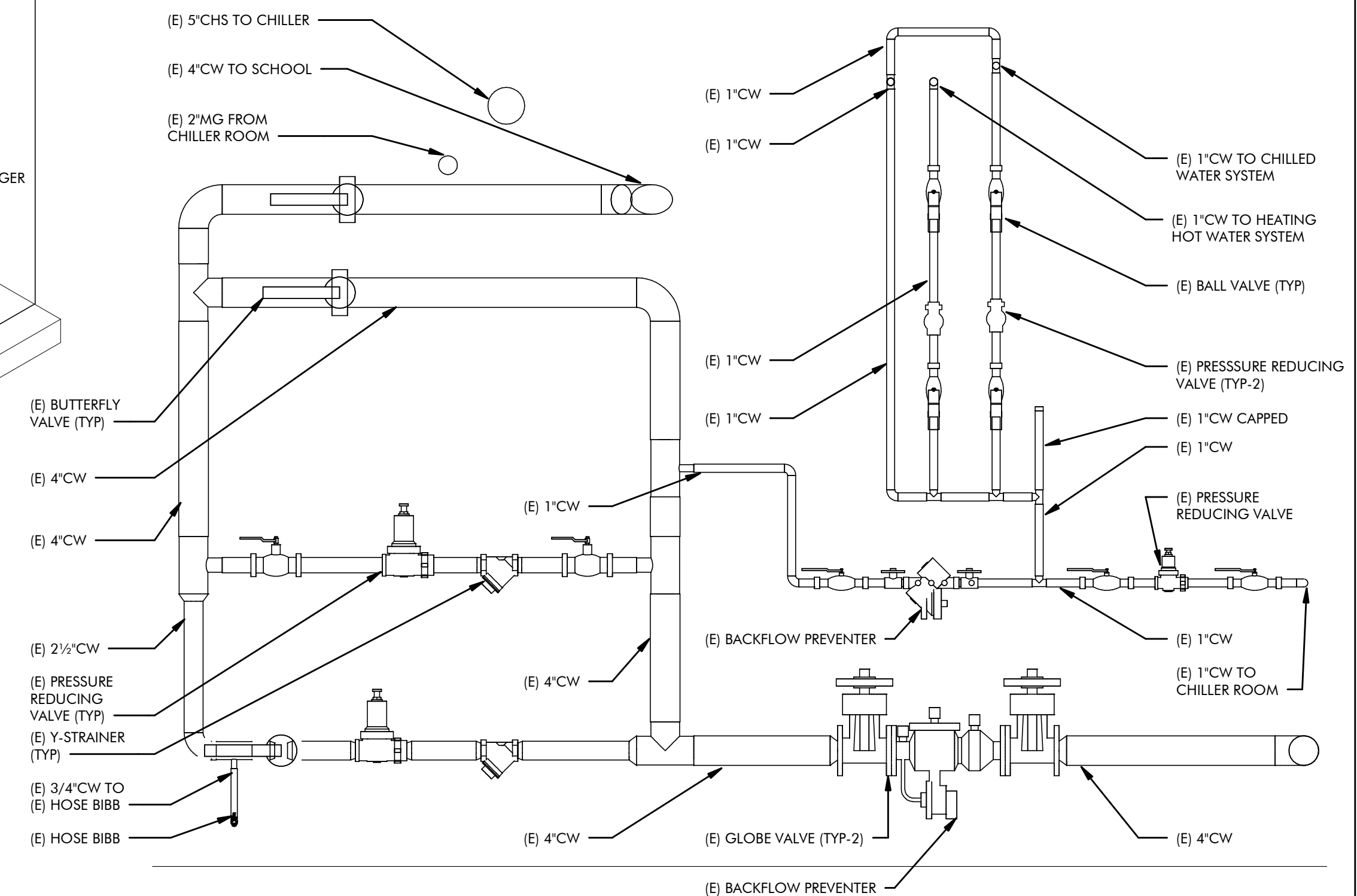
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1 BOILER DEMOLITION ISOMETRIC
M3.1 SCALE : NONE



2 HOT WATER DEMOLITION SECTION
M3.1 SCALE: 3/4" = 1'-0"



3 COLD WATER DEMOLITION SECTION
M3.1 SCALE: 3/4" = 1'-0"
(NO WORK, SHOWN FOR INFORMATION ONLY)

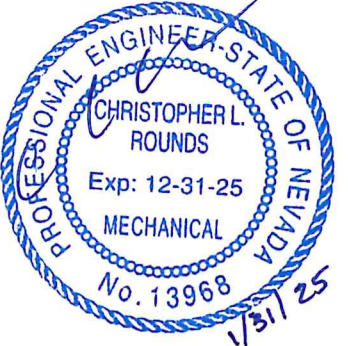


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MECHANICAL DEMOLITION SECTION AND
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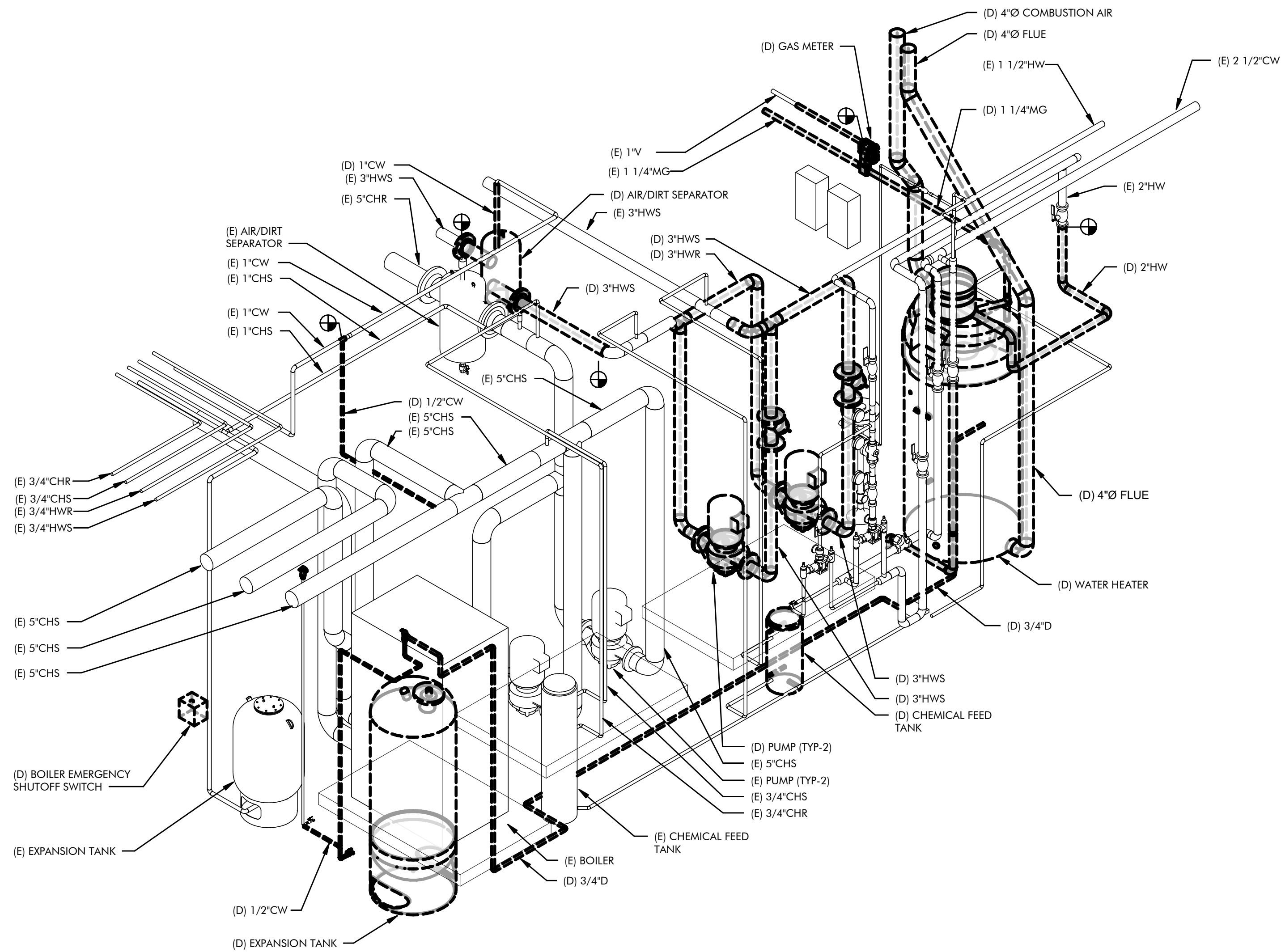
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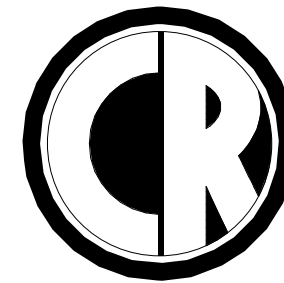
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PROJECT NO: 158324

SHEET NUMBER:

M3.1



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M3.2 SCALE : NONE

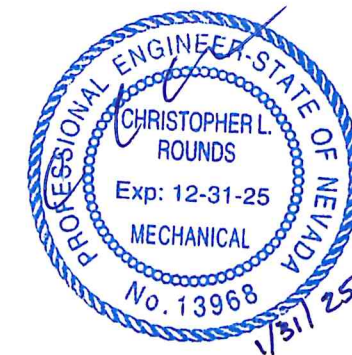


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ISOMETRICS

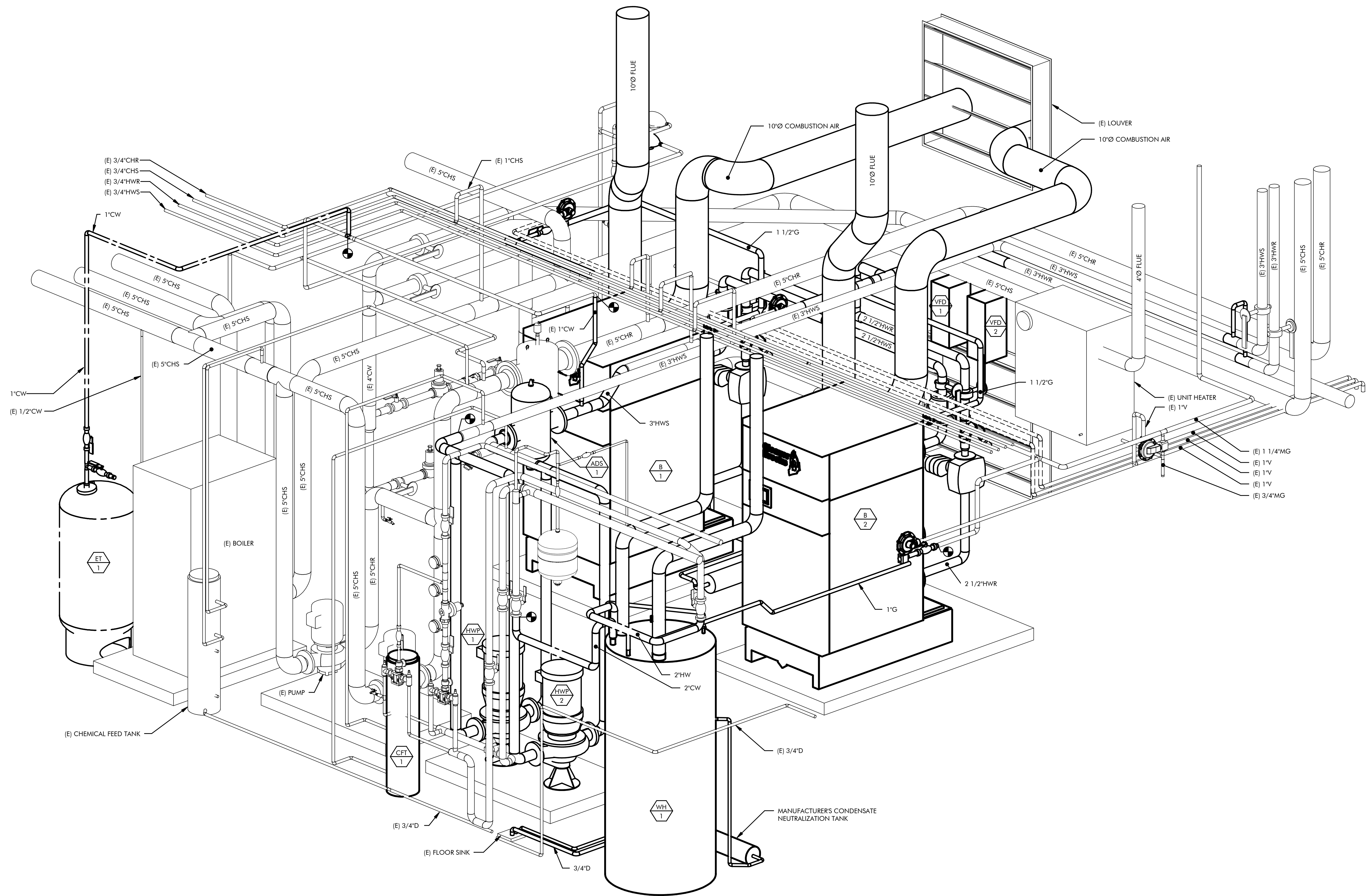
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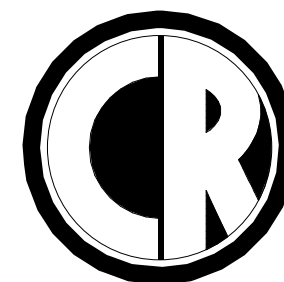
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M3.2

PLOT DATE:



1 MECHANICAL BOILER ROOM ISOMETRIC
M3.3 SCALE : NONE

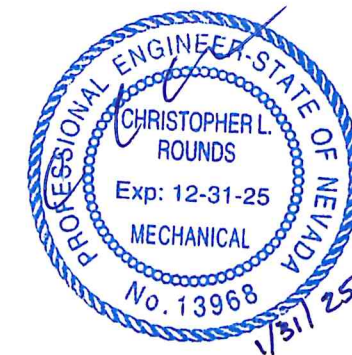


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MECHANICAL ISOMETRICS

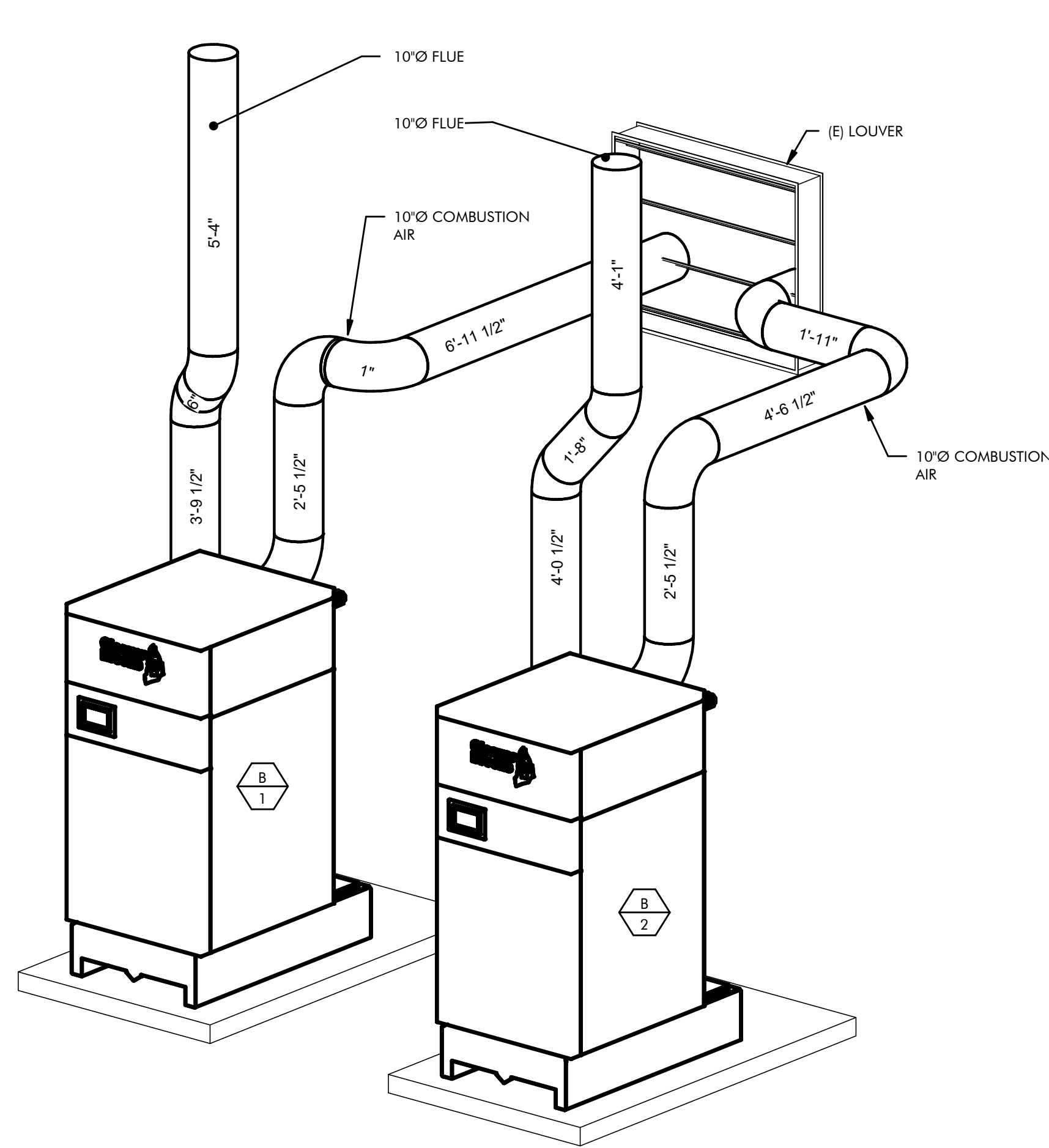
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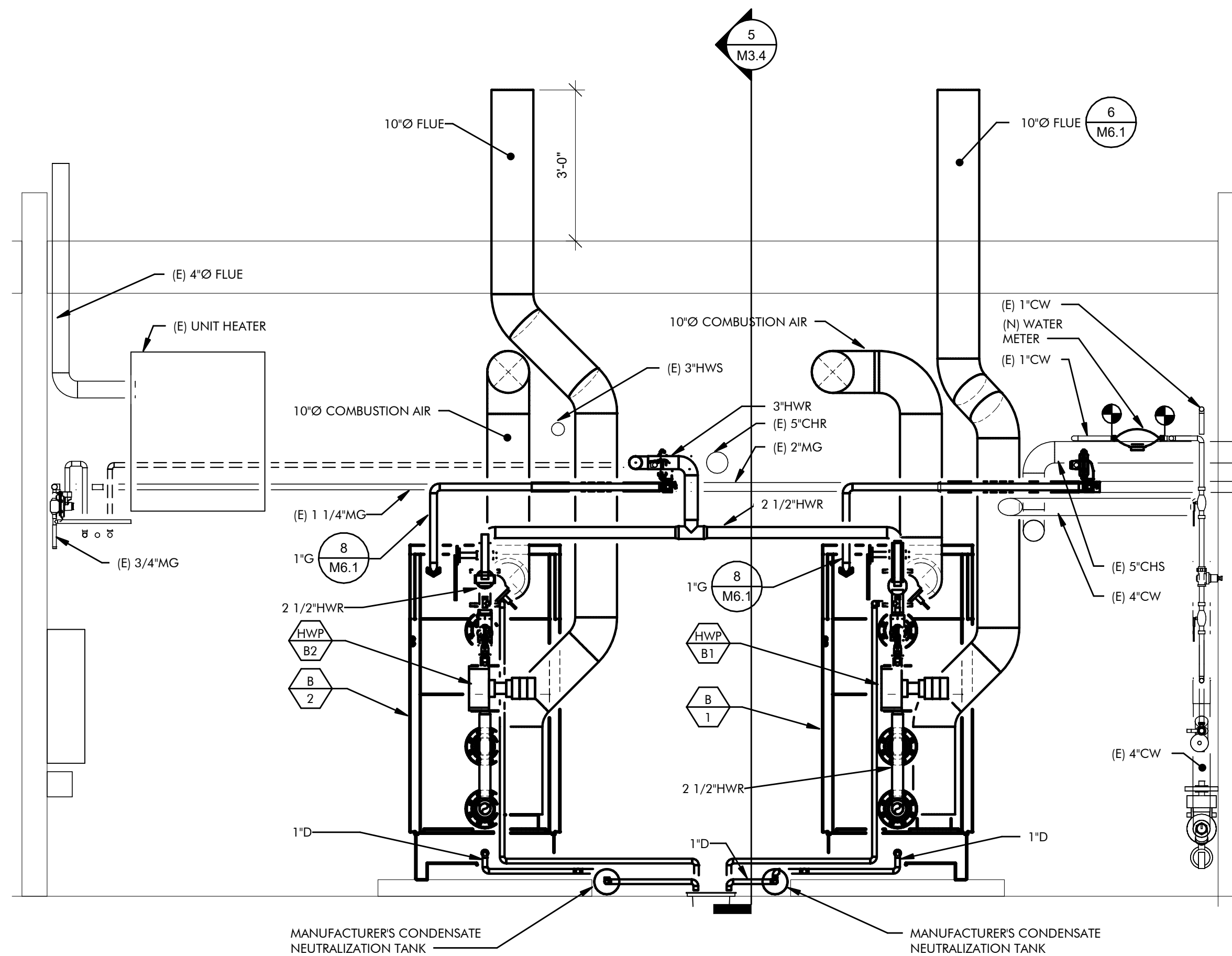
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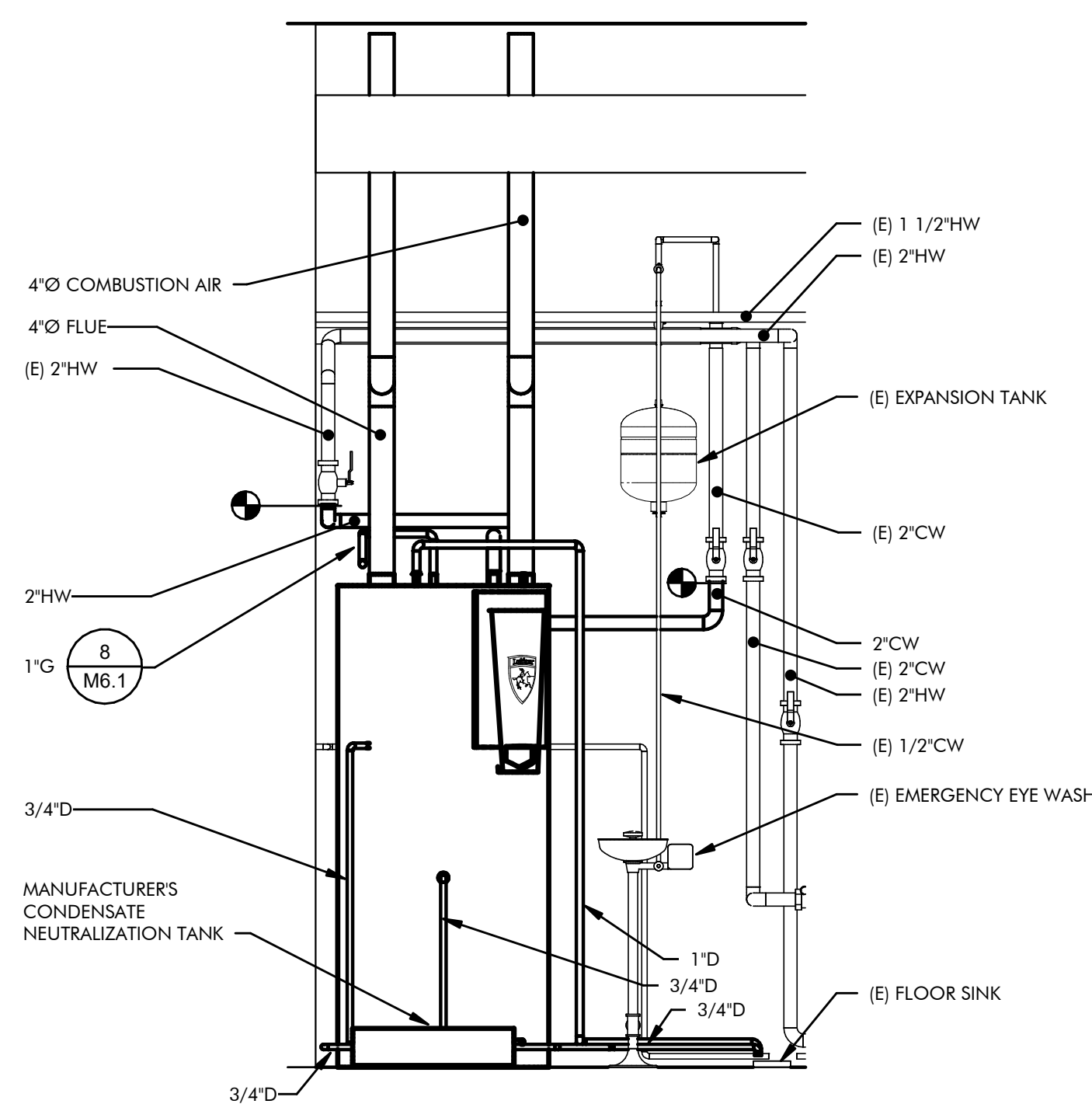
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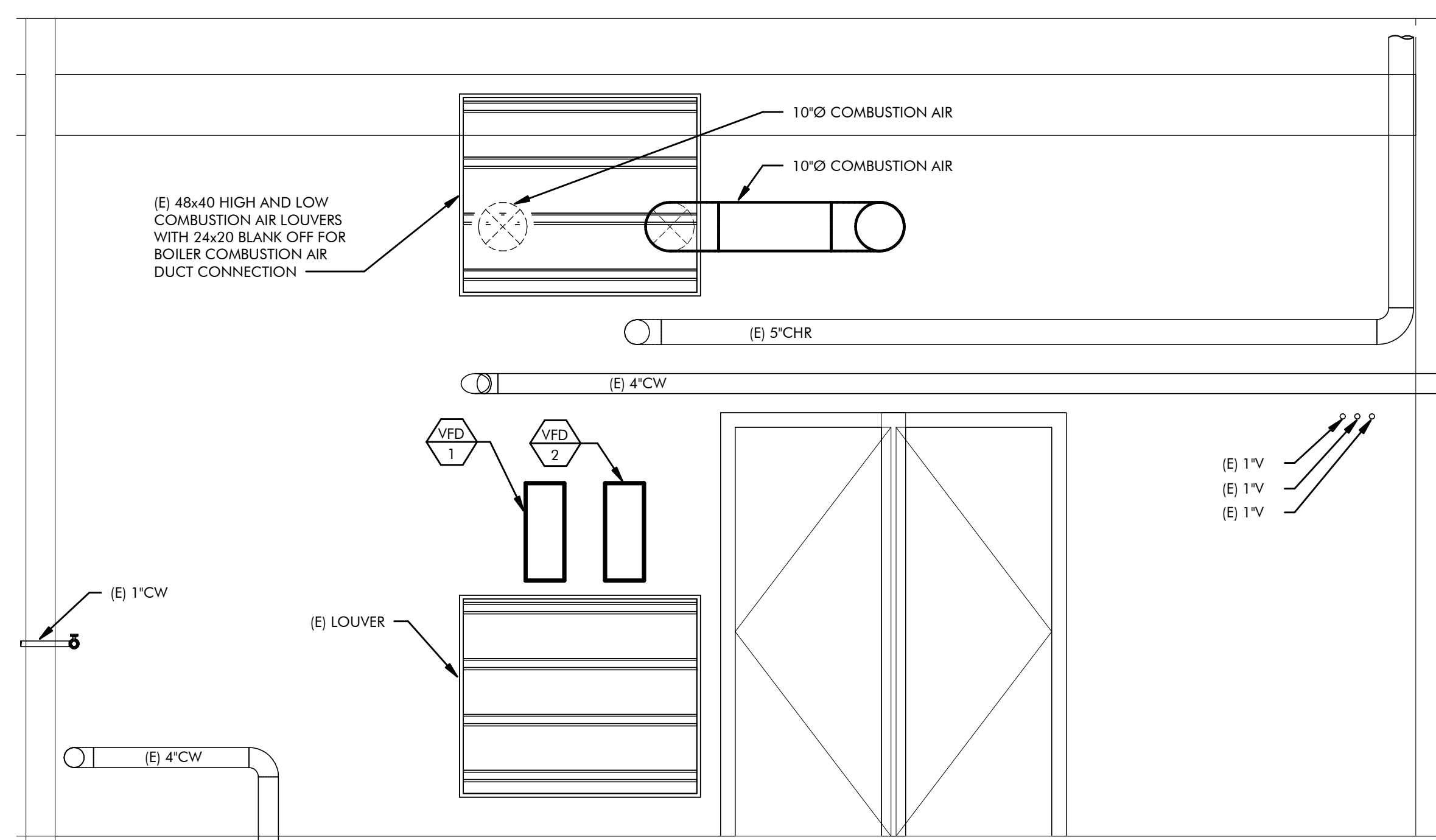
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M3.4 SCALE : NONE



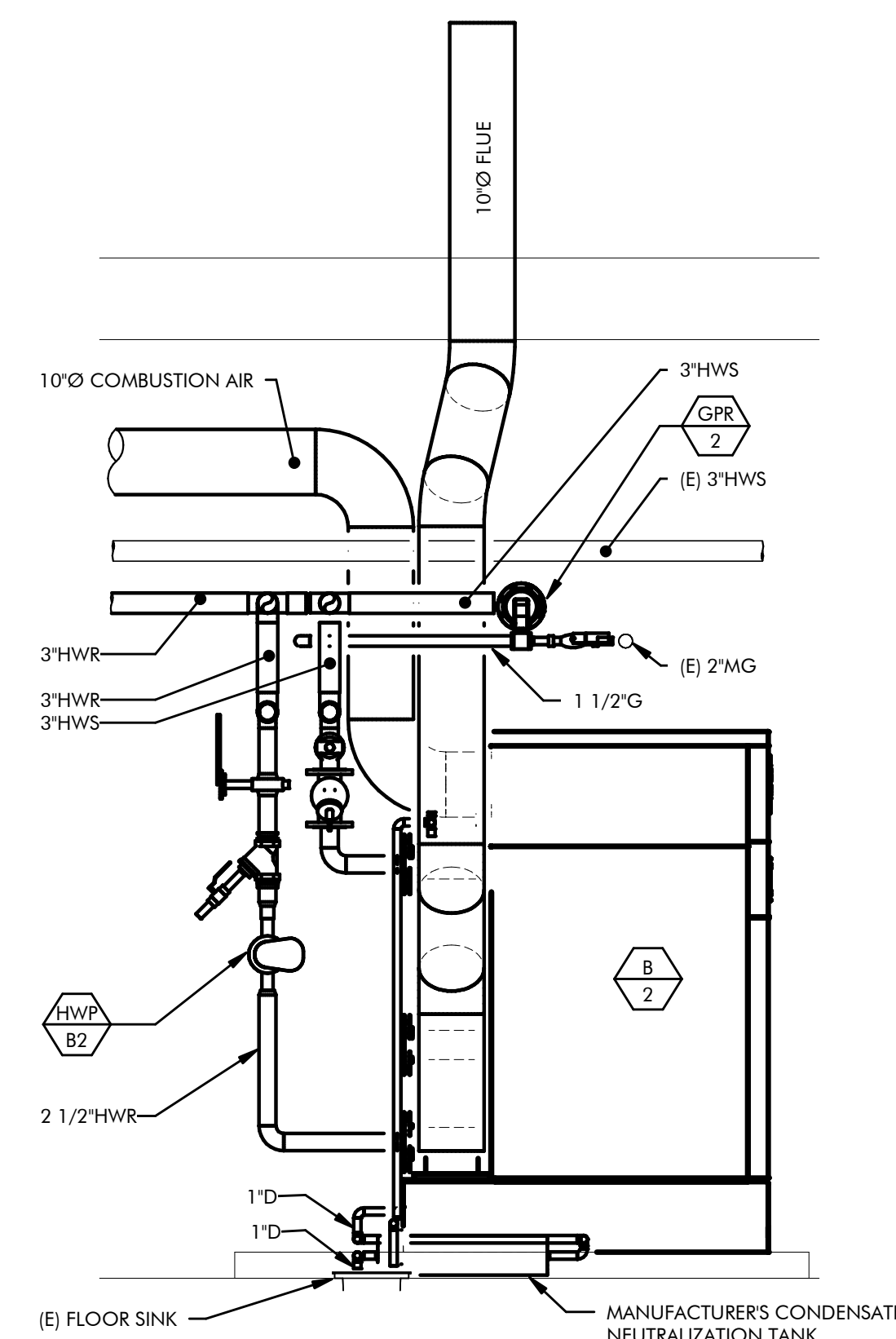
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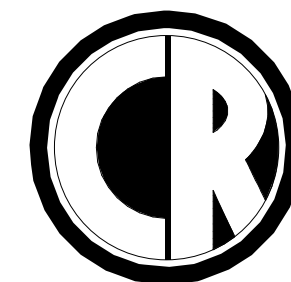
3 WATER HEATER SECTION
M3.4 SCALE: 1/2" = 1'-0"



4 MECHANICAL BOILER SECTION 2
M3.4 SCALE: 1/2" = 1'-0"



5 MECHANICAL BOILER SECTION 3
M3.4 SCALE: 1/2" = 1'-0"

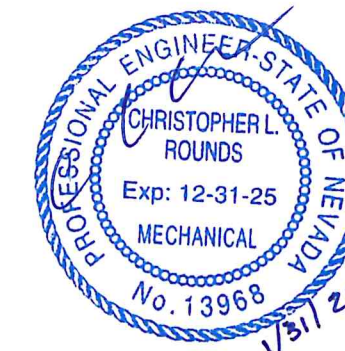


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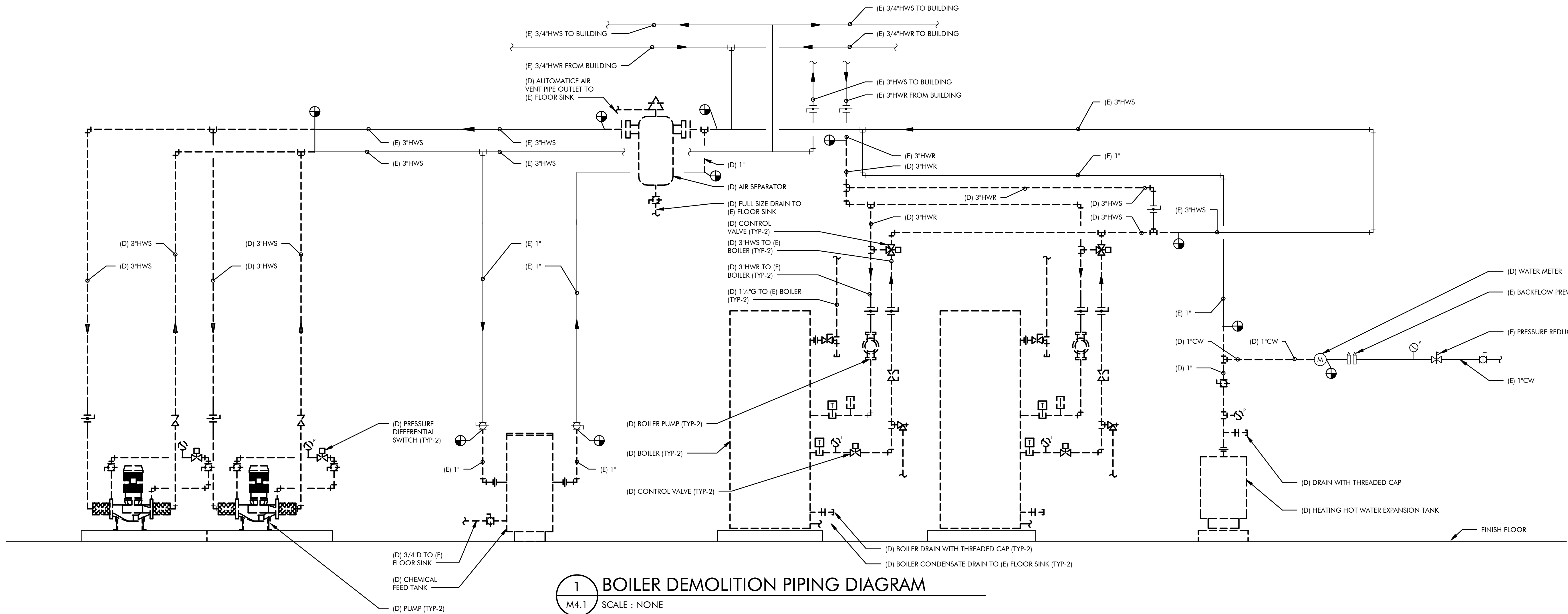
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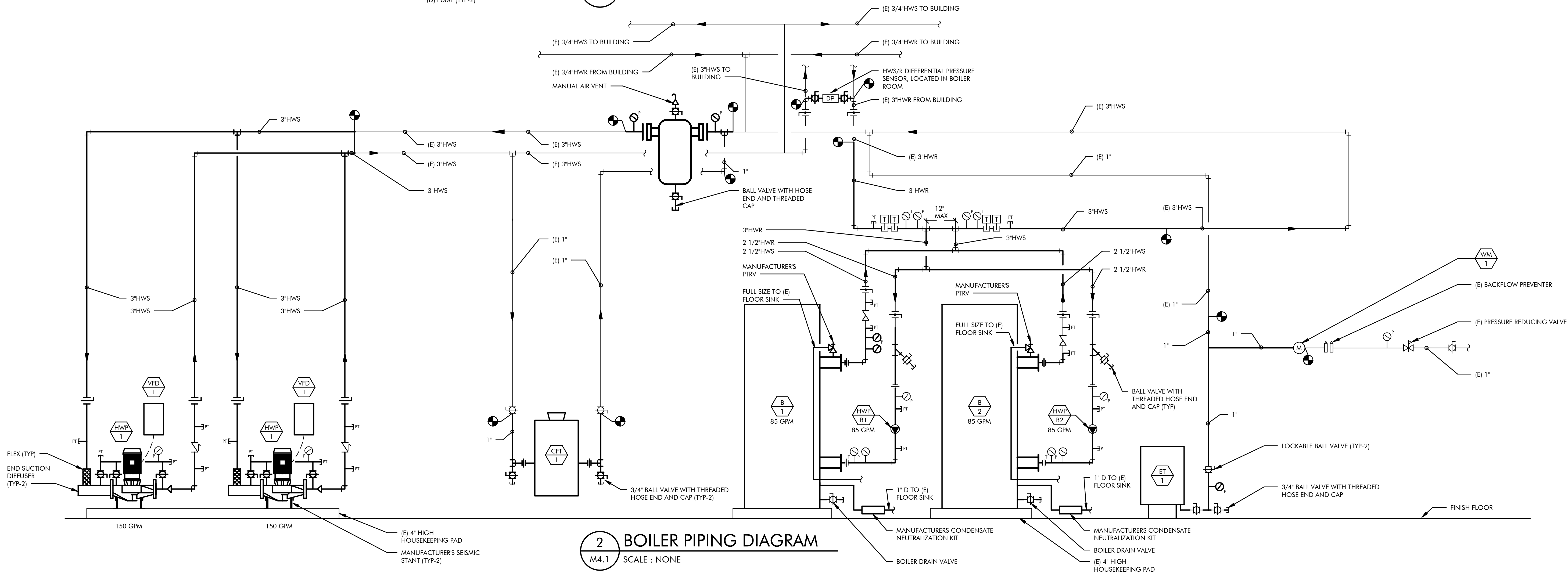
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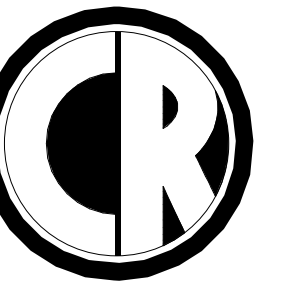
PLOT DATE:



1 BOILER DEMOLITION PIPING DIAGRAM
M4.1 SCALE : NONE



2 BOILER PIPING DIAGRAM
M4.1 SCALE : NONE



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MECHANICAL DEMOLITION AND NEW PIPING
DIAGRAMS

REVISIONS:

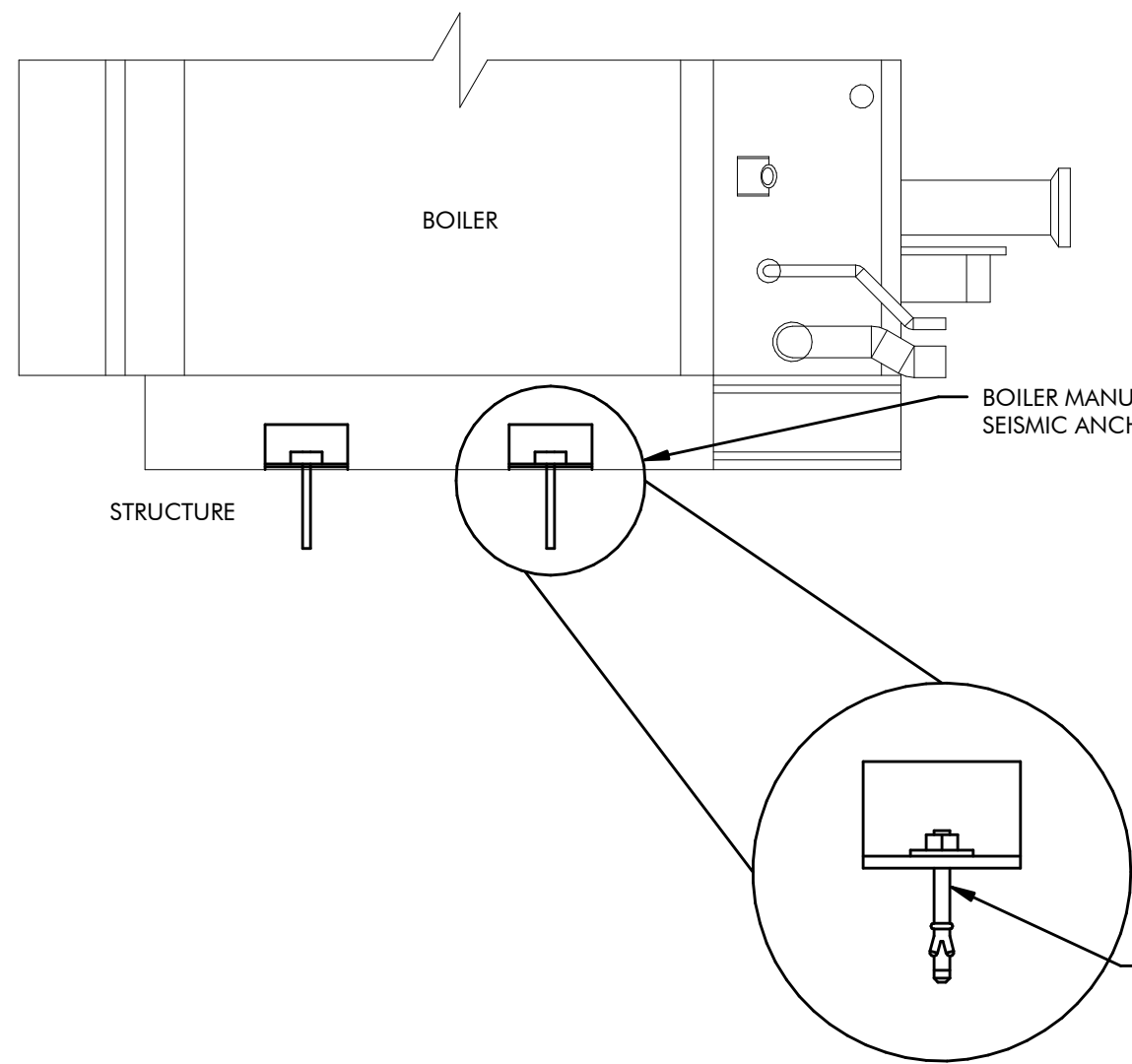
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SHEET NUMBER:

M4.1

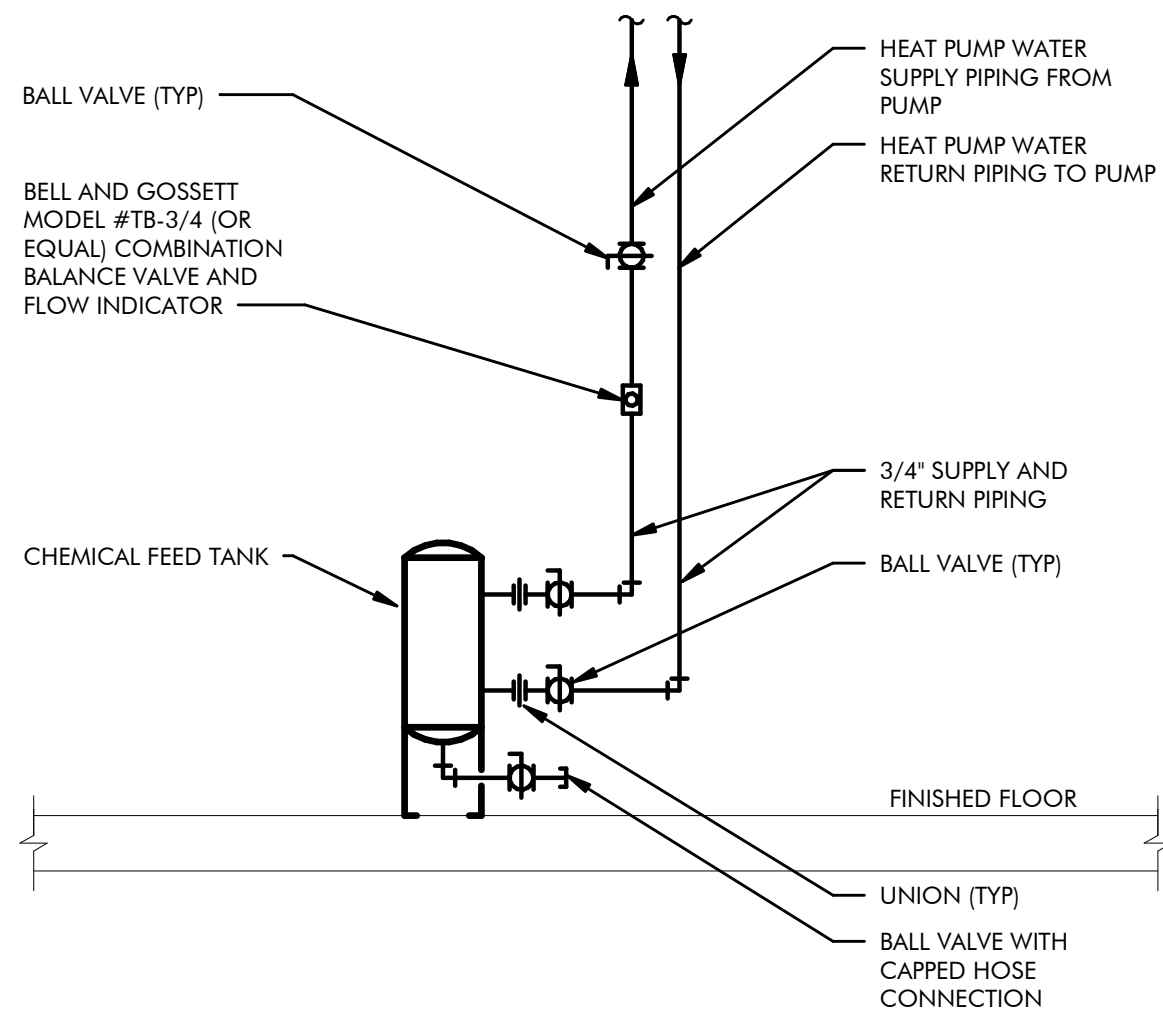
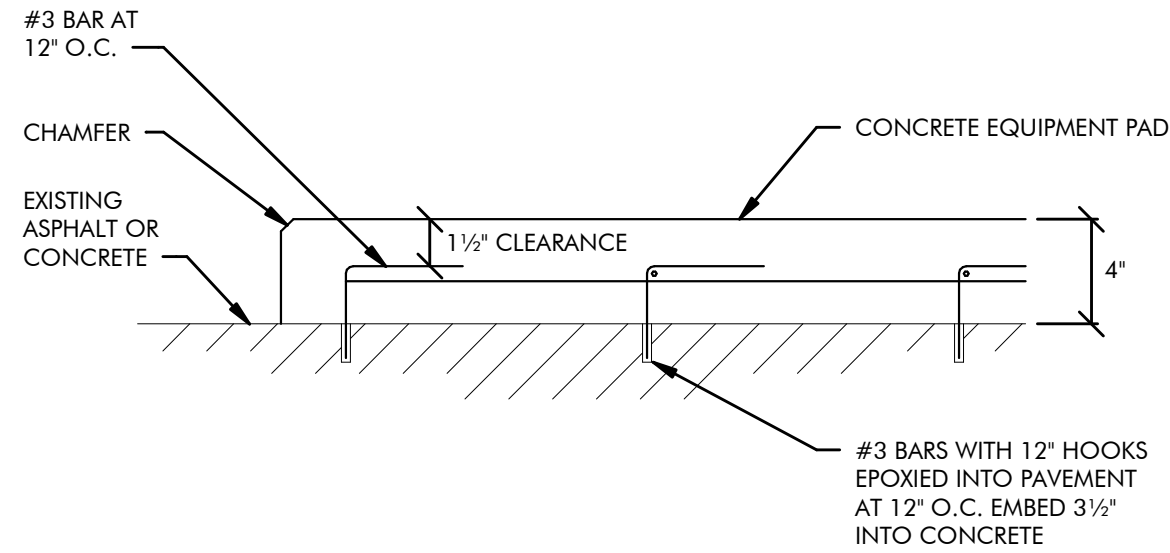
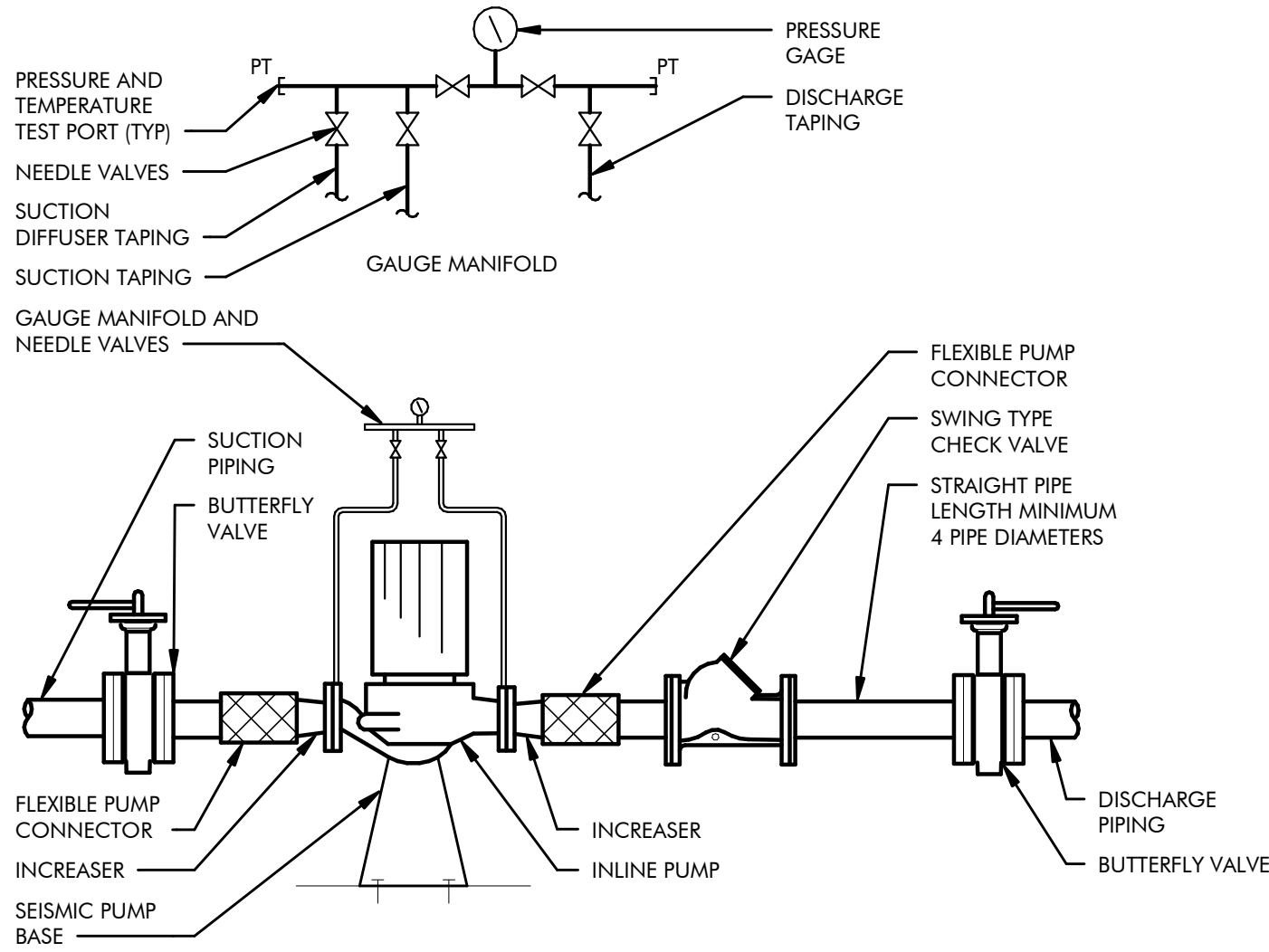
ANCHORAGE INSTALLATION INFORMATION					
ANCHOR	SIZE	SUPPORT	MINIMUM DIMENSIONS		
			EDGE (IN.)	DEPTH (IN.)	DEPTH (IN.)
DEWALT	3/8"Ø x 2.5"	SLAB	6	6	6
HILTI	3/8"Ø x 2.375"	SLAB	6	6	4-1/8



NOTE:

1. BOLT HOLES TO BE 1/16" LARGER THAN BOLT DIAMETER. FOR OVER-SIZED HOLES, CONTRACTOR TO USE WELDED WASHER AS SHOWN IN DETAIL B OR FILL OR FILL HOLE WITH EPOXY, GROUT, OR NEOPRENE GROMMET.

2. SEE CONDITION 4 TABLE FOR ANCHORAGE OPTIONS INTO SLAB AND FILLED DECK.

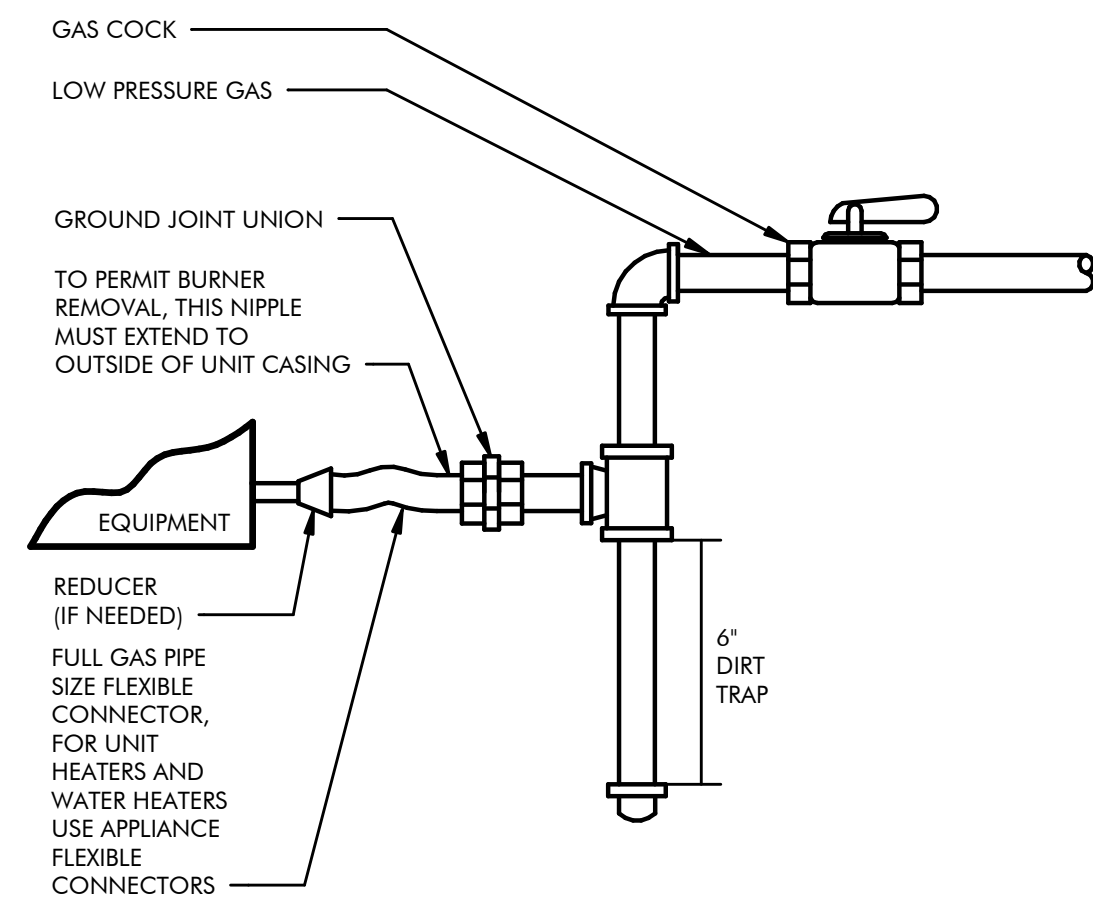
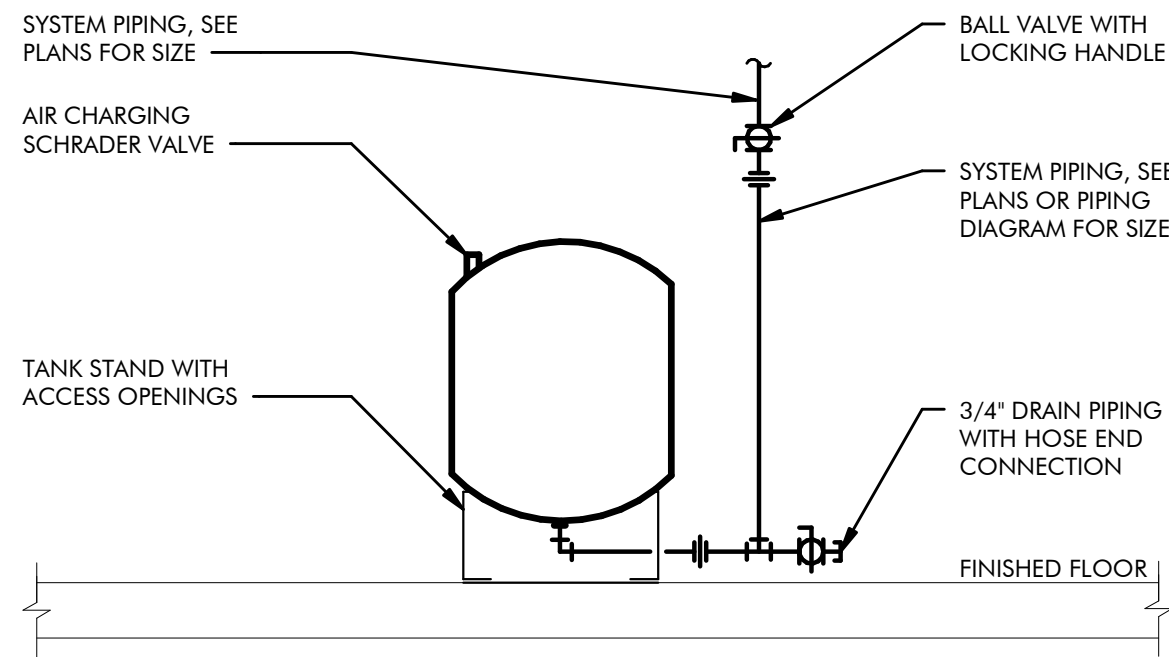
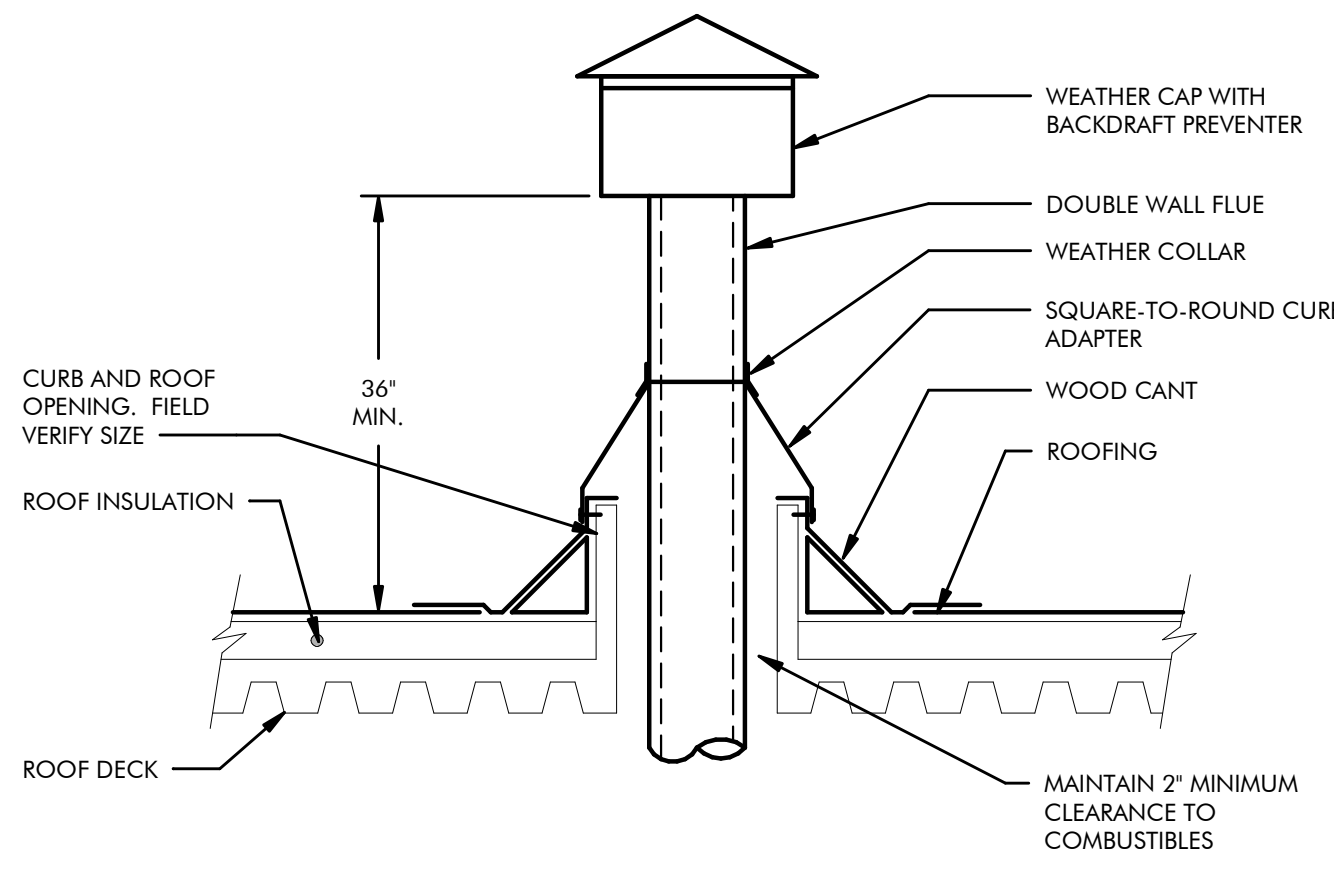
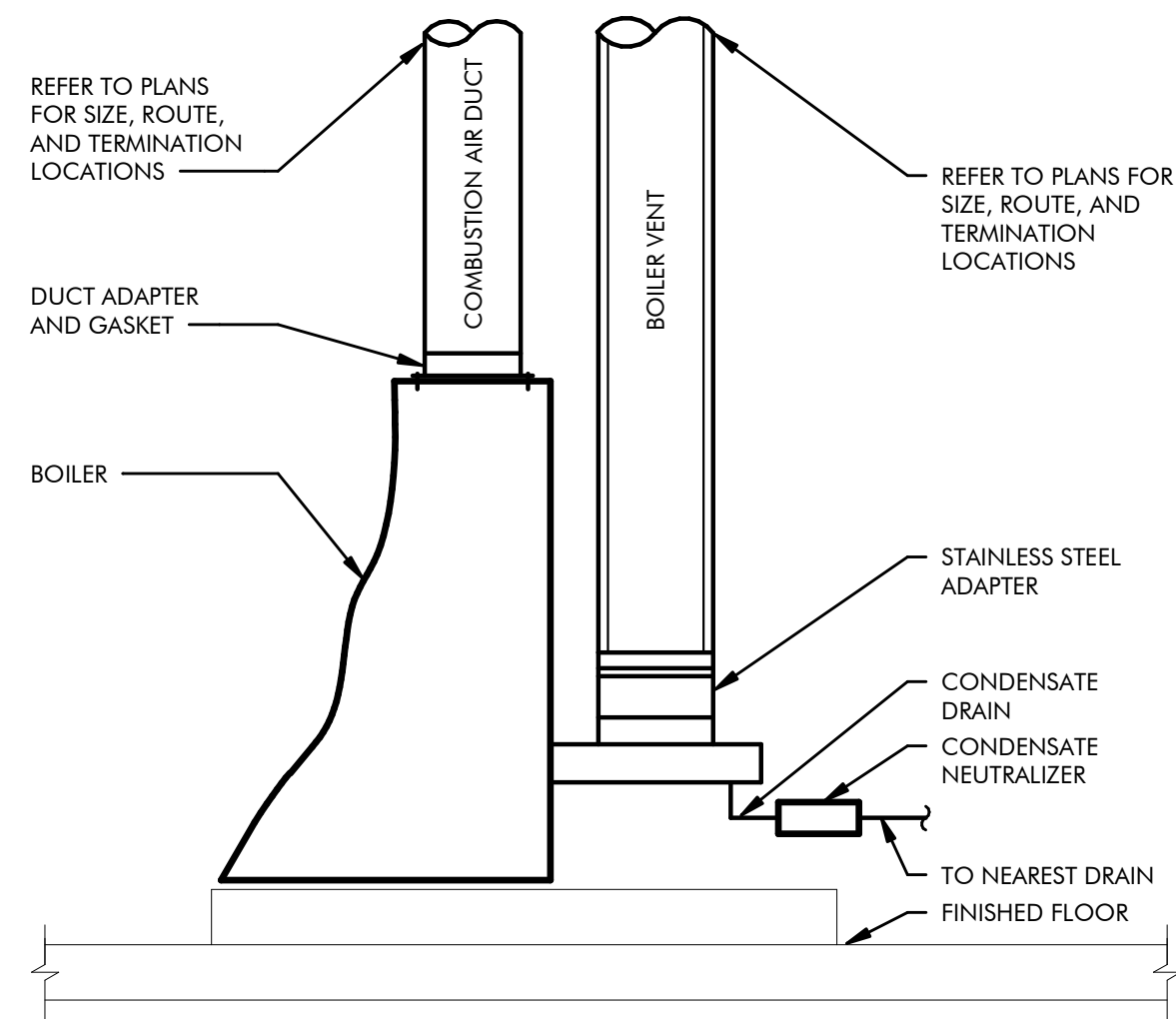


1 BOILER ANCHORAGE DETAIL
M6.1 SCALE : NONE

2 VARIABLE SPEED INLINE PUMP DETAIL
M6.1 SCALE : NONE

3 CONCRETE EQUIPMENT PAD
M6.1 SCALE : NONE

4 CHEMICAL FEED TANK DETAIL
M6.1 SCALE : NONE

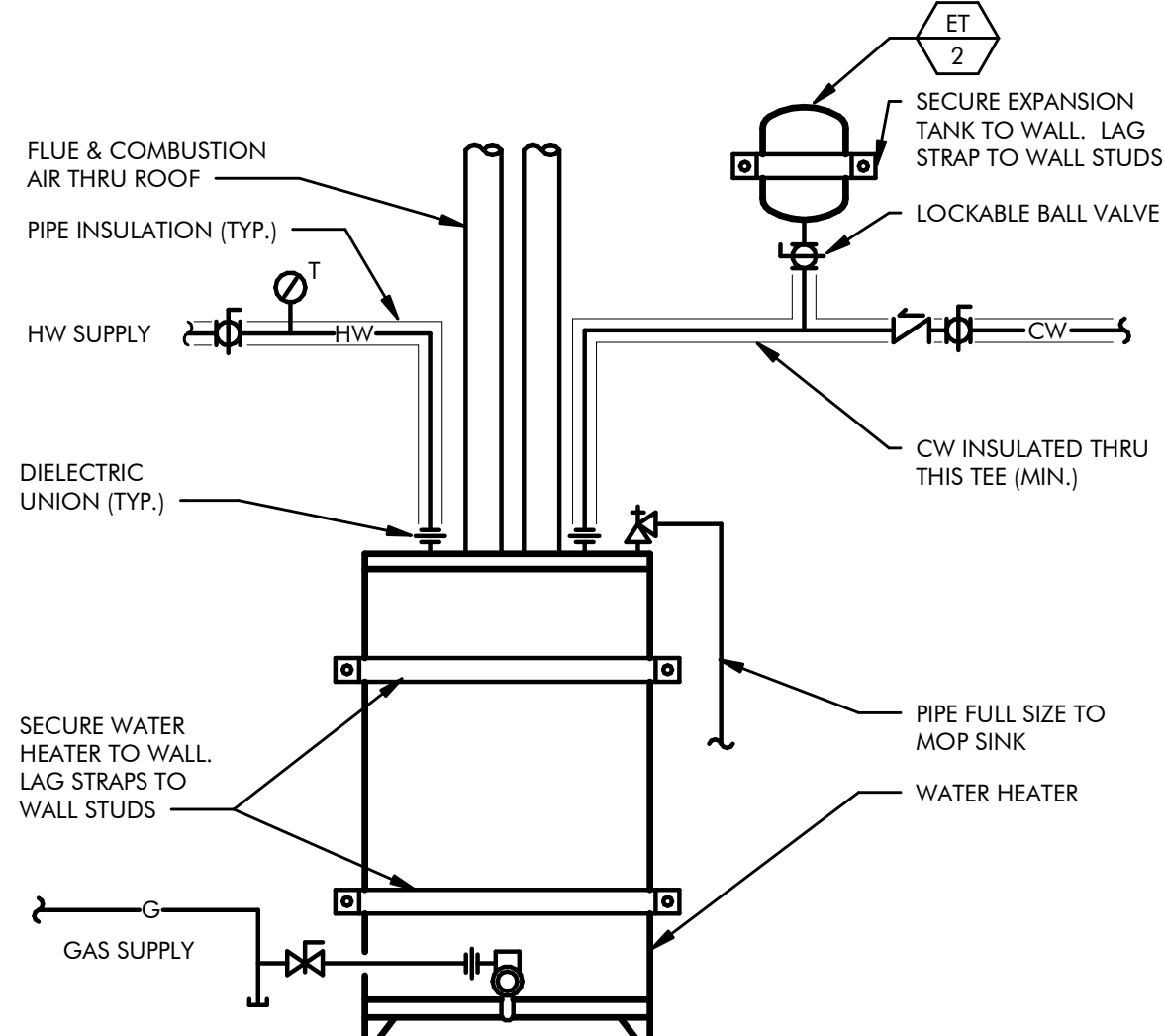
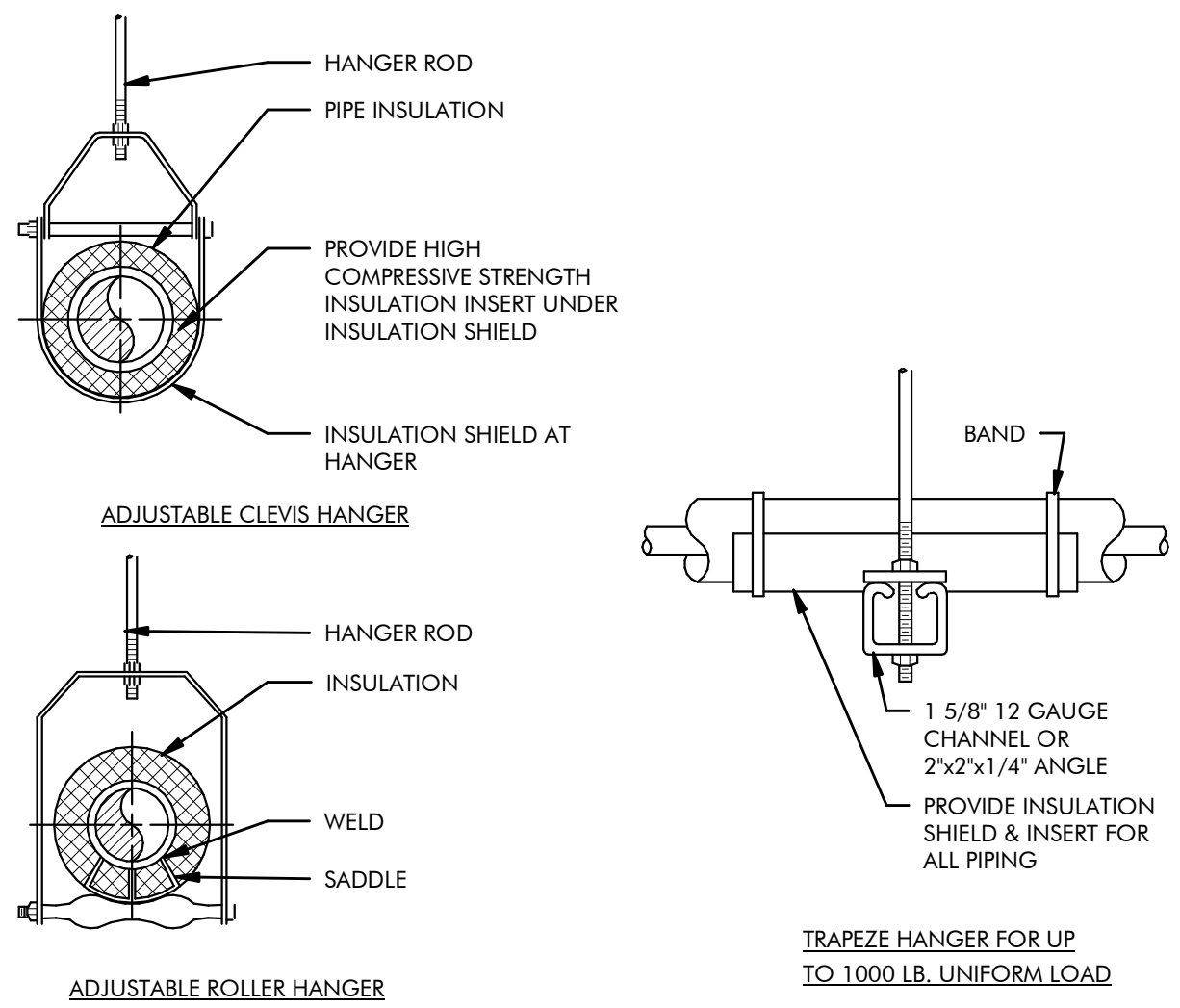


5 CONDENSING BOILER FLUE CONNECTION DETAIL
M6.1 SCALE : NONE

6 FLUE THROUGH ROOF DETAIL
M6.1 SCALE : NONE

7 EXPANSION TANK DETAIL
M6.1 SCALE : NONE

8 GAS CONNECTION DETAIL
M6.1 SCALE : NONE



9 TYPICAL PIPE HANGER DETAIL
M6.1 SCALE : NONE

10 WATER HEATER - GAS
M6.1 SCALE : NONE



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MECHANICAL DETAILS

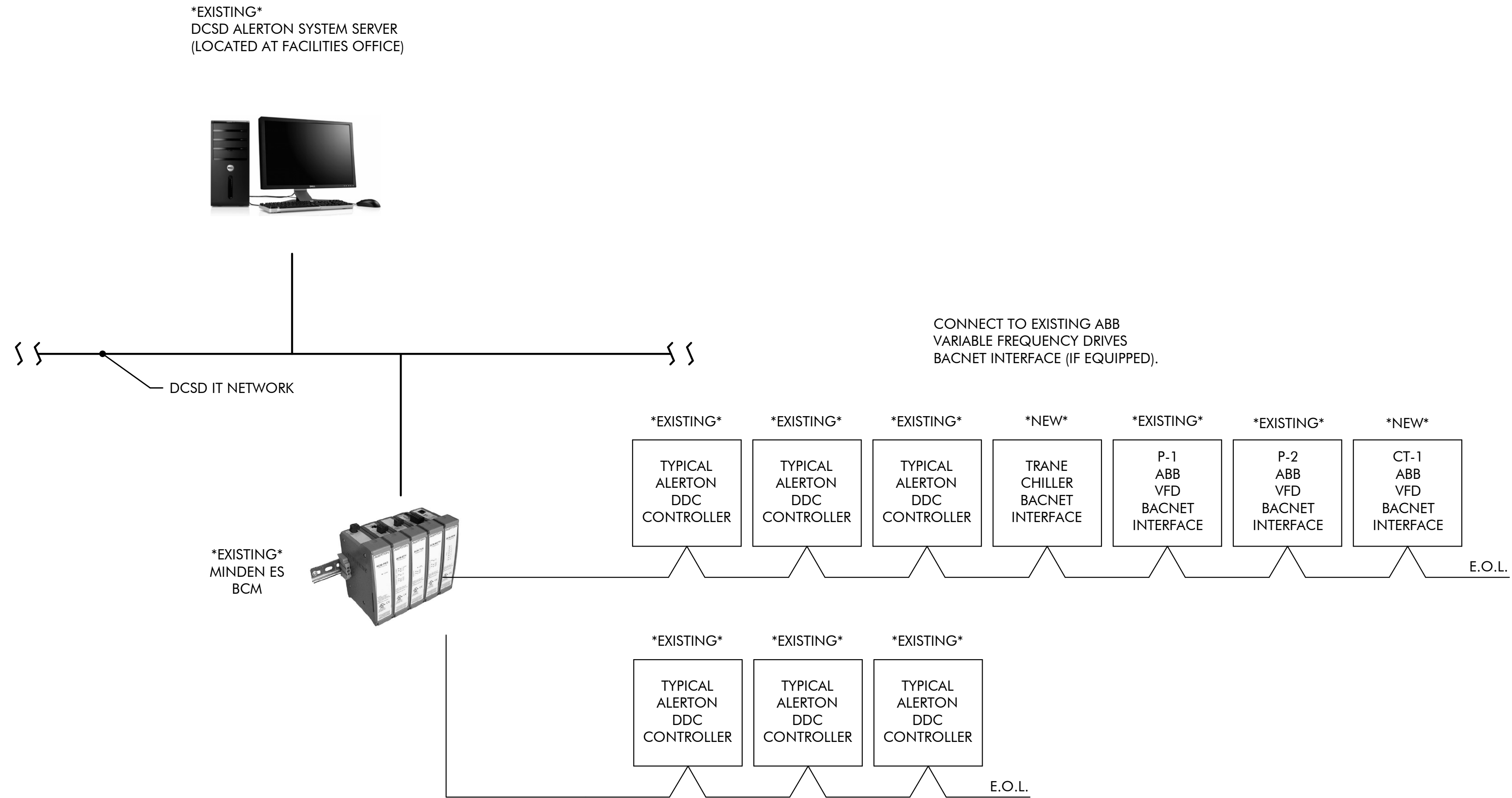
REVISIONS:		
REV.	DESCRIPTION	DATE

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CHECKED BY: CL
APPROVED BY: CLR
DATE: 1/31/2025
PROJECT NO: 158324

SHEET NUMBER:

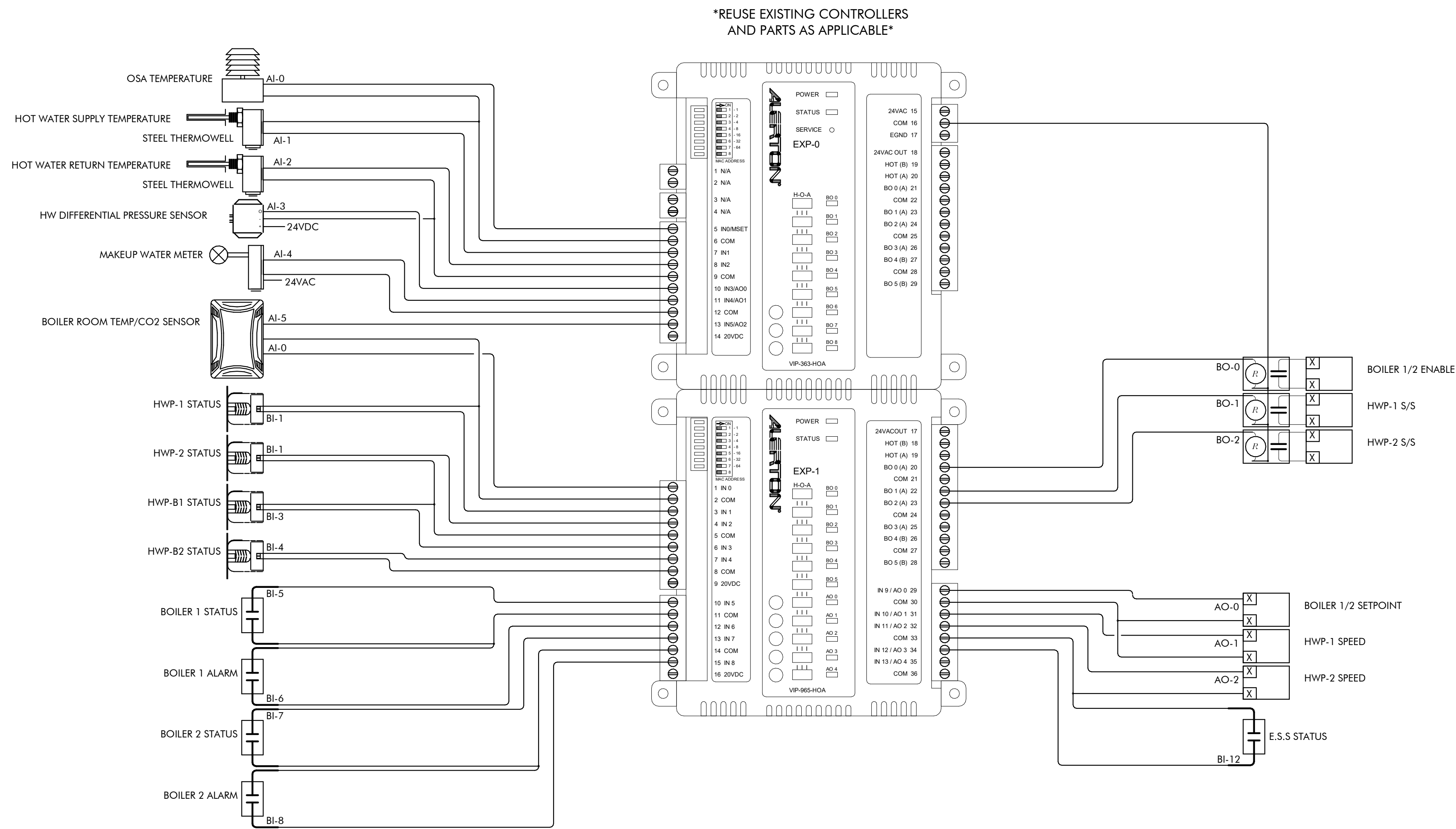
M6.1

PLOT DATE:



1 SYSTEM ARCHITECTURE

M7.1 SCALE : NONE



2 BOILER PLANT CONTROL DIAGRAM

M7.1 SCALE : NONE

CONTROLS SYMBOL LEGEND

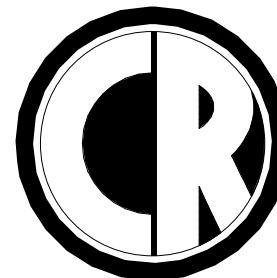
SYMBOL	ABBR.	DESCRIPTION
AS	AS	AVERAGING SENSOR
BSP	BSP	BUILDING STATIC PRESSURE SENSOR (WITH PROBES)
CO	CO ₂	CARBON DIOXIDE SENSOR
CS	CS	CURRENT SENSOR/SWITCH
DP	DP	DIFFERENTIAL PRESSURE SENSOR
DSP	DSP	DUCT STATIC PRESSURE SENSOR
DS	DS	DISCONNECT SWITCH (FUSED)
ESD	ESD	EMERGENCY SHUT-DOWN SWITCH (BREAK-GLASS TYPE)
FSD	FSD	COMBINATION FIRE/SMOKE DAMPER
FMS	FMS	FLOW MEASURING STATION
FS	FS	FLOW SWITCH
HDS	HDS	HIGH STATIC PRESSURE SENSOR
M	M	MOTORIZED ACTUATOR
MS	MS	MOTOR STARTER
OA	OA	OUTSIDE AIR TEMPERATURE/HUMIDITY SENSOR
OS	OS	OCCUPANCY SENSOR
OSP	OSP	OUTDOOR STATIC PRESSURE SENSOR
R	R	RELAY (POLES AND VOLTAGE AS REQUIRED)
RTS	RTS	ROOM TEMPERATURE SENSOR
SD	SD	SMOKE DAMPER
S	SD	SMOKE DETECTOR (PRODUCTS OF COMBUSTION DETECTOR)
T	TS	TEMPERATURE SENSOR (PENCIL TYPE)
T	TSTAT	THERMOSTAT OR TEMPERATURE SENSOR @ 48" AFF
TX	TX	TRANSFORMER (SIZE & VOLTAGE AS REQUIRED)
E		BY ELECTRICAL CONTRACTOR
P		BY PLUMBING CONTRACTOR
M		BY MECHANICAL CONTRACTOR
OB	OB	OPPOSED BLADE DAMPER
PB	PB	PARALLEL BLADE DAMPER
TCV	TCV	TEMPERATURE CONTROL VALVE (2-WAY OR 3-WAY)
P		PRESSURE SENSOR, TEMPERATURE SENSOR WITH WELL
P		PRESSURE GAUGE, TEMPERATURE GAUGE
P	P	PUMP
		POWER WIRING BY ELECTRICAL CONTRACTOR
		CONTROL WIRING

CONTROLS ABBREVIATIONS

AFF/AFG	ABOVE FINISHED FLOOR/GRADE
BSP	BUILDING STATIC PRESSURE SENSOR (WITH PROBES) CO CARBON MONOXIDE
DDC	DIRECT DIGITAL CONTROL SYSTEM
EA	EXHAUST AIR
HPS/HPR	HEAT PUMP WATER SUPPLY/RETURN PIPING
MAX	MAXIMUM
MOD	MODULATING ACTUATOR (SPRING RETURN - U.N.O.)
MIN	MINIMUM
NC	NORMALLY CLOSED
NO	NORMALLY OPEN
OA	OUTSIDE AIR
RA	RETURN AIR
SA	SUPPLY AIR
TCP	TEMPERATURE CONTROL PANEL
TYP	TYPICAL
UNO	UNLESS NOTED OTHERWISE
VFD	VARIABLE FREQUENCY DRIVE
2-POS	TWO-POSITION ACTUATOR (SPRING RETURN - U.N.O.)

CONTROL NOTES

- ALL WIRING TO BE IN CONDUIT. PLENUM RATED CABLE WITH J-HOOKS IS ALLOWED FOR ABOVE CEILING INSTALLATION.
- CONTROL SYSTEM CONTRACTOR SHALL PROVIDE A COMPLETE DIRECT DIGITAL CONTROL SYSTEM. PROVIDE AND INSTALL ALL NECESSARY WIRING TO MAKE SYSTEM OPERATIONAL. ALL WIRING SHALL BE IN CONDUIT WITH ANY SPLICES MADE IN JUNCTION BOXES. CONTROL DIAGRAMS AND SEQUENCE OF OPERATION ON REFER TO DRAWINGS.
- CONTROLS CONTRACTOR SHALL CONNECT NEW CONTROLLERS TO THE CONTROL NETWORK AND ADD NEW GRAPHICS. COORDINATE ALL WORK WITH LCSD MAINTENANCE PRIOR TO BID.
- THE THERMOGRAPHIC FLOOR PLAN SHALL BE UPDATED WITH THE NEW FLOOR PLAN AND ZONING, INCLUDING THE ROOM TEMPERATURE SENSORS.
- CONTROLS CONTRACTOR TO COORDINATE UNIT LABELING ON GRAPHICS, THERMOSTAT, AND CONTROLLER WITH LCSD MAINTENANCE PRIOR TO INSTALLATION.
- CONTROLS CONTRACTOR:
CERRIS SYSTEMS
4750 LONGLEY LANE #106
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MECHANICAL CONTROL DIAGRAMS AND
SEQUENCE OF OPERATION

REVISIONS:

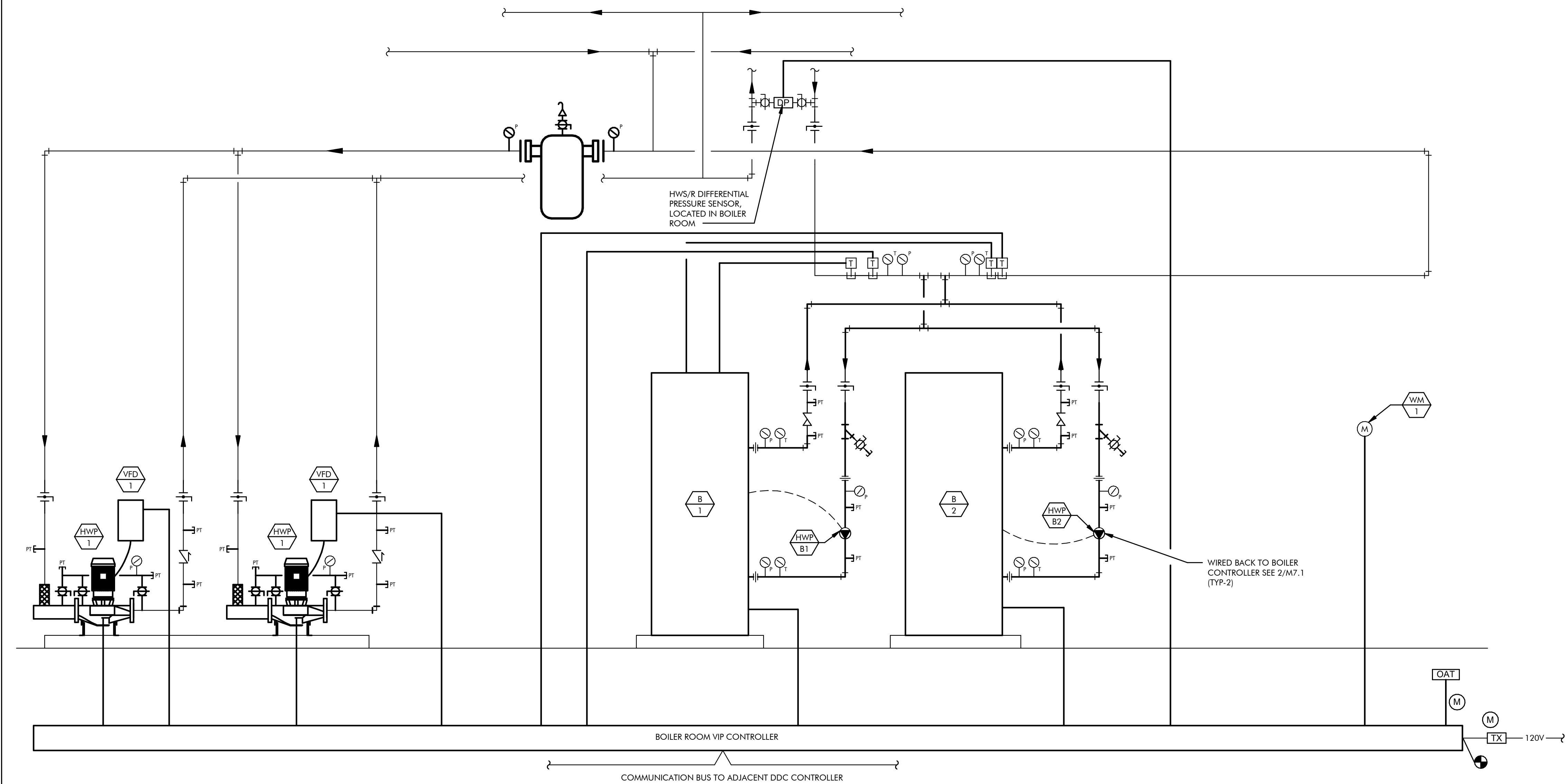
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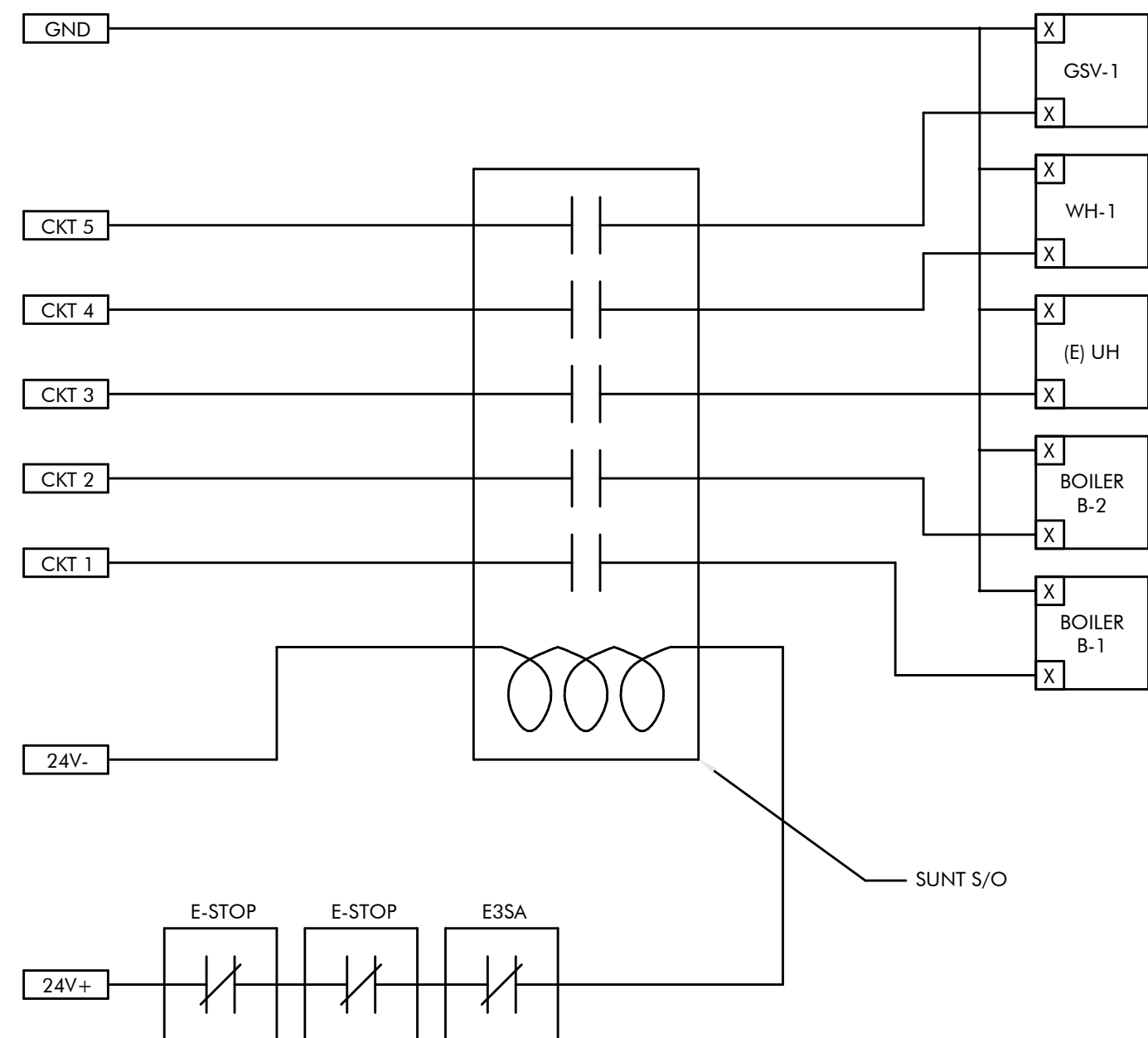
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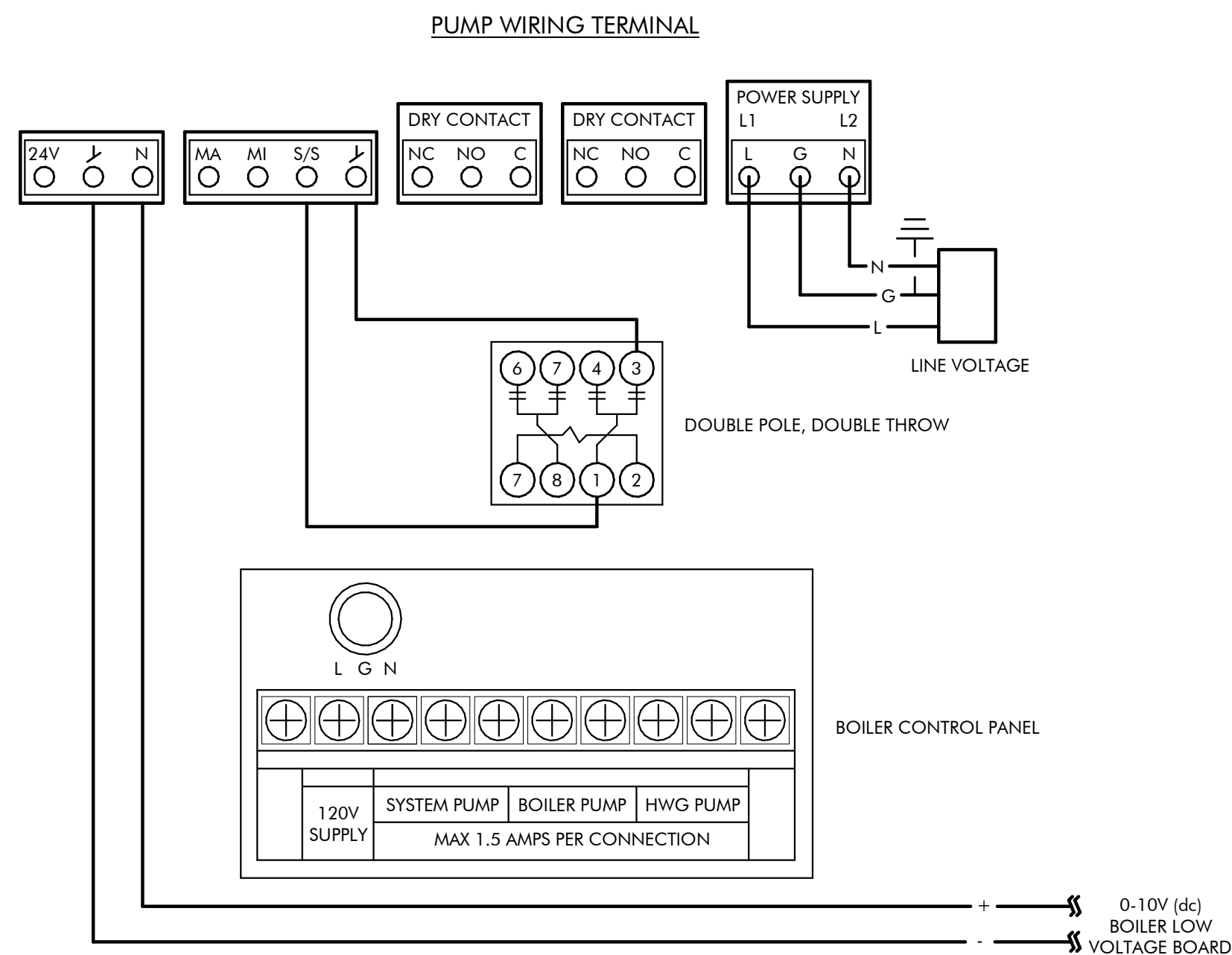
PLOT DATE:



1 HEATING HOT WATER CONTROL DIAGRAM
M7.2 SCALE : NONE



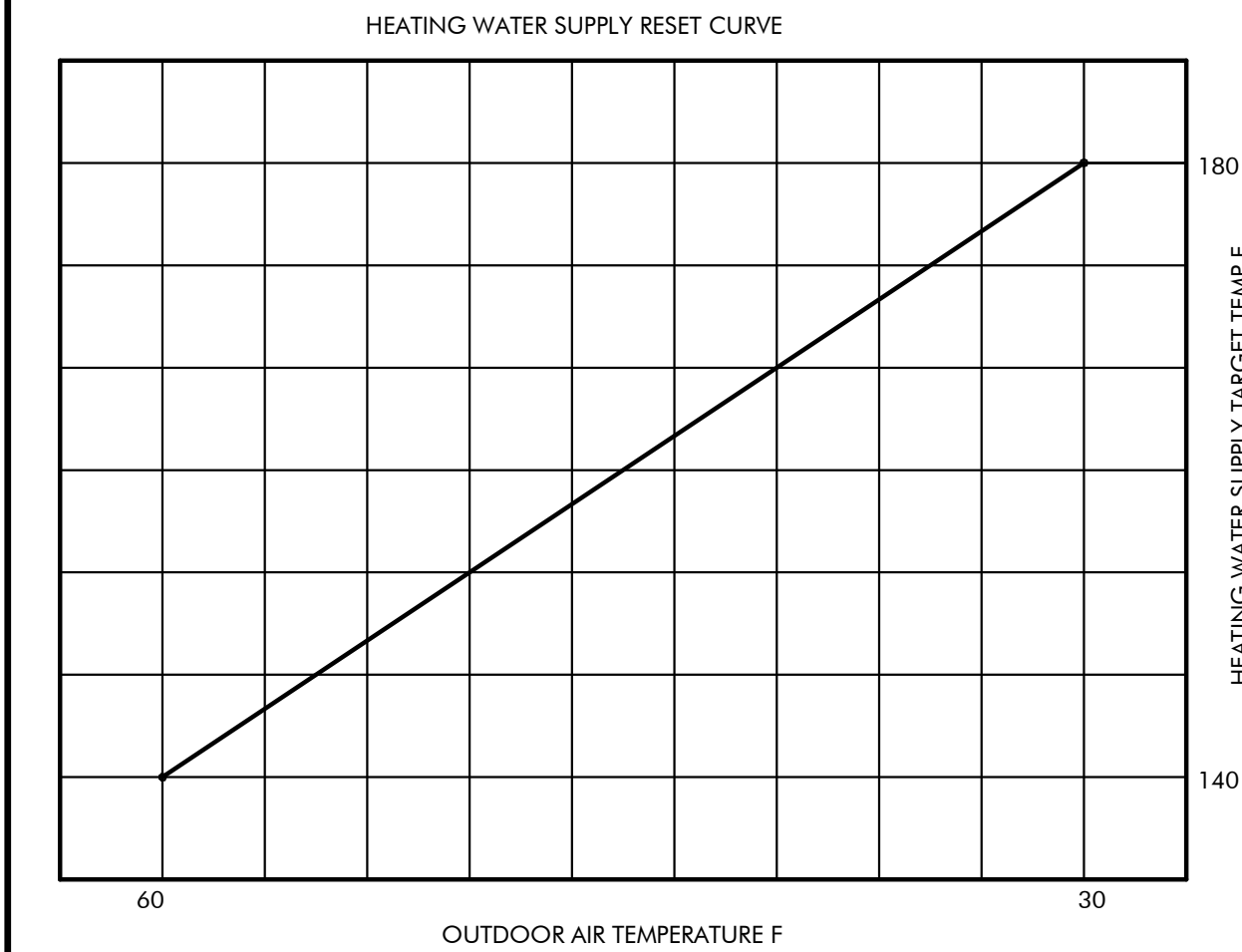
2 BOILER E-STOP CONTROL DIAGRAM
M7.2 SCALE : NONE



3 BOILER PUMP (HWP-B1, & HWP-B2) WIRING DIAGRAM
M7.2 SCALE : NONE

HEATING HOT WATER SYSTEM SEQUENCE OF OPERATION

- A. SETPOINTS
- HEATING SYSTEM SHALL BE ENABLED AT 60°F AND DISABLED AT 70°F (10°F DEADBAND) OR AS DIRECTED BY THE OWNER. ALL SETTINGS SHALL BE ADJUSTABLE.
 - THE HEATING WATER SUPPLY TEMPERATURE SHALL BE RE-SET BY THE BUILDING MANAGEMENT SYSTEM IN ACCORDANCE WITH THE FOLLOWING CURVE (INITIALLY 1:1 RATIO):



- B. BUILDING HEATING PUMPS (HWP-1, & HWP-2)
- WHEN HEATING SYSTEM IS ENABLED, THE BUILDING MANAGEMENT SYSTEM SHALL START LEAD BUILDING SUPPLY PUMP (HWP-1, & HWP-2)
 - UPON FAILURE OF THE LEAD PUMP, THE BUILDING MANAGEMENT SYSTEM SHALL ENERGIZE THE LAG (STANDBY) PUMP.
 - THE BUILDING MANAGEMENT SYSTEM SHALL ALTERNATE LEAD/LAG OF PUMPS WEEKLY.
- C. BOILERS (B-1 & B-2) AND ASSOCIATED BOILER PUMP (HWP-B1, & HWP-B2)
- THE BUILDING MANAGEMENT SYSTEM SHALL SEND SIGNAL TO MASTER BOILER CONTROLLER. THE BOILER CONTROLLER SHALL ENERGIZE LEAD BOILER (B-1 / B-2) AND START ASSOCIATED PUMP (HWP-B1 / HWP-B2) UTILIZING THE BOILERS INTERNAL LEAD/LAG CONTROL.
 - THE ASSOCIATED BOILER PUMP SHALL RUN CONTINUOUSLY WHEN BOILER IS IN OPERATION. THE BOILER CONTROLLER SHALL SHUT OFF THE PUMP 15 MINUTES AFTER BOILER SHUTDOWN TO PREVENT RESIDUAL HEAT FROM EXCEEDING BOILER HIGH LIMIT TEMPERATURE.
 - FLOW SWITCH AT BOILER DISCHARGE ALLOWS BOILERS TO ENERGIZE. BOILER INTEGRAL CONTROLS TO MODULATE BURNER TO MAINTAIN SYSTEM HEADER WATER TEMPERATURE SETPOINT.
 - THE BOILER CONTROLLER SHALL INDICATE ALARM CONDITION WHENEVER THE BOILER INDICATES FAILURE (THROUGH ALARM CONTACTS).
 - THE MANUAL RESET HIGH LIMIT CONTROL ON EACH BOILER SHALL BE SET INITIALLY AT APPROXIMATELY 210°F (ADJUSTABLE).
 - IF ANY SPACE TEMPERATURE SENSOR FALLS BELOW 50°F, THEN THE HEATING SYSTEM SHALL BE PLACED IN THE ENABLED MODE.
 - SAFETIES:
 - FLOW SWITCH SHALL DISABLE BOILER AND SET ALARM.
 - EMERGENCY SHUTDOWN SWITCH AT EACH BOILER ROOM EXIT SHALL DISCONNECT THE POWER TO ALL FUEL BURNING EQUIPMENT IN BOILER ROOM.
 - THE BUILDING MANAGEMENT SHALL SEND SIGNAL TO MASTER BOILER CONTROLLER, WHEN THE CONTROLLER ENERGIZES EITHER BOILERS, THE SUPPLY FAN (SF-1) SHALL ENERGIZE.
- D. OPERATOR'S TERMINAL
- SEE 'TEMPERATURE CONTROL AND EMCS GENERAL NOTES'.
 - HEATING WATER SUPPLY TEMPERATURE (°F).
 - HEATING WATER RETURN TEMPERATURE (°F).
 - BOILER SUPPLY TEMPERATURE (°F).
 - BOILER COMMAND (ENABLE/DISABLE).
 - BOILER STATUS (ON/OFF).
 - BOILER ALARM (ALARM/NORMAL).
 - HW PUMP COMMAND (START/STOP).
 - HW PUMP STATUS (ON/OFF).
 - HEATING WATER RESET TEMPERATURE (°F).
- E. SAFETIES
- EMERGENCY BOILER ROOM SHUT DOWN, SEE SEQUENCE BELOW
 - ROOM CARBON MONOXIDE (CO) DETECTOR SHALL ALARM IN ROOM AND ALSO BMS WHEN LEVELS ARE ABOVE 50 PPM (ADJUSTABLE THROUGH BMS)

BOILER ROOM EMERGENCY SHUTDOWN SEQUENCE OF OPERATION

- WHEN THE EMERGENCY SHUTDOWN BUTTON IS ENGAGED, BOTH BOILERS (B-1 AND B-2) WILL SHUT DOWN AND LOCKED OUT VIA THE AUXILIARY CONTACT LOCKOUT ON THE BOILERS. THE GAS SHUT OFF VALVE (GSV-1) POWER SHALL BE TRIPPED AND VALVE SHALL CLOSE. WATER HEATER (WH-1) SHALL SHUT DOWN WITH RELAY AT WATER HEATER POWER SUPPLY. EXISTING UNIT HEATER SHALL SHUT DOWN WITH NEW RELAY ON POWER SUPPLY.



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MECHANICAL CONTROL DIAGRAMS AND
SEQUENCE OF OPERATION

REVISIONS:

REV.	DESCRIPTION	DATE
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ELECTRICAL SYMBOLS AND NOMENCLATURE

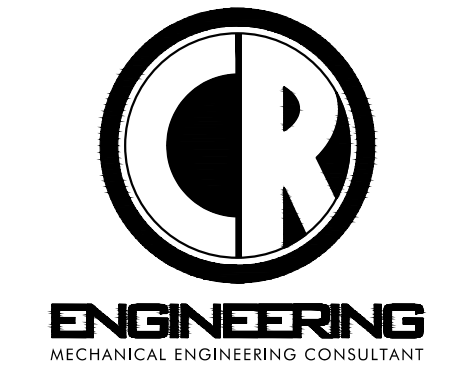
	SINGLE-OUTLET RECEPTACLE		SINGLE-PHASE, 1-POLE CIRCUIT PATH (1/2" CONDUIT, (2) - #10 CU, UNLESS OTHERWISE NOTED) BELOW FLOOR
	DOUBLE-OUTLET 'DUPLEX' RECEPTACLE		SINGLE-PHASE, 2-POLE CIRCUIT PATH (1/2" CONDUIT, (3) - #10 CU, UNLESS OTHERWISE NOTED) BELOW FLOOR
	THREE-PHASE (3W) RECEPTACLE (CONFIGURATION AS NOTED)		THREE-PHASE, 1-POLE CIRCUIT PATH (1/2" CONDUIT, (4) - #10 CU, UNLESS OTHERWISE NOTED) BELOW FLOOR
	QUADRUPLE-OUTLET 'QUAD' RECEPTACLE		RETURN CIRCUIT TO PANEL 'HOMERUN' (CIRCUIT AS NOTED) ABOVE FLOOR
	SPECIAL RECEPTACLE (VOLTAGE/CONFIGURATION AS NOTED)		CIRCUIT BREAKER (AMPS/POLES AS NOTED)
	JUNCTION BOX		FUSE (AMPS/POLES AS NOTED)
	FLOOR MOUNT RECEPTACLE		SHEET NOTE INDICATOR
	THERMOSTAT		SHEET/EQUIPMENT NOTE INDICATOR
	SAFETY DISCONNECT SWITCH (SIZE/VOLTAGE/CONFIGURATION AS NOTED)		EQUIPMENT NOTE INDICATOR
	COMBINATION SAFETY SWITCH/MAGNETIC STARTER		REVISION 'DELTA' NOTE INDICATOR
	TELEPHONE/DATA JUNCTION BACKBOX		FEEDER NOTE INDICATOR
	SINGLE-POLE TOGGLE SWITCH (VOLTAGE AS REQUIRED)	48"	48" MOUNTING HEIGHT AFF. (ACTUAL HEIGHT AS NOTED)
	MULTI-STATION 'THREE-WAY' TOGGLE SWITCH (VOLTAGE AS REQUIRED)	AFF.	ABOVE FINISHED FLOOR
	SOLID STATE DIMMING SWITCH (VOLTAGE AS REQUIRED)	AFG.	ABOVE FINISHED GRADE
	MOTOR-RATED TOGGLE SWITCH (VOLTAGE AS REQUIRED)	ATS.	AUTOMATIC TRANSFER SWITCH
	KEYED TOGGLE SWITCH (VOLTAGE AS REQUIRED)	C	CONDUIT
	CABLE TELEVISION OUTLET	CB	CIRCUIT BREAKER
	PANELBOARD (NAME/AMP/PHASE/VOLTAGE/CONFIGURATION AS NOTED)	CC	CONTROLS CONTRACTOR
	TRANSFORMER (NAME/KVA RATING/PHASE/VOLTAGE AS NOTED)	CLG	CEILING
	INDICATES MECHANICAL EQUIPMENT	(E)	EXISTING
	PHOTO ELECTRIC CELL	EC	ELECTRICAL CONTRACTOR
	TIME CLOCK	FACP	FIRE ALARM CONTROL PANEL
	CONTACTOR (CONFIGURATION AS NOTED)	F.B.O.	FURNISHED BY OTHERS
	DUCT DETECTOR FIRE ALARM SYSTEM COMPONENT	GFI	GROUND FAULT INTERRUPTING TYPE
	SMOKE DETECTOR FIRE ALARM SYSTEM COMPONENT	HID	HIGH INTENSITY DISCHARGE
	HEAT DETECTOR FIRE ALARM SYSTEM COMPONENT	LTG	LIGHTING
	FLOW SWITCH FIRE ALARM SYSTEM COMPONENT	NTS	NOT TO SCALE
	TAMPER SWITCH FIRE ALARM SYSTEM COMPONENT	MC	MECHANICAL CONTRACTOR
	HORN/STROBE COMBINATION FIRE ALARM SYSTEM COMPONENT	MCB	MAIN CIRCUIT BREAKER
	MANUAL PULL STATION	MSB'	MAIN SWITCH BOARD
	SINGLE-PHASE, 1-POLE CIRCUIT PATH (1/2" CONDUIT, (2) - #10 CU, UNLESS OTHERWISE NOTED) ABOVE FLOOR	(N)	NEW
	SINGLE-PHASE, 2-POLE CIRCUIT PATH (1/2" CONDUIT, (3) - #10 CU, UNLESS OTHERWISE NOTED) ABOVE FLOOR	NL	NIGHT LIGHT
	THREE-PHASE, 1-POLE CIRCUIT PATH (1/2" CONDUIT, (4) - #10 CU, UNLESS OTHERWISE NOTED) ABOVE FLOOR	TYP	TYPICAL
	RETURN CIRCUIT TO PANEL 'HOMERUN' (CIRCUIT AS NOTED) ABOVE FLOOR	UG	UNDER GROUND
	MOTOR (HORSEPOWER AS NOTED)	UN	UNLESS OTHERWISE NOTED
	SHUNT TRIP STATION	WP	WEATHER PROOF
		XFR	TRANSFORMER

MECHANICAL EQUIPMENT CONNECTION SCHEDULE:

MEQ #	DISCONNECTING MEANS	VOLTS / # / FLA	(E) CKT	LOAD KVA	(N) CKT	CONDUIT & WIRE	NOTE #3 & #4	NOTES
	LOCKABLE 20AMP MOTOR RATED SWITCH	120 / 1 / 15	'LA'-18	1.80	'LA'-18	1/2" C, (2) - #12 Cu & (1) - #12 Cu GND		--
	LOCKABLE 20AMP MOTOR RATED SWITCH	120 / 1 / 15	'LA'-20	1.80	'LA'-20	1/2" C, (2) - #12 Cu & (1) - #12 Cu GND		--
	PROVIDED BY M.C. & INSTALLED BY E.C.	480 / 3	'MCC'-A'	--	SEE A/E03	1/2" C, (3) - #10 Cu & (1) - #10 Cu GND		15 HP
	PROVIDED BY M.C. & INSTALLED BY E.C.	480 / 3	'MCC'-A'	--	SEE A/E03	1/2" C, (3) - #10 Cu & (1) - #10 Cu GND		15 HP
	VFD-1	480 / 3 / 21	'MCC'-A'	11.45	VIA VFD-1	1/2" C, (3) - #10 Cu & (1) - #10 Cu GND		15 HP
	VFD-2	480 / 3 / 21	'MCC'-A'	11.45	VIA VFD-2	1/2" C, (3) - #10 Cu & (1) - #10 Cu GND		15 HP
	LOCKABLE 20AMP MOTOR RATED SWITCH	120 / 1 / 5.7	'MCC'-A'	0.68	'LA'-24	1/2" C, (2) - #12 Cu & (1) - #12 Cu GND		1 HP
	LOCKABLE 20AMP MOTOR RATED SWITCH	120 / 1 / 5.7	'MCC'-A'	0.68	'LA'-24	1/2" C, (2) - #12 Cu & (1) - #12 Cu GND		1 HP
	JUNCTION BOX & HARDWIRE	120 / 1 / 1	--	0.12	'LA'-25	1/2" C, (2) - #12 Cu & (1) - #12 Cu GND		--
	JUNCTION BOX & HARDWIRE	120 / 1 / 6.2	'LA'-25	0.14	'LA'-25	1/2" C, (2) - #12 Cu & (1) - #12 Cu GND		--

MECHANICAL EQUIPMENT CONNECTION SCHEDULE NOTES:

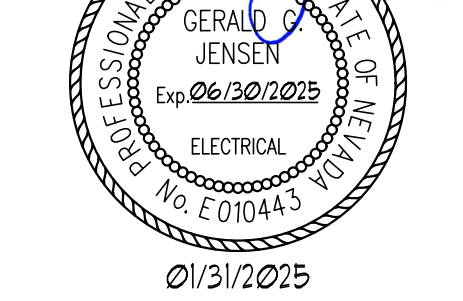
- CONTRACTOR SHALL DISCOVER AND FIELD VERIFY THE SERVING PANEL & BRANCH CIRCUIT AND UPDATE PANEL DIRECTORIES.
- SEE MECHANICAL PLANS FOR EXACT LOCATIONS OF MECHANICAL EQUIPMENT.
- CONTRACTOR'S BID SHALL INCLUDE NEW (OVERHEAD) CONDUITS AND PATHWAYS AS REQUIRED FOR ALL EQUIPMENT CONNECTIONS. NEVERTHELESS, CONTRACTOR MAY REUSE ANY EXISTING CONDUITS, BACK BOXES, AND PATHWAYS THAT ARE MADE AVAILABLE DURING THE DEMOLITION PHASE OF WORK.
- ALL BRANCH CIRCUIT WIRING SHALL BE & PROVIDED WITH PRINTED PERMANENT WIRE MARKERS WHICH CLEARLY IDENTIFY THE SERVING PANEL & CIRCUIT BREAKER.



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DOUGLAS COUNTY SCHOOL DISTRICT
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BOILER REPLACEMENT
1170 BALER STREET, GARDNERVILLE, NV 89423
ELECTRICAL SYMBOLS & MECHANICAL
EQUIPMENT CONNECTION SCHEDULE

REVISIONS:		
REV.	DESCRIPTION	DATE
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DRAWN BY: KPJ		
DESIGNED BY: KPJ		
CHECKED BY: GGJ		
APPROVED BY: GGJ		
DATE: 01/31/2025		
PROJECT NO: N223JK		
SHEET NUMBER:		

ELECTRICAL SPECIFICATIONS

1.0 GENERAL PROVISIONS

CONSIDER THE GENERAL AND SPECIFIC CONDITIONS OF THE CONTRACT AND THE COMPLETE SET OF DRAWINGS AS PART OF THIS DIVISION OF THE SPECIFICATIONS. WHERE REQUIREMENTS OF THIS DIVISION DO NOT CONCLUDE WITH GENERAL AND SPECIAL CONDITIONS, THE STRICTER REQUIREMENTS WILL GOVERN.

2.0 WORK INCLUDED

PROVIDE ALL LABOR, MATERIALS, TOOLS, EQUIPMENT, APPARATUS, ETC. INCLUDING THOSE REASONABLY INFERRED, AS REQUIRED FOR A COMPLETE INSTALLATION OF ANY ELECTRICAL WORK SHOWN WITHIN THESE ELECTRICAL CONSTRUCTION DOCUMENTS, OR DETAILED IN THE ELECTRICAL SPECIFICATIONS. ALL ELECTRICAL WORK SHALL BE PERFORMED BY LICENSED ELECTRICIANS AND TECHNICIANS. REPAIRS AND REPLACEMENTS FOR DEFECTIVE EQUIPMENT OR MATERIALS AS COVERED BY WARRANTY/GUARANTEE SHALL BE CONSIDERED WITHIN THE SCOPE OF WORK AND SHALL BE PERFORMED AT NO ADDITIONAL COST (EXCEPTION: LIGHTING LAMPS).

3.0 RELATED WORK SPECIFIED ELSEWHERE

ELECTRICAL CONSTRUCTION DOCUMENTS AND ELECTRICAL SPECIFICATION SECTION SHALL BE CONSIDERED AS A WHOLE. ALL ELECTRICAL WORK SHALL ACCOMMODATE THE REQUIREMENTS OF THIS DIVISION TO ENSURE PROPER PERFORMANCE OF ELECTRICAL WORK REQUIRED BY OTHER DIVISIONS.

4.0 SITE INVESTIGATION

ELECTRICAL CONTRACTOR SHALL THOROUGHLY INVESTIGATE ALL EXISTING CONDITIONS AT THE PROJECT SITE PRIOR TO SUBMITTING A BID.

5.0 REGULATIONS AND STANDARDS

5.1 ALL ELECTRICAL WORK SHALL BE PERFORMED IN ACCORDANCE WITH THE LATEST ADOPTED EDITIONS OF: UNR DESIGN AND CONSTRUCTION STANDARDS, THE 2017 NATIONAL ELECTRICAL CODE (NEC), NATIONAL FIRE PROTECTION AGENCY (NFPA) STANDARDS, INTERNATIONAL BUILDING CODE (IBC), INTERNATIONAL FIRE CODE (IFC), INTERNATIONAL ENERGY CONSERVATION CODE (IECC), NECA 1-2015 STANDARD FOR GOOD WORKMANSHIP IN ELECTRICAL CONSTRUCTION, AMERICANS WITH DISABILITIES ACT (ADA), OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA), THE REQUIREMENTS OF THE FIRE MARSHALL, AND ANY UTILITY COMPANY STANDARDS AS DETAILED IN UTILITY WORK ORDER DRAWINGS. ADDITIONALLY, ALL STATE AND LOCAL CODES AND ORDINANCES SHALL BE UPHOLD. CONTRACTOR SHALL NOT OMIT ANY COMPONENT OR PORTION OF THESE ELECTRICAL CONSTRUCTION DOCUMENTS WHICH MAY EXCEED THE LISTED STANDARDS. NO ELECTRICAL WORK DETAILED IN THE ELECTRICAL CONSTRUCTION DOCUMENTS OR ELECTRICAL SPECIFICATION SECTION SHALL BE INTERPRETED TO PERMIT WORK WHICH FAILS TO CONFORM TO THESE REQUIREMENTS. WHERE CONFLICTS OCCUR, HIGHER STANDARDS SHALL GOVERN. RULINGS AND INTERPRETATIONS BY GOVERNING AGENCIES SHALL BE CONSIDERED A PART OF THIS DIVISION IF COMMONLY IMPOSED UPON THE TRADE PRIOR TO SUBMISSION OF BID.

6.0 FEES

ELECTRICAL CONTRACTOR SHALL INCLUDE ALL FEES AND ROYALTIES FOR PERMITS, TESTS AND INSPECTIONS. UTILITY COMPANY CHARGES FOR PERMANENT CONNECTION TO ELECTRICAL SERVICE ARE NOT THE RESPONSIBILITY OF THE ELECTRICAL CONTRACTOR.

7.0 DRAWINGS AND SPECIFICATIONS

7.1 ELECTRICAL CONTRACTOR SHALL VERIFY THE EXACT LOCATIONS, ELEVATIONS, AND INSTALLATION REQUIREMENTS OF ALL ELECTRICAL EQUIPMENT PRIOR TO "ROUGH-IN" (INCLUDING RECEPTACLES, SWITCHES, CONDUITS, SWITCHBOARDS, PANELBOARD, ETC.). LOCATIONS SHALL BE VERIFIED FOR APPROPRIATE SPACE (LENGTH, WIDTH, AND HEIGHT) AND CLEARANCE PRIOR TO FABRICATING OR ORDERING ANY EQUIPMENT OR MATERIALS. ALL DISCREPANCIES SHALL BE REPORTED TO THIS ENGINEER IMMEDIATELY. FINAL CONNECTIONS SHALL BE MADE IN ACCORDANCE WITH MANUFACTURER'S APPROVED WIRING DIAGRAMS, DETAILS AND INSTRUCTIONS.

7.2 ELECTRICAL CONTRACTOR SHALL SUBMIT WRITTEN REQUEST-FOR-INFORMATION (RFI) DOCUMENTS TO THIS ENGINEER PRIOR TO PERFORMING ANY WORK WHERE AMBIGUITY ARISES. ELECTRICAL CONTRACTOR SHALL NOT PERFORM ANY FIELD MODIFICATIONS OR DEVIATIONS FROM THE ELECTRICAL CONSTRUCTION DOCUMENTS AND/OR SPECIFICATIONS WITHOUT APPROVED WRITTEN RESPONSE FROM THIS ENGINEER THROUGH AN APPROPRIATELY SUBMITTED RFI.

7.3 ELECTRICAL CONTRACTOR SHALL PERFORM ELECTRICAL WORK PER MANUFACTURER'S DIRECTIONS WHERE SAID DETAILS ARE NOT SPECIFICALLY COVERED OR INDICATED BY THESE ELECTRICAL CONSTRUCTION DOCUMENTS AND ELECTRICAL SPECIFICATIONS. WHEN CONFLICT ARISES, SECTION 7.2 OF THIS SPECIFICATION SHALL DICTATE PERFORMANCE.

7.4 ALL SERVICES RENDERED BY THIS ENGINEER ARE PROFESSIONAL OPINIONS AND RECOMMENDATIONS, ONLY. UNDER NO CIRCUMSTANCE IS IT THE INTENT OF THIS ENGINEER TO DIRECTLY CONTROL THE PHYSICAL ACTIVITIES OF THE CONTRACTOR OR HIS EMPLOYEES.

8.0 MATERIALS

8.1 APPEARANCE AND FINISH OF MATERIALS SHALL BE OF THE HIGHEST STANDARDS. ALL MATERIALS AND EQUIPMENT SHALL BE NEW, OPERATING NORMALLY, AND OF HIGHEST AVAILABLE QUALITY. ANY DEFECTIVE MATERIALS SHALL BE IDENTIFIED AND REMOVED FROM SITE IMMEDIATELY.

8.2 PROVIDE UNDERWRITERS LABORATORY (UL) LISTED MATERIALS AND EQUIPMENT WHEREVER STANDARDS FOR SAID ITEMS HAVE BEEN ESTABLISHED. UNLISTED DEVICES SHALL BE INSTALLED IN EQUIPMENT NORMALLY LISTED OR LABELED, AND SHALL CONFORM TO UL STANDARDS AS FAR AS POSSIBLE.

8.3 ALL CATALOG NUMBERS ARE GIVEN TO ASST IN IDENTIFYING THE BASIC REQUIREMENTS OF THIS PROJECT AND INDICATE THE MINIMUM LEVEL OF QUALITY. CATALOG NUMBERS WILL, GENERALLY, NOT SPECIFY COLOR AND ACCESSORIES. CONSULT OWNER AND ARCHITECT FOR COLOR AND ACCESSORY DETAILS.

9.0 CLEAN WORK

REGULARLY REMOVE DEBRIS FROM THE PROJECT SITE, AS REQUIRED, DURING CONSTRUCTION. CLEAN ALL RACEWAYS, FIXTURES, AND OTHER EQUIPMENT PRIOR TO FINAL ACCEPTANCE BY OWNER.

10.0 CLOSING IN OF UNINSPECTED WORK

ELECTRICAL CONTRACTOR SHALL NOT CLOSE IN OR CONCEAL ANY ELECTRICAL WORK PERFORMED PRIOR TO INSPECTION AND APPROVAL.

11.0 STANDARD FIELD TESTS

11.1 ELECTRICAL CONTRACTOR SHALL PERFORM THE FOLLOWING TESTS OF THE ELECTRICAL SYSTEM AND SHALL PROVIDE THE ENGINEER WITH TABULATED AND SIGNED TEST REPORTS FOR THE FOLLOWING TESTS:

CONDUCTOR INSULATION TESTING: TEST POWER CONDUCTORS USING A 500 VOLT DC INSULATION TESTER. TEST CONDUCTORS INSTALLED IN PLACE, DISCONNECTED AT BOTH ENDS, AND ACCORDING TO TEST EQUIPMENT MANUFACTURERS INSTRUCTIONS. MINIMUM RESISTANCE VALUES SHALL BE AS RECOMMENDED BY TEST EQUIPMENT MANUFACTURERS PUBLISHED VALUES BASED ON SPECIFIC SITE CONDITIONS.

GROUND RESISTANCE TEST: TEST MAIN GROUNDING ELECTRODE SYSTEM USING THREE POINT FALL OF POTENTIAL TESTER. PERFORM TEST ACCORDING TO TEST EQUIPMENT MANUFACTURERS INSTRUCTIONS. MAXIMUM GROUND RESISTANCE OF THE GROUNDING ELECTRODE SYSTEM SHALL BE 10 OHMS. IF MEASURED GROUND RESISTANCE IS GREATER THAN 10 OHMS, CONTRACTOR SHALL PROVIDE AND INSTALL ONE 3/4" X 8" COPPER CLAD GROUND ROD WITH #2 CU CONNECTION TO THE GROUNDING ELECTRODE SYSTEM.

POLARITY TESTS: TEST ALL UTILIZATION EQUIPMENT, OUTLETS, AND RECEPTACLES FOR PROPER POLARITY. POLARITY SHALL COMPLY WITH N.E.C. REQUIREMENTS.

CHECK ALL MECHANICAL LUGS FOR PROPER TENSION. COMPLETE MECHANICAL LUG CONNECTIONS USING A CALIBRATED TORQUE WRENCH (OR SCREWDRIVER) ACCORDING TO LUG MANUFACTURERS TIGHTENING RECOMMENDATIONS.

11.2 ANY WORK WHICH FAILS TO MEET THE REQUIREMENTS OF THESE ELECTRICAL CONSTRUCTION DOCUMENTS, OR ANY OF THE ABOVE-LISTED TESTING SHALL BE CONSIDERED DEFECTIVE AND SHALL BE PROMPTLY CORRECTED UNDER WARRANTY.

12.0 IDENTIFICATION

ELECTRICAL CONTRACTOR SHALL PROVIDE AND INSTALL PRINTED PHENOLIC WEATHERPROOF LABELS FOR ALL ELECTRICAL OUTLETS AND EQUIPMENT. LABELS SHALL INDICATE DEVICE DESIGNATION, EQUIPMENT SERVED, VOLTS/PHASE/WIRE, AND SOURCE FEEDING THE EQUIPMENT.

LABELS FOR ALL OUTDOOR EQUIPMENT SHALL BE WEATHERPROOF PHENOLIC ENGRAVED TYPED LABELS.

PROVIDE ALL PANELBOARDS WITH ACCURATE AND TYPED DIRECTORIES, INSTALLED UNDER CLEAR PLASTIC COVER. PROVIDE DIRECTORY INFORMATION TO OWNER FOR APPROVAL PRIOR TO FINALIZATION.

13.0 PENETRATIONS

13.1 PROVIDE AND INSTALL APPROVED UL LISTED ASSEMBLY AND EMPLOY ARCHITECTURALLY APPROVED METHODS FOR WATER-TIGHT PENETRATION OF EXTERIOR WALLS. CONSULT ARCHITECT FOR DETERMINATION OF PENETRATION LOCATIONS FOR EXTERIOR WALLS.

13.2 PROVIDE AND INSTALL APPROVED UL LISTED MATERIALS AND EMPLOY ARCHITECTURALLY APPROVED METHODS FOR PENETRATION OF FIRE-RATED ASSEMBLIES. ELECTRICAL CONTRACTOR SHALL NOT EXCEED THE MAXIMUM ALLOWABLE SURFACE PENETRATIONS. CONSULT ARCHITECT FOR DETERMINATION OF PENETRATION LOCATIONS INTO FIRE-RATED ASSEMBLIES.

14.0 EXCAVATION AND BACKFILL

14.1 PROVIDE ALL EXCAVATION, BACKFILL, TRENCHING, SHORING, PUMPING, COMPACTION, ETC. REQUIRED FOR ALL ELECTRICAL WORK DETAILED IN THE ELECTRICAL CONSTRUCTION DOCUMENTS AND THIS ELECTRICAL SPECIFICATION. CONFORM TO REQUIREMENTS OF EARTHWORK SECTION WHERE THIS SPECIFICATION DOES NOT DETAIL.

14.2 COORDINATE WITH EARTHWORK CONTRACTOR TO INSTALL RACEWAYS AND CONDUIT ROUTES PROMPTLY. ELECTRICAL CONTRACTOR SHALL PERFORM BACKFILL UPON INSPECTION AND APPROVAL.

14.3 UNDERGROUND ELECTRICAL WORK SHALL BE PERFORMED WITH CONSIDERATION FOR EXISTING SERVICES. ELECTRICAL CONTRACTOR SHALL PROMPTLY AND COMPLETELY REPAIR OR REPLACE ANY SYSTEMS DISRUPTED DURING ELECTRICAL INSTALLATION AND RETURN TO WORKING ORDER.

14.4 BACKFILL SHALL CONFORM TO REQUIREMENTS OF EARTHWORK SPECIFICATION SECTION AND SHALL BE FREE OF ROCKS OR OTHER DEBRIS, AND SHALL BE COMPACTED TO FINISHED GRADE.

15.0 SUPPORTS AND FASTENERS

ELECTRICAL CONTRACTOR SHALL PROVIDE AND INSTALL SUPPORTS AND HANGARS FOR ALL RACEWAYS, CABINETS, BOXES, BACK-BOXES, AND ALL OTHER EQUIPMENT. DESIGN OF SUPPORTS AND FASTENERS SHALL BE MADE USING PRE-ENGINEERED AND MANUFACTURED COMPONENTS DESIGNED FOR THE INTENDED USE. SUPPORTS AND FASTENERS SHALL BE INSTALLED PER MANUFACTURERS INSTRUCTIONS AND IN GENERAL CONFORMANCE WITH THE RECOMMENDATIONS OF NECA STANDARD 1-2015 AND NECA STANDARD 101-2013. ANCHORS, BOLTS, SUPPORT SYSTEMS, HANGERS, ETC. SHALL FEATURE ADEQUATE CORROSION RESISTANCE FOR THE APPLICATION. RACEWAY SUPPORTS SHALL BE TRAPEZE TYPE WITH BEAM CLAMPS, THREADED RODS, AND STRUCTURAL CHANNELS. SELECTION OF SUPPORTS AND FASTENING METHODS SHALL BE BASED ON SIZE AND WEIGHT OF COMPONENTS SUPPORTED, AS WELL AS SAFETY AND ACCESSIBILITY. ALL SUPPORTS AND HANGARS SHALL BE RATED FOR FIVE (5) TIMES THE ACTUAL LOAD.

16.0 TRADE COORDINATION

ELECTRICAL CONTRACTOR SHALL COORDINATE THE ELECTRICAL INSTALLATION WORK WITH ALL OTHER CONTRACTORS. REFER TO PLANS AND SPECIFICATIONS OF OTHER TRADES. ELECTRICAL CONTRACTOR SHALL CONSULT OTHER CONTRACTORS TO ENSURE TIMELY AND APPROPRIATE CONNECTIONS AND INTERFACE WITH PLUMBING, MECHANICAL, FIRE/SMOKE DAMPERS, OR OTHER EQUIPMENT. ALL REQUIRED WIRING AND CONTROL COMPONENTS SHALL BE CONSIDERED PART OF THE SCOPE OF WORK.

17.0 RECORD DRAWINGS

ELECTRICAL CONTRACTOR SHALL PROVIDE A NEAT AND COMPLETE SET OF "AS-BUILT" RECORD DRAWINGS TO THE OWNER WITHIN TEN (10) DAYS OF FINAL ACCEPTANCE OF WORK. RECORD DRAWINGS SHALL INDICATE ALL DEVIATIONS FROM THE ELECTRICAL CONSTRUCTION DOCUMENTS, LOCATIONS OF STUB-OUTS AND CONCEALED ITEMS (PER FIELD DIMENSIONS). RECORD DRAWINGS SHALL BE OF EQUAL TO OR HIGHER QUALITY THAN THESE ELECTRICAL CONSTRUCTION DOCUMENTS (INCLUDING SIZE, CLARITY AND MEDIUM). ALL MAINTENANCE AND OPERATING MANUALS AS WELL AS ANY ADDITIONAL INSTRUCTIONS, SHALL BE CONSIDERED A PART OF THE RECORD DRAWINGS.

18.0 ELECTRICAL SUBMITTALS

ELECTRICAL CONTRACTOR SHALL SUBMIT ELECTRONIC COPY OF FACTORY SHOP-DRAWINGS FOR ALL ELECTRICAL COMPONENTS PROPOSED FOR THIS PROJECT TO THIS ENGINEER, AND TO THE OWNER. ELECTRICAL CONTRACTOR SHALL OBTAIN WRITTEN PLANS FROM THIS ENGINEER, AND THE OWNER, OF ALL PROVIDED MANUFACTURER'S DATA SHEETS FOR ALL SWITCHGEAR, LIGHTING FIXTURES, WIRING DEVICES, FIRE ALARM SYSTEM COMPONENTS, MOTOR CONTROL CENTERS, PANELBOARDS, ETC. ANY PROPOSED SUBSTITUTIONS SHALL MEET THE PROJECT REQUIREMENTS EXACTLY, AND SHALL BE OF EQUAL OR GREATER QUALITY IN ALL RESPECTS, AND REQUIRE THIS ENGINEER'S APPROVAL. SUBSTITUTION PROPOSALS MUST BE SUBMITTED NO LESS THAN TEN (10) WORKING DAYS PRIOR TO BID ACCEPTANCE. ELECTRICAL CONTRACTOR SHALL ORDER AND/OR RELEASE ANY MATERIALS PROMPTLY AFTER SUBMITTAL APPROVAL. NO SUBSTITUTIONS OR ALTERNATE METHODS SHALL BE ACCEPTED AS A RESULT OF UNTIMELY WORK.

19.0 FIRE ALARM SYSTEM

ELECTRICAL CONTRACTOR SHALL RETAIN A LICENSED SPECIALTY FIRE ALARM SUB CONTRACTOR TO PROVIDE AND INSTALL A COMPLETE, TESTED AND TAGGED, AUTOMATIC FIRE DETECTION AND ALARM SYSTEM AS REQUIRED BY THE FIRE MARSHALL. PROVIDE AND INSTALL ALL COMPONENTS AS REQUIRED TO COMPLY WITH ALL REQUIREMENTS OF THE LOCAL FIRE MARSHALL. ELECTRICAL CONTRACTOR SHALL COORDINATE THE SPECIFIC PROJECT REQUIREMENTS, AND SHALL PROVIDE DETAILED PLANS, CLEARLY INDICATING ALL METHODS TO BE USED, FOR APPROVAL OF THE FIRE MARSHALL.

20.0 ELECTRICAL DEMOLITION

ELECTRICAL DEMOLITION AS REQUIRED FOR THE ELECTRICAL SCOPE OF WORK SHALL BE CONSIDERED A PART OF THE SCOPE OF WORK. REMOVE AND RETIRE ALL ELECTRICAL COMPONENTS WHERE IN CONFLICT WITH NEW CONSTRUCTION OR DESIGN. EXISTING CONCEALED CONDUITS MAY BE ABANDONED IN PLACE WHERE THIS DOES NOT CAUSE CONFLICT. REMOVE ALL CONDUCTORS FROM ABANDONED OR DEMOLISHED CONDUITS/RACEWAYS. PROVIDE AND INSTALL ANY COMPONENTS REQUIRED FOR COMPLETE RECONNECTION OF CIRCUITS WHERE DEMOLITION HAS CAUSED INTERRUPTION. RELOCATE AND RECONFIGURE EXISTING EQUIPMENT AS REQUIRED TO ACCOMMODATE CONDITIONS. ALL EXISTING EQUIPMENT REMOVED DURING THE COURSE OF THIS PROJECT SHALL BE OFFERED TO THE OWNER FOR SALVAGE. ANY EQUIPMENT SELECTED BY THE OWNER SHALL BE DELIVERED TO THE OWNER ON SITE. ALL REMAINING EQUIPMENT BECOMES THE PROPERTY OF THE CONTRACTOR AND SHALL BE REMOVED FROM THE SITE AND DISPOSED OF IN A SAFE AND LEGAL MANNER.

21.0 OWNERSHIP OF DOCUMENTS

THESE ELECTRICAL CONSTRUCTION DOCUMENTS AND SPECIFICATIONS CONSTITUTE THE INTELLECTUAL PROPERTY OF JENSEN ENGINEERING, INC. AND ALL RIGHTS ARE RESERVED BY JENSEN ENGINEERING, INC.. THESE MATERIALS SHALL REMAIN AS THE INTELLECTUAL PROPERTY OF JENSEN ENGINEERING, INC. AND MAY NOT BE REPRODUCED, DISTRIBUTED, OR USED FOR ANY OTHER PURPOSE, EXCEPT FOR THE PROJECT FOR WHICH THEY ARE INTENDED, WITHOUT THE EXPLICIT WRITTEN CONSENT OF JENSEN ENGINEERING, INC.

22.0 ONGOING OPERATIONS

ELECTRICAL CONSTRUCTION WORK SHALL BE PERFORMED WITH ALL DUE CONSIDERATION FOR ONGOING OPERATIONS AT THE PROJECT SITE AND SHALL MINIMIZE DISRUPTIONS IN EVERY RESPECT. PROVIDE AND INSTALL BARRICADES, DUST CONTAINMENT, NOISE ABATEMENT, ETC. TO ENSURE SAFETY AND COMFORT OF NON-CONSTRUCTION PERSONNEL ON THE PROJECT SITE. ANY INTERRUPTIONS TO EXISTING FIRE-ALARM, DATA/COMMUNICATION, OR ELECTRICAL SERVICES SHALL BE COORDINATED WITH THE OWNER AND THIS ENGINEER PRIOR TO ENGAGEMENT. DISRUPTIONS SHALL BE TEMPORARY AND MUST BE SCHEDULED 48 HOURS IN ADVANCE.

23.0 TEMPORARY POWER

ELECTRICAL CONTRACTOR SHALL PROVIDE TEMPORARY POWER SERVICE AND DISTRIBUTION FOR ALL TRADES WHICH REQUIRE SERVICE DURING CONSTRUCTION. TEMPORARY POWER SERVICE SHALL COMPLY WITH THE REQUIREMENTS OF THE NEC, AS WELL AS OSHA. COSTS OF TEMPORARY POWER ARE NOT THE RESPONSIBILITY OF THE ELECTRICAL CONTRACTOR.

24.0 MATCH EXISTING

ELECTRICAL CONTRACTOR SHALL COMPLETELY IDENTIFY ANY COMPONENTS WHERE DIRECTED TO MATCH EXISTING, AND SHALL PROVIDE AND INSTALL THE ITEM(S) EXACTLY. WHERE EXACT REPLACEMENT IS NOT AVAILABLE, NEW EQUIPMENT SHALL MATCH EXISTING EQUIPMENT IN FUNCTION AND APPEARANCE, AND MUST BE OF EQUAL OR GREATER QUALITY THAN EXISTING EQUIPMENT. WHERE SCOPE OF WORK OCCURS AT AN EXISTING FACILITY, ALL MATERIALS AND WORKMANSHIP SHALL BE OF GREATER QUALITY THAN EXISTING. TRANSITIONS FROM NEW WORK AREAS TO EXISTING AREAS SHALL BE SEAMLESS IN APPEARANCE AND FUNCTION.

25.0 CONDUCTORS

25.1 ALL CONDUCTORS SHALL CONFORM TO THE REQUIREMENTS STATED UNDER SECTION 5.0 OF THIS ELECTRICAL SPECIFICATION, AND UL LISTING STANDARDS. ALL CONDUCTORS SHALL BE COPPER, STANDARD AMERICAN WIRE GAUGE, SOFT-DRAWN, CONCEALED IN CONDUIT. CONDUCTORS SIZED #10 AWG AND SMALLER MAY BE SOLID OR STRANDED. CONDUCTORS SIZED #8 AWG AND LARGER SHALL BE STRANDED. MINIMUM WIRE SIZE SHALL BE #12 AWG (UNLESS OTHERWISE NOTED). CONDUCTOR INSULATION SHALL BE TYPE THHN-2/THWN-2 600 VOLT RATED. CONDUCTORS SHALL BE CONTINUOUS FROM ORIGIN TO EQUIPMENT WITHOUT SPLICES, PER NEC. WHERE REQUIRED, SPLICES SHALL OCCUR IN SPLICE BOXES PER THIS SPECIFICATION. WIRE/CABLE SHALL BE HANDLED TO AVOID DAMAGE TO BOTH CONDUCTOR AND INSULATION. WIRE/CABLE SHALL BE DELIVERED IN STANDARD COILS OR REELS WITH SUITABLE PROTECTION FROM WEATHER AND DAMAGE DURING STORAGE, HANDLING, AND INSTALLATION. ELECTRICAL CONTRACTOR SHALL COLOR CODE CONDUCTORS CONSISTENTLY THROUGHOUT THE PROJECT ACCORDING TO THE FOLLOWING OUTLINE:

VOLTAGE	PHASE A	PHASE B	PHASE C	NEUTRAL	GROUND
120/208V	BLACK	RED	BLUE	WHITE	GREEN
277/480V	BROWN	ORANGE	YELLOW	GRAY	GREEN OR GREEN/YELLOW STRIPE

25.2 EACH 120V OR 277V CIRCUIT SHALL HAVE A DEDICATED NEUTRAL CONDUCTOR.

25.3 SHARING OF NEUTRALS IS SHALL NOT BE ALLOWED.

26.0 CONDUIT SYSTEMS

26.1 CONDUIT AND CONDUCTOR ROUTES SHALL BE DETERMINED BY THE ELECTRICAL CONTRACTOR AT THE TIME OF INSTALLATION AND ARE SHOWN ON THESE PLANS FOR EXPLANATORY PURPOSES. PROVIDE AND INSTALL A CODE SIZED GREEN INSULATED GROUNDING WIRE IN ALL CONDUITS.

26.2 TYPE RMC AND IMC (NEC ART. 344 - RIGID METALLIC CONDUIT, & NEC ART. 342 - INTERMEDIATE METALLIC CONDUIT): SHALL BE PERMITTED, AS ALLOWED BY CODE, FOR ALL LOCATIONS INCLUDING EXPOSED TO PHYSICAL DAMAGE OR EXTERIOR ELEMENTS. ALL CONDUIT RUN EXPOSED ON ROOFS SHALL BE TYPE RMC OR IMC.

26.3 TYPE PVC (NEC ART. 352 - RIGID PVC CONDUIT) SHALL BE PERMITTED, AS ALLOWED BY CODE, FOR UNDERGROUND AND UNDER CONCRETE SLAB APPLICATIONS. UNDERGROUND CONDUITS SHALL BE BURIED IN SAND ENVELOPE, MINIMUM OF 24" (TWO FEET) BELOW FINISHED GRADE. PROVIDE AND INSTALL GREEN INSULATED GROUNDING WIRE IN ALL NON-METALLIC CONDUITS. ALL ELBOWS AND EXPOSED RISERS SHALL BE RMC (GRS) AND SHALL BE PVC COATED OR HALF-LAP WRAPPED WITH SCOTCH 50 TAPE.

26.4 TYPE EMT (NEC ART. 358 - ELECTRICAL METALLIC TUBING) SHALL BE PERMITTED, AS ALLOWED BY CODE, FOR ALL INTERIOR LOCATIONS WHERE NOT SUBJECT TO PHYSICAL DAMAGE. ALL INTERIOR HOMERUNS SHALL BE TYPE EMT. ALL FITTINGS SHALL BE STEEL. ALL CONNECTORS SHALL HAVE INSULATED THROATS.

26.5 TYPE FMC (NEC ART. 348 - FLEXIBLE METAL CONDUIT) SHALL BE USED FOR SHORT CONNECTIONS TO MOTORS AND EQUIPMENT FOR INDOOR LOCATIONS. TYPE FMC SHALL BE STEEL AND SHALL BE PROVIDED WITH STEEL (INSULATED THROAT) FITTINGS. THE MAXIMUM LENGTH OF TYPE FMC SHALL BE 48".

26.6 TYPE LFMC (NEC ART. 350 - LIQUIDTIGHT FLEXIBLE METAL CONDUIT) SHALL BE USED FOR SHORT CONNECTIONS TO MOTORS AND EQUIPMENT IN WET OR OUTDOOR LOCATIONS. THE MAXIMUM LENGTH OF TYPE LFMC SHALL BE 48".

26.7 TYPE MC (NEC ART. 330 - METAL-CLAD CABLE) OR TYPE AC CABLES SHALL NOT BE USED.

26.8 TYPE LFNC (NEC ART. 356 - LIQUIDTIGHT FLEXIBLE NONMETALLIC CONDUIT) SHALL NOT BE USED.

26.9 TYPE ENT (NEC ART. 362 - ELECTRICAL NONMETALLIC TUBING) SHALL NOT BE USED.

26.10 TYPE NM, NMC, AND NMS (NEC ART. 334 - NONMETALLIC-SHEATHED CABLES) SHALL NOT BE USED.

27.0 TERMINATIONS AND SPLICES

WIRE CONNECTORS FOR WIRE SIZES #14 AWG THROUGH #8 AWG SHALL BE SCOTCHLOK OR APPROVED EQUAL. FOR WIRE SIZES #14 AWG THROUGH #8 AWG, USE SOLDERLESS, FULLY ANNULAR PRESSURE TYPE CONNECTORS WITH HEAT SHRINK COVERING FOR ALL OTHERS.

28.0 RECEPTACLES, SWITCHES, WIRING DEVICES, AND PLATES

PROVIDE AND INSTALL COMMERCIAL GRADE RECEPTACLES, SWITCHES, AND OTHER WIRING DEVICES AS INDICATED IN THE ELECTRICAL CONSTRUCTION DOCUMENTS AND ELECTRICAL SPECIFICATIONS. WIRING DEVICE TERMINALS SHALL TENSIONED TO MANUFACTURERS PUBLISHED TORQUE VALUES USING A (CALIBRATED) ADJUSTABLE TORQUE SCREWDRIVER. GROUNDING TYPE RECEPTACLES WITH NEMA CONFIGURATIONS: *PROVIDE WEATHERPROOF "IN-USE" COVERS WITH CASKETED SPRING LIFT DOORS FOR EXTERIOR AND WET-LOCATIONS. PROVIDE STAMPED STEEL INDUSTRIAL COVERS FOR WIRING DEVICES IN EXPOSED WORK AREAS. PROVIDE ONE PIECE COVERS AND GANG OUTLETS TO SUIT THE DEVICES AT A LOCATION.

29.0 SWITCHGEAR AND DISTRIBUTION EQUIPMENT

ALL ELECTRICAL SWITCHGEAR EQUIPMENT SHALL BE OF THE SAME MANUFACTURER. ACCEPTABLE MANUFACTURES ARE: EATON, ABB-GE, SIEMENS, OR SQUARE-D, (NO SUBSTITUTES). SERVICE EQUIPMENT SHALL BE FULLY ENCLOSED, FACTORY ASSEMBLED, AND SHALL OPERATE PER SERVING ELECTRICAL UTILITY STANDARDS. SWITCHBOARDS AND PANELBOARDS SHALL HAVE COPPER BUSBARS (UNLESS NOTED OTHERWISE). PANELBOARDS SHALL USE BOLT-IN TYPE CIRCUIT BREAKERS (THIN 1/2" WIDE CIRCUIT BREAKERS ARE NOT PERMITTED). ALL EQUIPMENT AND BREAKERS SHALL BE PROVIDED WITH TERMINATION LUGS RATED 75 DEGREE C. OR HIGHER. CONTRACTOR SHALL PROVIDE AND INSTALL 4" CONCRETE HOUSE-KEEPING PAD FOR ALL FREE STANDING ELECTRICAL EQUIPMENT (SWITCHBOARDS, TRANSFORMERS, ETC.).

30.0 SAFETY DISCONNECT SWITCH

ALL FUSED AND NON-FUSED SAFETY DISCONNECT SWITCHES SHALL BE OF THE SAME MANUFACTURER. SAFETY DISCONNECT SWITCHES SHALL BE HEAVY DUTY, FULLY ENCLOSED, FACTORY ASSEMBLED, AND LOCKABLE.

31.0 SHORT CIRCUIT PROTECTION

AVAILABLE FAULT CURRENT (A.F.C.) VALUES, AS INDICATED ON THESE ELECTRICAL CONSTRUCTION DOCUMENTS, REFER TO THE EXPECTED MAXIMUM (3~ SYM) SHORT CIRCUIT CURRENT AVAILABLE AT THE POINT IDENTIFIED ON THE POWER DISTRIBUTION DIAGRAMS. ALL ELECTRICAL EQUIPMENT SHALL BE PROVIDED WITH SHORT CIRCUIT WITHSTAND LEVELS AND INTERRUPTING CAPACITY RATINGS GREATER THAN THE AVAILABLE FAULT CURRENT AT THE POINT WHERE THE EQUIPMENT IS LOCATED.

SERIES RATING OF THE OVER-CURRENT DEVICES IS ONLY ALLOWED WHERE PERMITTED BY CODE AND IF ADEQUATELY SUPPORTED BY MANUFACTURER'S LISTED EQUIPMENT DATA. ANY PROPOSED SERIES RATING OF ELECTRICAL EQUIPMENT SHALL BE CLEARLY IDENTIFIED IN THE SHOP DRAWING SUBMITTALS INCLUDING SUPPORTING DOCUMENTS WHICH IDENTIFY HOW THE SERIES RATED OCPD DEVICES COORDINATE WITHIN THE SYSTEM.

32.0 VANDAL PROTECTION

ALL ELECTRICAL WORK THAT IS ACCESSIBLE TO THE PUBLIC SHALL BE TAMPER-PROOF AND VANDAL RESISTANT. ALL EQUIPMENT WITH OPERABLE-DOOR ENCLOSURES SHALL BE LOCKING TYPE, OR PAD-LOCKING.

33.0 GROUNDING AND BONDING

PROVIDE AND INSTALL GROUNDING AND BONDING OF ALL EQUIPMENT AND SYSTEM NEUTRAL AS REQUIRED BY NEC ARTICLE 250 AND AS SHOWN ON THE CONSTRUCTION DOCUMENTS.

34.0 FINAL OBSERVATION

UPON ACCEPTANCE OF OPERATION AND MAINTENANCE INSTRUCTIONS AND RECORD DRAWINGS, THIS ENGINEER SHALL MAKE A FINAL OBSERVATION OF THE PROJECT AND GENERATE A LIST OF UNACCEPTABLE ITEMS. FINAL PROJECT ACCEPTANCE SHALL NOT BE CONSIDERED COMPLETE UNTIL ALL ITEMS IN THIS LIST HAVE BEEN CORRECTED.

35.0 ELEVATOR

CONTRACTOR SHALL COORDINATE ALL ELEVATOR ELECTRICAL WORK AND REQUIREMENTS WITH ELEVATOR CONTRACTOR. ELEVATOR SYSTEM SHALL CONFORM TO ALL LOCAL, STATE, NATIONAL CODES AND REQUIREMENTS. ELEVATOR SHUNT-TRIP MAIN-LINE BREAKER SHALL BE A UL LISTED PRODUCT AND SINGLE PIECE OF EQUIPMENT, EATON ES SERIES CONTROLLER OR APPROVED EQUIVALENT ONLY.

ELEVATOR SWITCH SHALL HAVE CONNECTIONS FOR THE FOLLOWING:

1. FUSED MAIN LINE DISCONNECTING SWITCH WITH
2. MAIN LINE SHUNT TRIP BREAKER OR FIRE SAFETY INTERFACE DISCONNECTING RELAY (IF PERMITTED BY AHA)
3. SURGE PROTECTION
4. (2) - NO/NC AUXILIARY CONTACT SETS

36.0 PRELIMINARY OPERATION

IF THE OWNER DEMANDS THAT ANY PORTION OF THE ELECTRICAL SYSTEM BE OPERATED PRIOR TO FINAL COMPLETION AND ACCEPTANCE OF THE WORK, THE CONTRACTOR SHALL CONSENT, AND SUCH OPERATION SHALL BE PERFORMED UNDER SUPERVISION AND DIRECTION OF THE CONTRACTOR. ALL OPERATING EXPENSE THEREOF SHALL BE PAID BY THE OWNER. PRELIMINARY OPERATION AND PAYMENT THEREOF SHALL NOT BE CONSTRUED AS ACCEPTANCE OF WORK.

37.0 INDEMNIFICATION

37.1 ELECTRICAL CONTRACTOR SHALL INDEMNIFY, AND HOLD HARMLESS, THE OWNER AND THIS ENGINEER, AND THEIR AGENTS AND EMPLOYEES, FROM AND AGAINST ALL CLAIMS, DAMAGES, LOSSES AND EXPENSES, INCLUDING ATTORNEY'S FEES, ARISING OUT OF, OR RESULTING FROM, THE PERFORMANCE OF THE WORK, PROVIDED THAT ANY SUCH CLAIM, DAMAGE, LOSS OR EXPENSE (a) IS ATTRIBUTED TO BODILY INJURY, SICKNESS, DISEASE OR DEATH, OR INJURY TO, OR DESTRUCTION OF, OF ANGLE PROPERTY (OTHER THAN THE WORK ITSELF) INCLUDING THE LOSS OF USE RESULTING THEREFROM (b) IS CAUSED IN WHOLE OR IN PART BY ANY NEGLIGENT ACT OR OMISSION BY THE CONTRACTOR, ANY SUB-CONTRACTOR, ANYONE DIRECTLY OR INDIRECTLY EMPLOYED BY ANY OF THEM, OR ANYONE FOR WHOSE ACTS ANY OF THEM MAY BE LIABLE, REGARDLESS OF WHETHER OR NOT IT IS CAUSED IN PART BY A PARTY INDEMNIFIED HEREUNDER.

37.2 IN ANY AND ALL CLAIMS AGAINST THE OWNER, OR THE ENGINEER, OR ANY OF THEIR AGENTS OR EMPLOYEES, BY ANY EMPLOYEE OF THE CONTRACTOR, ANY SUB-CONTRACTOR, ANYONE DIRECTLY OR INDIRECTLY EMPLOYED BY ANY OF THEM OR ANYONE WHOSE ACTS ANY OF THEM MAY BE LIABLE, THE INDEMNIFICATION OBLIGATION SHALL NOT BE LIMITED IN ANY WAY BY ANY LIMITATION ON THE AMOUNT OR TYPE OF DAMAGE, COMPENSATION OR BENEFITS PAYABLE BY OR FOR THE CONTRACTOR, OR ANY SUB-CONTRACTOR, UNDER WORKMEN'S COMPENSATION ACTS, DISABILITY BENEFIT ACTS, OR OTHER EMPLOYEE BENEFIT ACTS.

37.3 THE INDEMNIFICATION OBLIGATIONS OF THE CONTRACTOR SHALL NOT EXTEND TO THE LIABILITY OF THE ENGINEER, HIS AGENTS OR EMPLOYEES, ARISING OUT OF (a) THE PREPARATION OR APPROVAL OF MAPS, DRAWINGS, OPINIONS, REPORTS, SURVEYS, CHANGE ORDERS, DESIGNS OR SPECIFICATIONS OR (b) THE GIVING OF OR THE FAILURE TO GIVE DIRECTIONS OR INSTRUCTIONS BY THE ENGINEER, HIS AGENTS OR EMPLOYEES, PROVIDED SUCH GIVING OR FAILURE TO GIVE IS THE PRIMARY CAUSE OF INJURY OR DAMAGE.

38.0 WARRANTY/GUARANTEE

ELECTRICAL CONTRACTOR SHALL PROVIDE A GUARANTEE OF THE ELECTRICAL WORK TO BE FREE FROM DEFECTS IN MATERIALS AND WORKMANSHIP FOR A PERIOD OF ONE YEAR FROM DATE OF FINAL ACCEPTANCE. LIGHTING LAMPS ARE EXEMPT FROM THIS REQUIREMENT, HOWEVER, LAMPS SHALL BE NEW AND IN PERFECT OPERATING CONDITION AT THE TIME OF FINAL ACCEPTANCE.

39.0 THROUGH PENETRATION IN RATED WALLS AND FLOORS

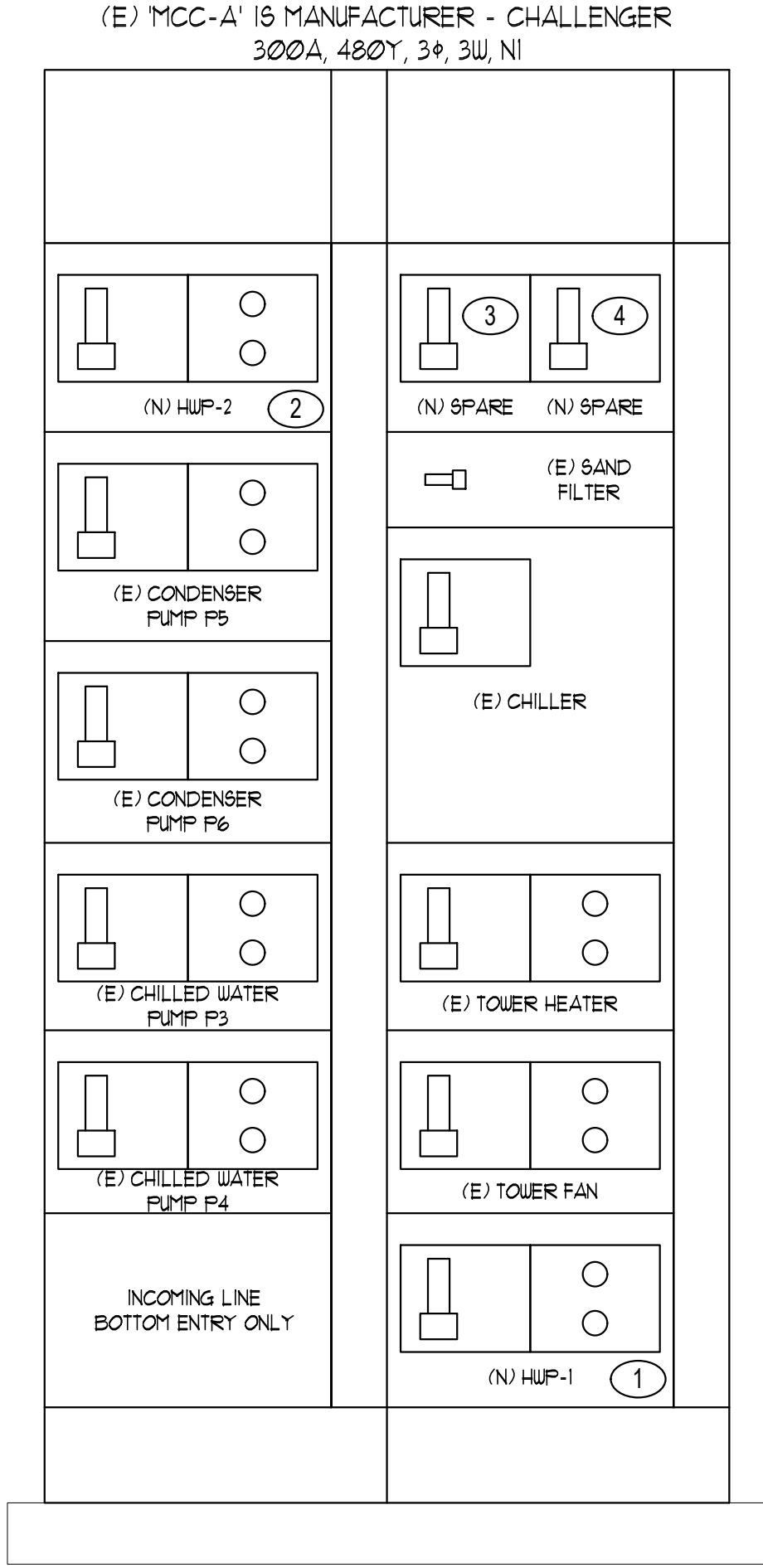
39.1 WALL ASSEMBLY - THE 1, 2, 3 OR 4 HR FIRE-RATED GYPSUM WALLBOARD/STUD WALL ASSEMBLY SHALL BE CONSTRUCTED OF THE MATERIALS AND IN THE MANNER DESCRIBED IN THE INDIVIDUAL USDO OR U400 SERIES WALL OR PARTITION DESIGNS IN THE UL FIRE RESISTANCE DIRECTORY AND SHALL INCLUDE THE FOLLOWING CONSTRUCTION FEATURES:
A. STUDS WALL FRAMING MAY CONSIST OF EITHER WOOD STUDS (MAX 2 HR FIRE RATED ASSEMBLIES) OR STEEL CHANNEL STUDS. WOOD STUDS TO CONSIST OF NOM 2 BY 4 IN. (51 BY 102 MM) LUMBER SPACED 16 IN. (406 MM) OC WITH NOM 2 BY 4 IN. (51 BY 102 MM) LUMBER END PLATES AND CROSS BRACES. STEEL STUDS TO BE MIN 3-5/8 IN. (92 MM) WIDE BY 1-3/8 IN. (35 MM) DEEP CHANNELS SPACED MAX 24 IN. (610MM) OC.
B. GYPSUM BOARD* - NOM 1/2 OR 5/8 IN. (13 OR 16 MM) THICK, 4 FT. (122 CM) WIDE WITH SQUARE OR TAPERED EDGES. THE GYPSUM WALLBOARD TYPE, THICKNESS, NUMBER OF LAYERS, FASTENER TYPE AND SHEET ORIENTATION SHALL BE AS SPECIFIED IN THE INDIVIDUAL USDO OR U400 SERIES DESIGN IN THE UL FIRE RESISTANCE DIRECTORY. MAX DIAM OF OPENING IS 26 IN. (660 MM).

39.2 THROUGH PENETRANT - ONE METALLIC PIPE, CONDUIT OR TUBING INSTALLED EITHER CONCENTRICALLY OR ECCENTRICALLY WITHIN THE FIRESTOP SYSTEM. THE ANNUAL SPACE BETWEEN PIPE, CONDUIT OR TUBING AND PERIPHERY OF OPENING SHALL BE MIN OF 0 IN. (0 MM) (POINT CONTACT) TO MAX 2 IN. (51 MM). PIPE, CONDUIT OR TUBING TO BE RIGIDLY SUPPORTED ON BOTH SIDES OF WALL ASSEMBLY. THE FOLLOWING TYPES AND SIZES OF METALLIC PIPES, CONDUITS OR TUBING MAY BE USED:

- A. STEEL PIPE - NOM 24 IN. (610 MM) DIAM (OR SMALLER) SCHEDULE 10 (OR HEAVIER) STEEL PIPE.
- B. IRON PIPE - NOM 24 IN. (610 MM) DIAM (OR SMALLER) SERVICE WEIGHT (OR HEAVIER) CAST IRON SOIL PIPE, NOM 12 IN. (305 MM) DIAM (OR SMALLER) OR CLASS 50 (OR HEAVIER) DUCTILE IRON PRESSURE PIPE.
- C. CONDUIT - NOM 6 IN. (152 MM) DIAM (OR SMALLER) STEEL CONDUIT OR NOM 4 IN. (102 MM) DIAM (OR SMALLER) STEEL ELECTRICAL METALLIC TUBING.
- D. COPPER TUBING - NOM 6 IN. (152 MM) DIAM (OR SMALLER) TYPE L (OR HEAVIER) COPPER TUBING.
- E. COPPER PIPE - NOM 6 IN. (152 MM) DIAM (OR SMALLER) REGULAR (OR HEAVIER) COPPER PIPE.
- F. THROUGH PENETRATING PRODUCT - FLEXIBLE METAL PIPING - THE FOLLOWING TYPES OF STEEL FLEXIBLE METAL GAS PIPING MAY BE USED:
NOM 2 IN. (51 MM) DIAM (OR SMALLER) STEEL FLEXIBLE METAL GAS PIPING. PLASTIC COVERING ON PIPING MAY OR MAY NOT BE REMOVED ON BOTH SIDES OF FLOOR OR WALL ASSEMBLY.
NOM 1 IN. (25 MM) DIAM (OR SMALLER) STEEL FLEXIBLE METAL GAS PIPING. PLASTIC COVERING ON PIPING MAY OR MAY NOT BE REMOVED ON BOTH SIDES OF FLOOR OR WALL ASSEMBLY.

39.3 FILL, VOID OR CAVITY MATERIAL* - CAULK OR SEALANT - MIN 5/8, 1-1/4, 1-7/8 AND 2-1/2 IN. (16, 32, 48 AND 64 MM) THICKNESS OF CAULK FOR 1, 2, 3 AND 4 HR RATED ASSEMBLIES, RESPECTIVELY, APPLIED WITHIN ANNULUS, FLUSH WITH BOTH SURFACES OF WALL. MIN 1/4 IN. (6 MM) DIAM BEAD OF CAULK APPLIED TO GYPSUM BOARD/PENETRANT INTERFACE AT POINT CONTACT LOCATION ON BOTH SIDES OF WALL. THE HOURLY F RATING OF THE FIRESTOP SYSTEM IS DEPENDENT UPON THE HOURLY FIRE RATING OF THE WALL ASSEMBLY IN WHICH IT IS INSTALLED, AS SHOWN IN THE FOLLOWING TABLE. THE HOURLY F RATING OF THE FIRESTOP SYSTEM IS DEPENDENT UPON THE TYPE OR SIZE OF THE PIPE OR CONDUIT AND THE HOURLY FIRE RATING OF THE WALL ASSEMBLY IN WHICH IT IS INSTALLED, AS TABULATED BELOW:

MAX PIPE DIAMETER	F RATING HR	T RATING HR	SYSTEM NO. W-L-1001 F RATINGS-1, 2, 3 AND 4 HR (SEE ITEMS 2 AND 3) T RATINGS-0, 1, 2, 3, AND 4 HR (SEE ITEM 3) L RATINGS AT AMBIENT-LESS THAN 1 CFM/SQ FT L RATING AT 400 F-LESS THAN 1 CFM/SQ FT
1	1 OR 2	0+ 1 OR 2	
3	3 OR 4	0 OR 4	
4	1 OR 2	0	
6	3 OR 4	0	
12	1 OR 2	0	



(E) 'MCC-A' ELEVATION

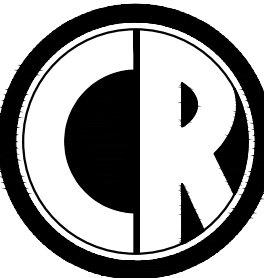
NOT TO SCALE

A
E03

SHEET NOTES:(THIS SHEET ONLY)

- 1 (E) HOT WATER PUMP P1 IS TO BE REMOVED AND RETIRED. PROVIDE AND INSTALL (N) 3ØAMP, 3-POLE CIRCUIT BREAKER TO ACCOMMODATE (N) HWP-1.
- 2 (E) HOT WATER PUMP P2 IS TO BE REMOVED AND RETIRED. PROVIDE AND INSTALL (N) 3ØAMP, 3-POLE CIRCUIT BREAKER TO ACCOMMODATE (N) HWP-1.
- 3 (E) BOILER PUMP 1 IS TO BE REMOVED AND RETIRED. ABANDON (E) BUCKET, SET IN THE 'OFF' POSITION AND LABEL AS 'SPARE'.
- 4 (E) BOILER PUMP 2 IS TO BE REMOVED AND RETIRED. ABANDON (E) BUCKET, SET IN THE 'OFF' POSITION AND LABEL AS 'SPARE'.

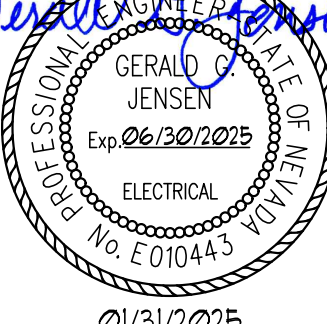
3-Phase, 4-Wire, Y-Connected Electrical Panelboard Schedule by Jensen Engineering, Inc.																								
Project Name:		MINDEN ES BOILER REPLACEMENT				Line to Neutral Voltage:		120		Bus Material:		COPPER		Short Circuit Rating:		NEW								
Panel Name:		1A				Line to Line Voltage:		208		Bus Rating:		225 AMP		New or Existing:		NEW								
Panel Location:		AS SHOWN ON SHEET E1.0				Main Breaker or Lug Only:		BREAKER		Lug/Breaker Rating:		200 AMP		Mounting:		SURFACE								
Ckt. No.	Load (VA)	Description	Load Power Factor	One-Way Ckt Length (ft)	Wire Size (AWG)	Corrected 2' (0-to-Neutral)	VOLTRIP (%)	Poles	Breaker	Phase	Breaker	VOLTRIP (%)	Corrected 2' (0-to-Neutral)	Wire Size (AWG)	One-Way Ckt Length (ft)	Load Power Factor	Description	Load (VA)	Ckt. No.					
1	1200	(E) REC K2, K3						1	20								(E) REC MPR, ART	1000	2					
3	1000	(E) REC K1, K2						1	20								(E) REC MPR, ART	1000	4					
5	1000	(E) K1 POWER POLE K3						1	20								(E) REC CUSTODIAL, ART, RR	800	6					
7	1000	(E) REC K3, STAGE						1	20								(E) MPR, CUSTODIAL, RR	1000	8					
9	1000	(E) REC K3, MPR						1	20								(E) SODA MACHINE, RR	1000	10					
11	1000	(E) REC MPR						1	20								(E) NURSE	1000	12					
13	1200	(E) BOILER ROOM						1	20								(E) OFFICE	1200	14					
15	1200	(E) REC PE, MPR, STORAGE						1	20								(E) REC 106, 108, 109, OFFICES	1400	16					
17	1200	(E) REC OFFICE						1	20								(N) B-1	1800	18					
19	1400	(E) REC OFFICE						1	20								(N)B-2	1800	20					
21	700	(E) EXHAUST FAN KINDERGARTEN						1	20								(E) EXHAUST FAN	1200	22					
23	500	(E) EXHAUST FANS						1	20								(N) HWP- B1 & HWP-B2	1360	24					
25	864	(N) GSV-1 & WH-1						1	20								(E) FC-8	700	26					
27	250	(E) CONTROL (MECH) BOILER ROOM						1	20								(E) REC SERVER		28					
29	250	(E) SHUNT TRIP						1	20								(E) REC KINDERGARTEN		30					
31	500	(E) LIGHTING CONTROL PANEL						1	20								(E) REC TELEPHONEBOARD	250	32					
33	250	(E) FIRE SMOKE DAMPERS						1	20								(E) FACP	500	34					
35	500	(E) CONTROL (MECH) OVER ELECT ROOM						1	20								(E) REC TELECENTER	500	36					
37	500	(E) EXHAUST FAN ELECT. ROOM						1	20								(E) SPARE MAIN SERVER	0	38					
39	1000	(E) GFI KITCHEN MIXER						1	20								(E) SPARE POWER POLES OFFICE	0	40					
41	1080	(E) KITCHEN RECEPT						1	20								(E) KITCHEN ROLL UP FIRE	500	42					
6664	5400	5530 Total Load (VA)	Notes: 1. Corrected impedance calculated using Neher-McGrath method for determining resistance in AC circuits. 2. Circuit length used for calculating voltage drop; not to be used for estimating or pricing. 3. Wire size used for calculating voltage drop; not to be used for estimating or pricing. See electrical drawing												Total Load (VA):			5950	5100	5960				
																		+25% of Lighting Load (VA):			0	0	0	
																		+25% of Largest Motor Load (VA):			0	0	0	
																		Combined Total Load (VA):			12614	10500	11490	
																		Average Line Current (Amps):			105.12	87.50	95.75	
																		Average Total Current (Amps):			96.16			
																		Total Connected Load (KVA):			34.60			



ENGINEERING
MECHANICAL ENGINEERING CONSULTANT

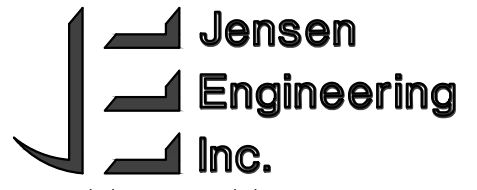
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RENO, NEVADA 89511
PHONE: 775.826.1919
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CONSULTANT:



Jensen Engineering Inc.
Electrical Engineers

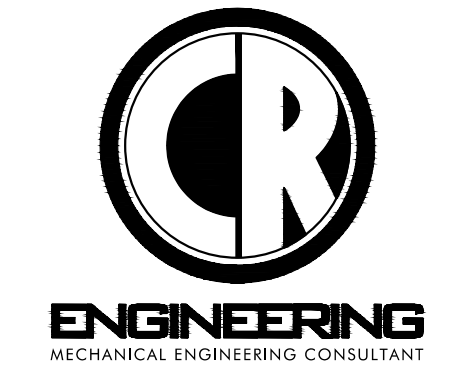
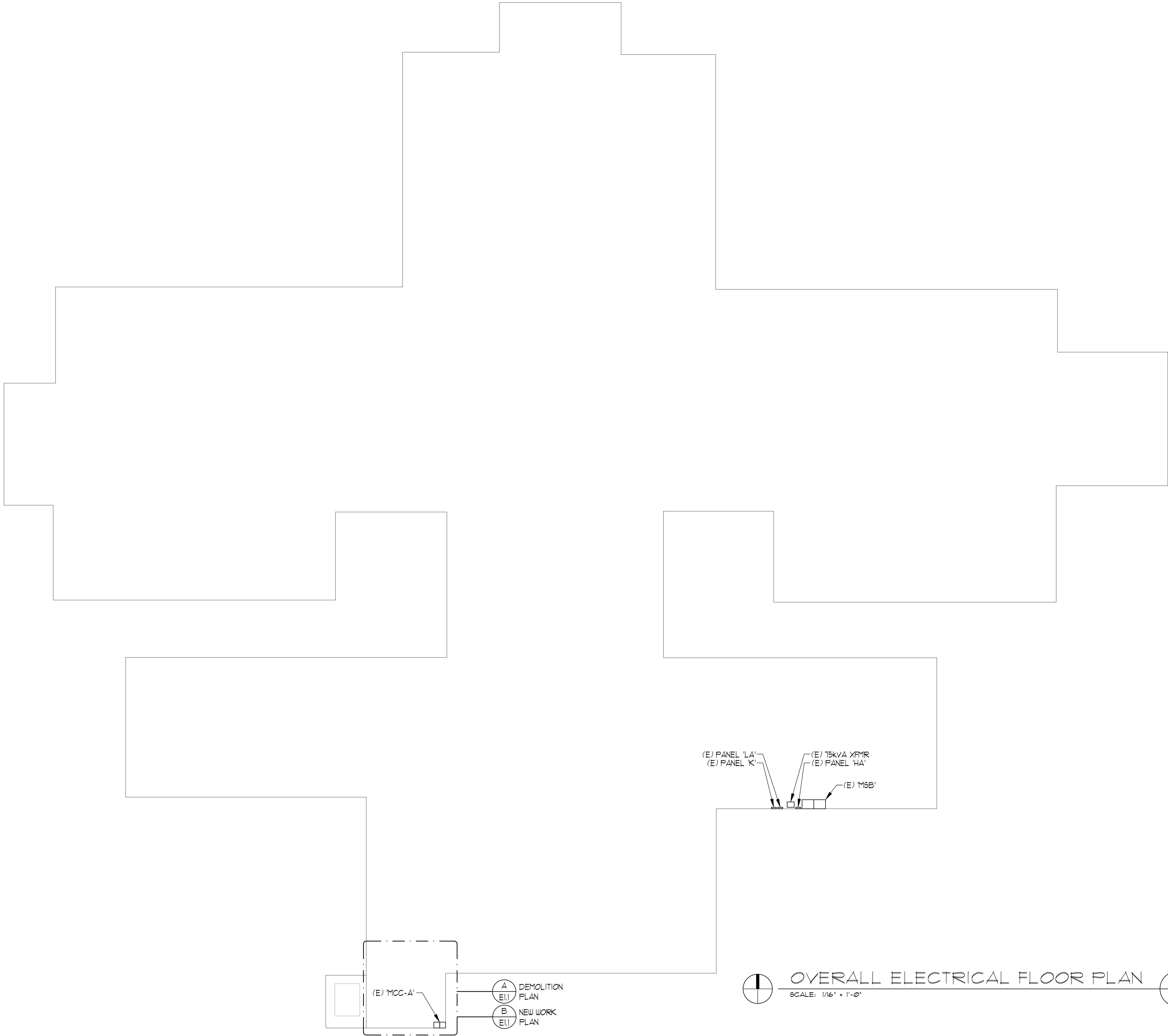
9655 Gateway Drive
Reno, Nevada 89521-2968
Ph. (775) 852-2288
kyle.jensen@jeneng.com
web: www.jeneng.com

DOUGLAS COUNTY SCHOOL DISTRICT
MINDEN ELEMENTARY SCHOOL
BOILER REPLACEMENT
1170 BALER STREET, GARDNERVILLE, NV 89423

DETAILS

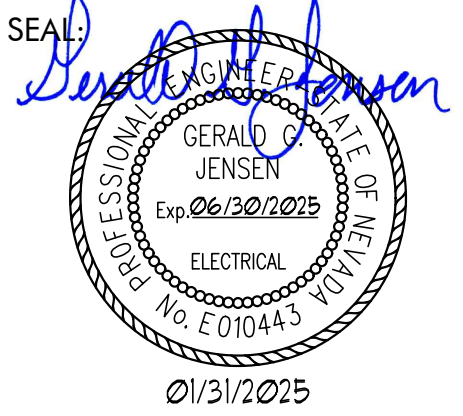
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DRAWN BY: KPJ		
DESIGNED BY: KPJ		
CHECKED BY: GGJ		
APPROVED BY: GGJ		
DATE: 01/31/2025		
PROJECT NO: N223JK		
SHEET NUMBER:		

E0.3



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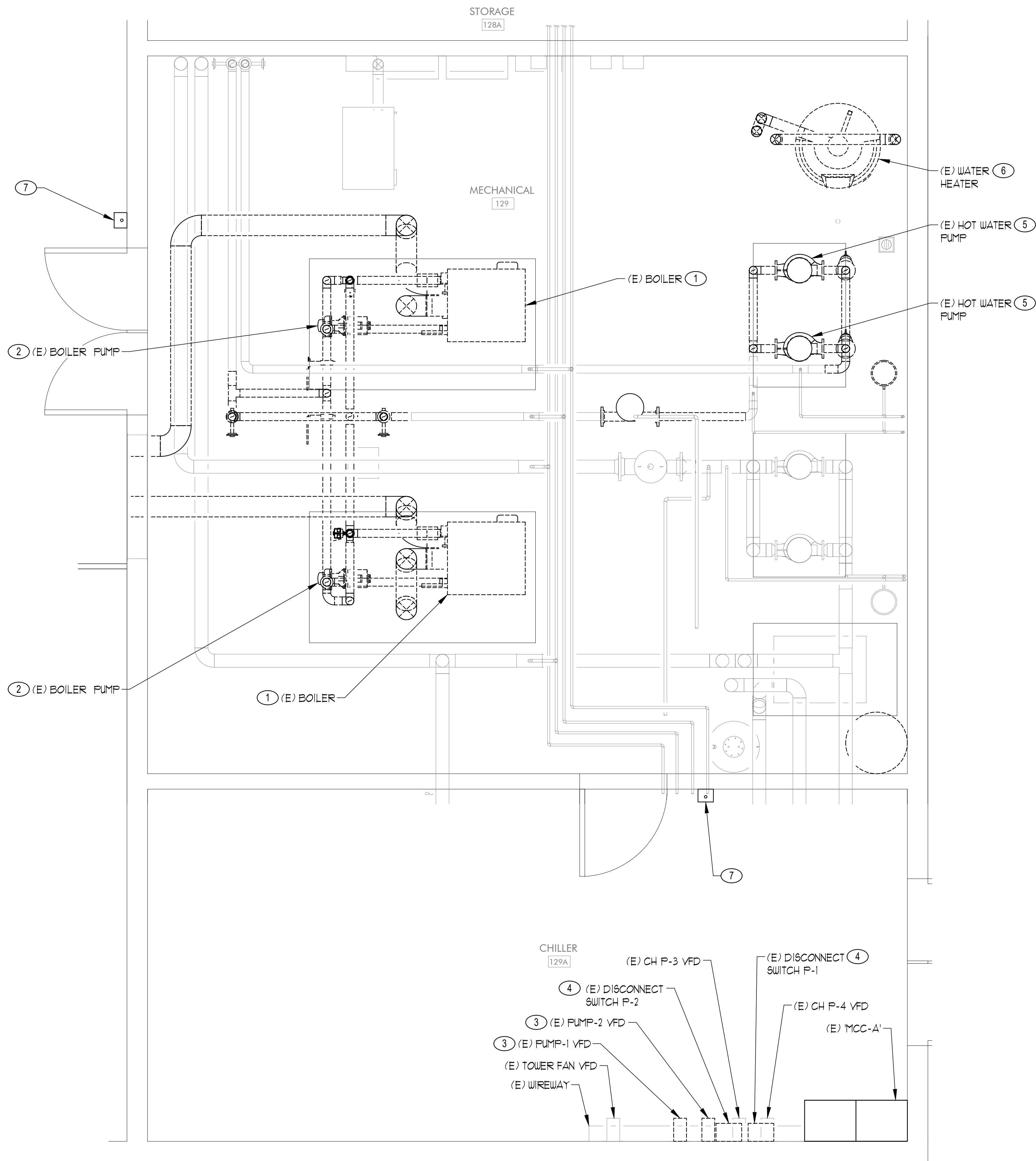
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CONSULTANT:

**Jensen
Engineering
Inc.**
Electrical Engineers
9655 Gateway Drive
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Ph. (775) 852-2288
kyle.jensen@jeneng.com
web: www.jeneng.com

DOUGLAS COUNTY SCHOOL DISTRICT
MINDEN ELEMENTARY SCHOOL
BOILER REPLACEMENT
1170 BALER STREET, GARDNERVILLE, NV 89423
OVERALL ELECTRICAL FLOOR PLAN

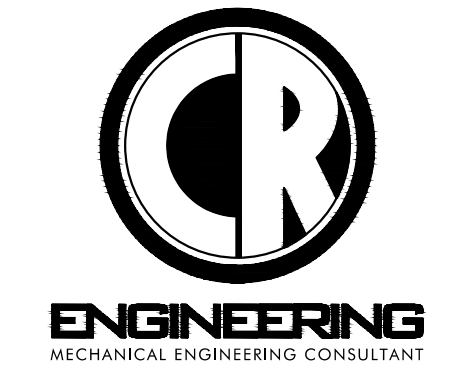
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DESIGNED BY: KPJ		
CHECKED BY: GGJ		
APPROVED BY: GGJ		
DATE: 01/31/2025		
PROJECT NO: N223JK		

SHEET NUMBER:
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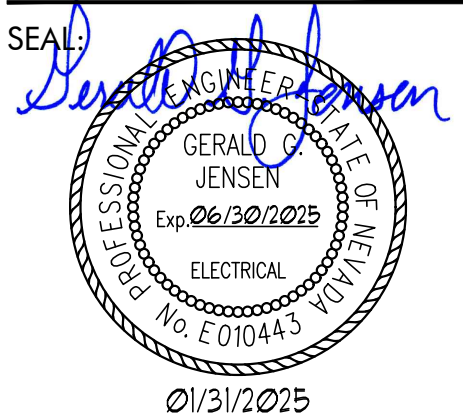
- SHEET NOTES: (THIS SHEET ONLY)
- 1 REMOVE AND RETIRE (E) CONDUIT AND CONDUCTORS TO (E) BOILER.
 - 2 REMOVE AND RETIRE (E) CONDUIT AND CONDUCTORS TO (E) PUMP.
 - 3 REMOVE AND RETIRE (E) CONDUIT AND CONDUCTORS TO (E) VFD.
 - 4 REMOVE AND RETIRE (E) CONDUIT AND CONDUCTORS TO (E) DISCONNECT SWITCH.
 - 5 REMOVE AND RETIRE (E) CONDUIT AND CONDUCTORS TO (E) DISCONNECT SWITCH.
 - 6 REMOVE AND RETIRE (E) CONDUIT AND CONDUCTORS TO (E) DISCONNECT SWITCH.
 - 7 COORDINATE WITH MECHANICAL AND CONTROL DRAWINGS FOR REQUIREMENTS WITH (E) SHUTDOWN SWITCHES.

ENLARGED BOILER ROOM DEMOLITION FLOOR PLAN
SCALE: 1/2" = 1'-0"



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DOUGLAS COUNTY SCHOOL DISTRICT
MINDEN ELEMENTARY SCHOOL
BOILER REPLACEMENT
1170 BALER STREET, GARDNERVILLE, NV 89423
ENLARGED BOILER ROOM ELECTRICAL
DEMOLITION PLAN

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DRAWN BY: KPJ		
DESIGNED BY: KPJ		
CHECKED BY: GGJ		
APPROVED BY: GGJ		
DATE: 01/31/2025		
PROJECT NO: N223JK		
SHEET NUMBER:		

PAU WA LU MIDDLE SCHOOL
BUILDING E CHILLED WATER IMPROVEMENT

701 LONG VALLEY ROAD
GARDNERVILLE, NV 89460

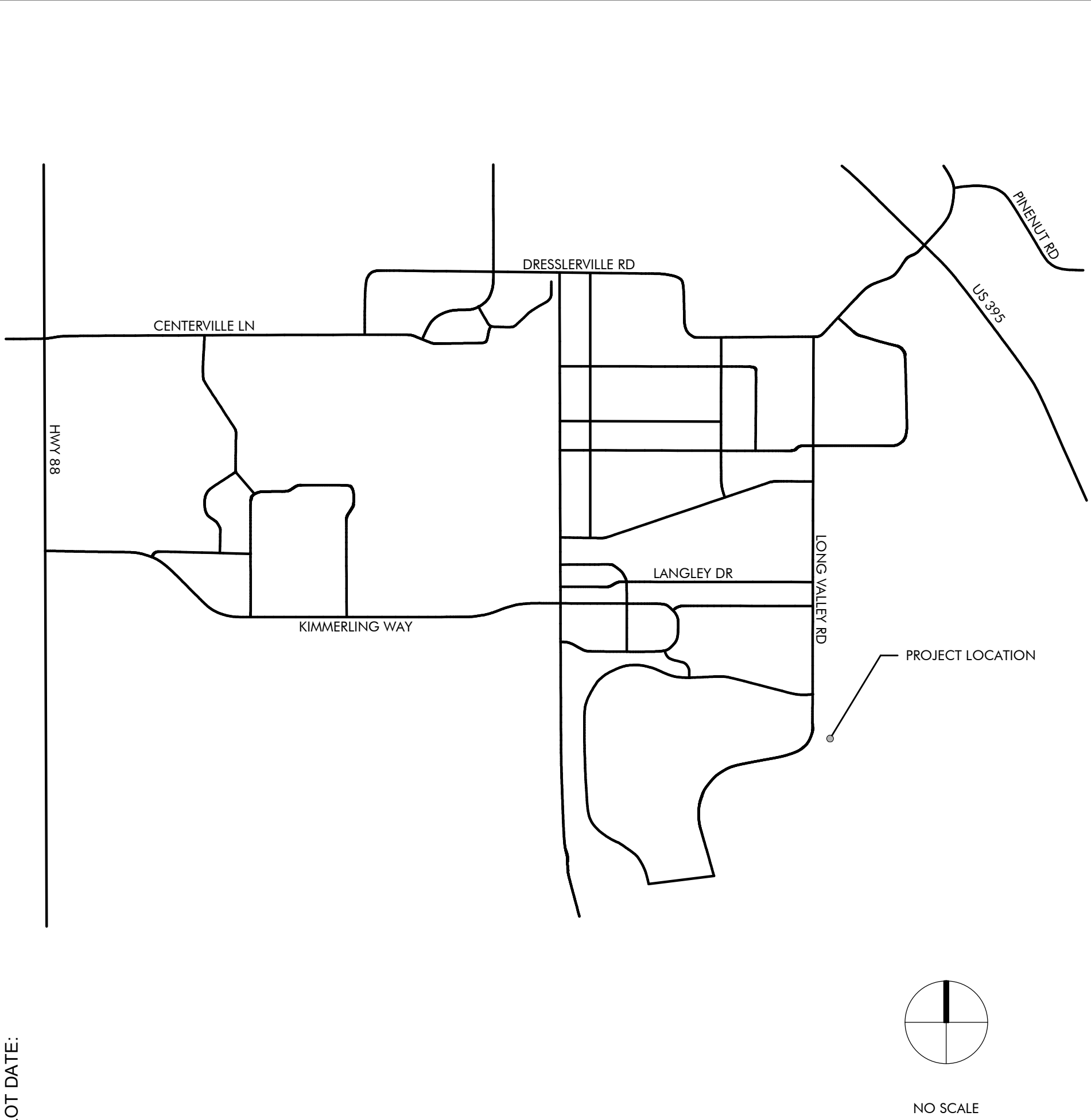
FOR
DOUGLAS COUNTY SCHOOL DISTRICT
1126 AIRPORT ROAD, BUILDING E-1
MINDEN, NV 89423

DO-2025-166

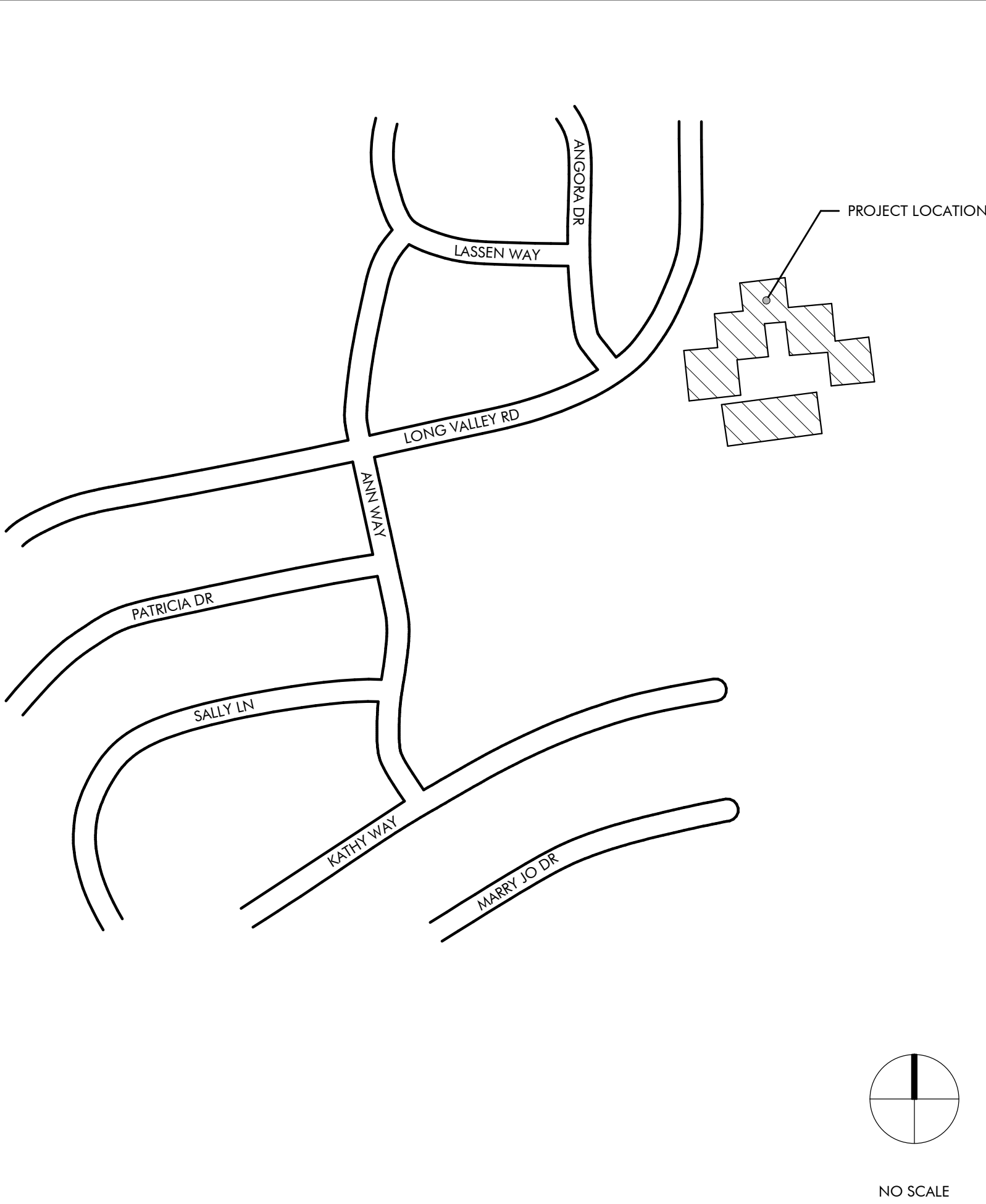


Douglas County
School District

VICINITY MAP



LOCATION MAP



DIRECTORY

OWNER
DOUGLAS COUNTY SCHOOL DISTRICT
1126 AIRPORT ROAD, BUILDING E-1
MINDEN, NV 89423

CONTACTS: PHIL DEMUS
FACILITIES DIRECTOR
(775) 782-5134

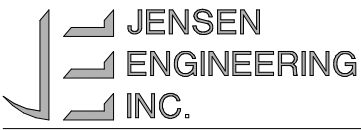
CONSULTANTS

MECHANICAL


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PHONE:(775) 826-1919
WWW.CR-ENG.COM

CONTACT: CHUN LEE, P.E.
PROJECT MANAGER

ELECTRICAL


Electrical Engineers
9655 Gateway Drive Reno, Nevada 89521-2968
Ph. (775) 852-2288 Fax (775) 852-3388
email: kyle.jensen@jeneng.com web: www.jeneng.com

CONTACT: KYLE JENSEN
PROJECT MANAGER

GENERAL NOTES

1. THE PROJECT SPECIFICATIONS AND DRAWINGS ARE A DOCUMENT SET AND SHOULD NOT BE SEPARATED. INFORMATION AND REFERENCES ARE CONTAINED IN ALL SPECIFICATIONS AND DRAWINGS.
2. IT IS THE CONTRACTOR'S RESPONSIBILITY TO FULLY UNDERSTAND THE COMPLETE SET OF SPECIFICATIONS AND THE DRAWINGS FOR THIS PROJECT. IT IS THE CONTRACTOR'S RESPONSIBILITY TO REVIEW ALL OF THE INFORMATION CONTAINED IN THE SPECIFICATIONS AND DRAWINGS, INCLUDING ALL OTHER DISCIPLINES (ARCHITECTURAL, ELECTRICAL, STRUCTURAL, ETC.) PRIOR TO BID AND CONSTRUCTION.
3. THE CONTRACTOR SHALL INSTALL THE NEW EQUIPMENT, AND PIPING AROUND ALL EXISTING OBSTACLES INCLUDING: ELECTRICAL CONDUIT, DOMESTIC WATER PIPING, WASTE AND VENT PIPING, CHILLED AND HEATING WATER PIPING, AND FIRE SPRINKLER PIPING. PROVIDE OFFSETS TO AVOID RELOCATION OF OTHER UTILITIES. RELOCATE UTILITIES IF THEY ARE IN CONFLICT WITH THE MECHANICAL SYSTEM INSTALLATION, CAUSE DEVIATIONS IN THE DESIGN INTENT, UNSATISFACTORY OPERATION, NOISY CONDITIONS, OR INTERFERE WITH MAINTENANCE. IT IS THE MECHANICAL CONTRACTOR'S RESPONSIBILITY TO COORDINATE ANY UTILITY RELOCATION WITH THE APPROPRIATE SUBCONTRACTOR.
4. THE INFORMATION INDICATED ON THESE DRAWINGS AS EXISTING IS BASED UPON INFORMATION TAKEN FROM AS-BUILT DRAWINGS, FIELD INVESTIGATION, AND INFORMATION OBTAINED FROM SUBMITTAL DATA, ETC. THE PLANS DO NOT GUARANTEE ACCURACY BUT ARE ONLY AN INDICATION OF EXISTING CONDITIONS. IT IS THE CONTRACTOR'S RESPONSIBILITY TO FIELD VERIFY EXACT CONDITIONS SUCH AS EQUIPMENT PLACEMENT, DUCTWORK (SIZE, ROUTING, AND ELEVATION), PIPING (SIZE, ROUTING, AND ELEVATION), ETC. THE DRAWINGS ARE INTENDED TO PROVIDE THE CONTRACTOR AN INDICATION OF THE SYSTEM INSTALLED IN THE FACILITY TO DATE. IT WILL BE THE CONTRACTOR'S RESPONSIBILITY TO MAKE ADJUSTMENTS TO THE INSTALLATION AS REQUIRED TO MATCH EXISTING FIELD CONDITIONS.
5. ALL ROOF-MOUNTED EQUIPMENT OR PENETRATIONS ASSOCIATED WITH THIS PROJECT ARE TO BE FLASHED BY A LICENSED ROOFING CONTRACTOR. THE ROOFING CONTRACTOR SHALL HAVE EXPERIENCE WITH THE EXISTING ROOFING MEMBRANE. NEW FLASHING MATERIALS SHALL BE INSTALLED TO COMPLY WITH THE MEMBRANE MANUFACTURER'S SPECIFICATIONS OR DETAILS PUBLISHED BY THE NATIONAL ROOFING CONTRACTORS ASSOCIATION WATERPROOFING MANUAL. IN ACCEPTANCE OR REJECTION OF THE WORK, THE OWNER WILL MAKE NO ALLOWANCE FOR LACK OF SKILL ON THE PART OF THE CONTRACTOR.

SHEET INDEX

GENERAL INFORMATION

T0.1 TITLE SHEET

MECHANICAL

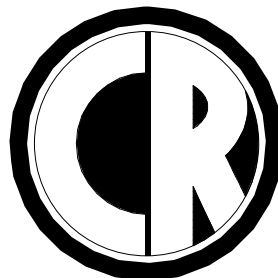
- M0.1 MECHANICAL ABBREVIATIONS, LEGEND, SCHEDULES, AND DETAILS
- M1.0 MECHANICAL FLOOR PLAN
- M1.1 ENLARGED CHILLED WATER PUMP MECHANICAL DEMOLITION FLOOR PLAN
- M2.1 ENLARGED CHILLED WATER PUMP MECHANICAL FLOOR PLAN
- M6.1 MECHANICAL CONTROL DIAGRAMS AND SEQUENCE OF OPERATION

ELECTRICAL

- E0.1 ELECTRICAL SYMBOLS & MECHANICAL EQUIPMENT CONNECTION SCHEDULE
- E0.2 ELECTRICAL SPECIFICATIONS
- E1.0 OVERALL ELECTRICAL FLOOR PLAN
- E1.1 ENLARGED CHILLED WATER PUMP NEW WORK PLAN

BUILDING CODES

- 2018 INTERNATIONAL BUILDING CODE
- 2018 INTERNATIONAL FIRE CODE
- 2018 UNIFORM MECHANICAL CODE
- 2018 INTERNATIONAL ENERGY CONSERVATION CODE
- 2018 UNIFORM PLUMBING CODE
- 2017 NATIONAL ELECTRICAL CODE


ENGINEERING
MECHANICAL ENGINEERING CONSULTANT

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SEAL:



CONSULTANT:

DOUGLAS COUNTY SCHOOL DISTRICT
PAU WA LU MIDDLE SCHOOL
BUILDING E CHILLED WATER IMPROVEMENT
701 LONG VALLEY ROAD, GARDNERVILLE, NV 89460

TITLE SHEET

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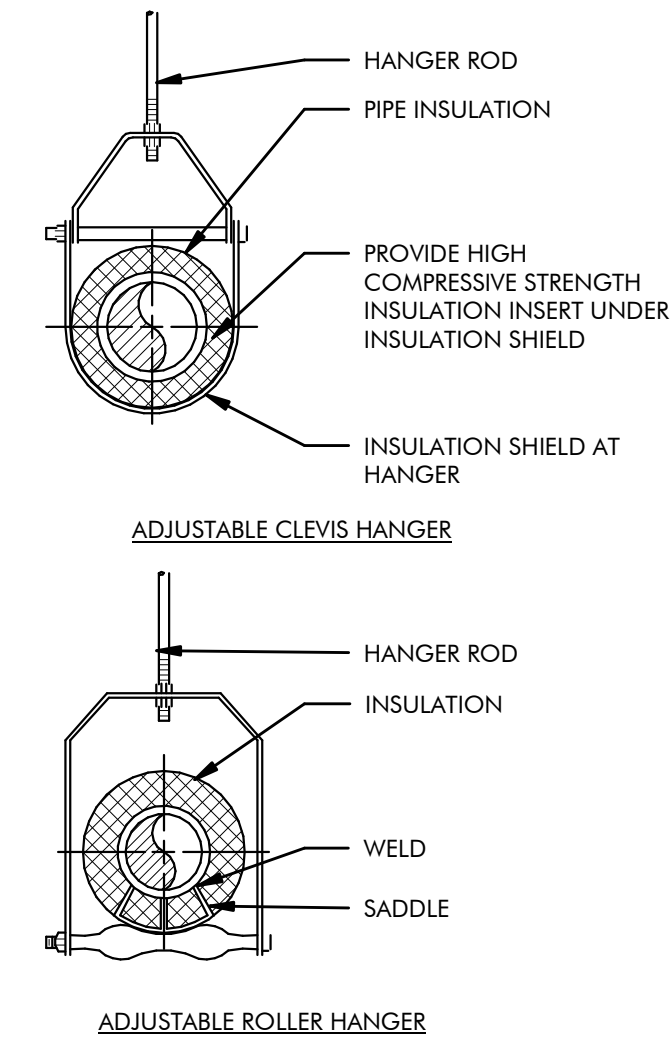
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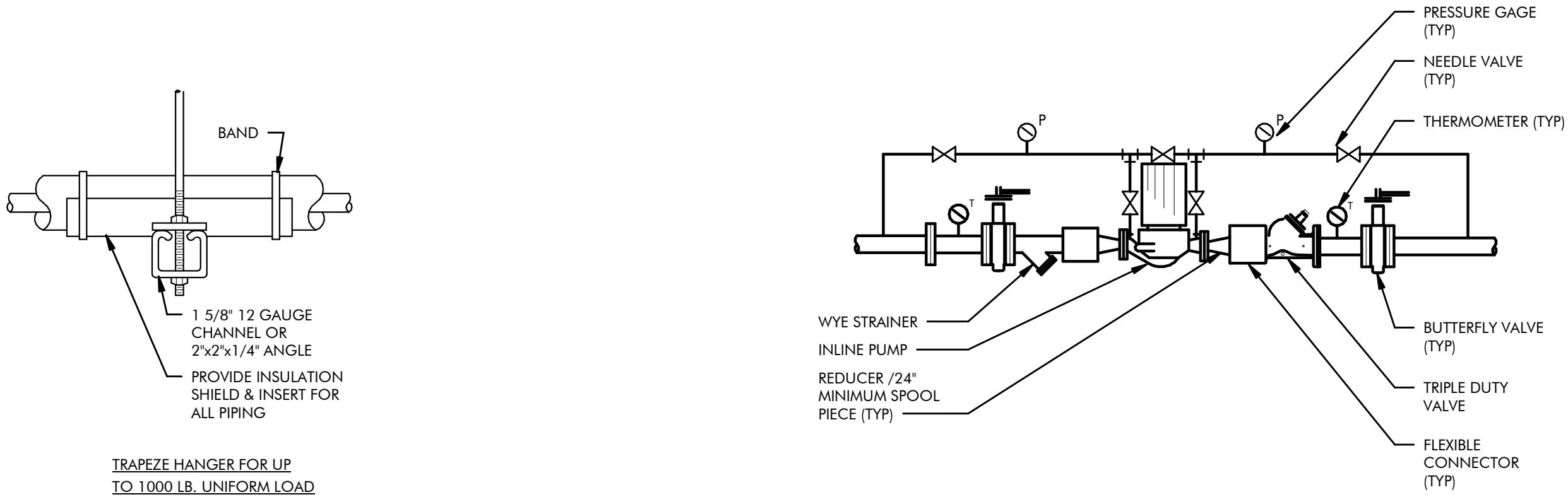
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PUMP SCHEDULE

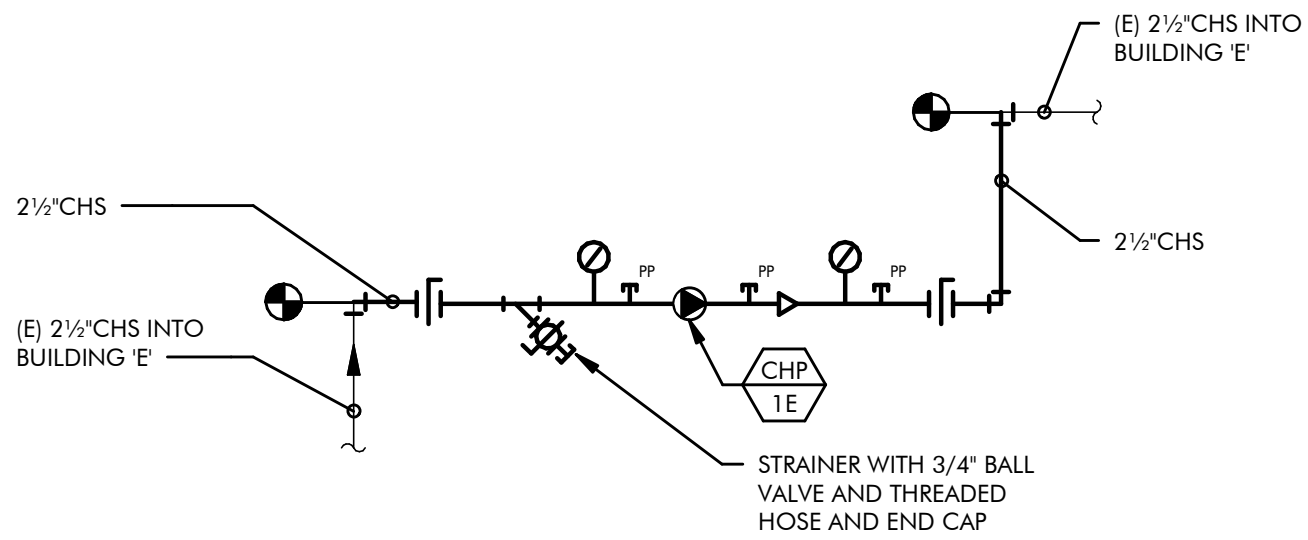
UNIT GENERAL DATA																			
TYPE	SERVICE	MANUFACTURER	MODEL	OPERATING WEIGHT (LBS)	SIZE	TYPE	FLOW (GPM)	TDH (FT)	FLUID	IMP. DIA. (IN)	MIN EFF. (%)	SUCTION (IN)	DISCH. (IN)	TRIPLE DUTY VALVE MODEL	TRIPLE DUTY VALVE SIZE (IN)	TRIPLE DUTY PRESS DROP (PSI)	SUCTION DIFFUSER MODEL	FRAME SIZE	MOTOR
																			UNIT OPTION
CHP-1E	CHILLED WATER SYSTEM	TACO	VR25H-1	75	2.5	INLINE	68	35	GLYCOL	6.5	51	2½	2½	MPV 025	2.5	1.5	N/A	N/A	HP FLA V/Ph/Hz RPM
																			A,B
INFORMATION FOR INLINE PUMPS SCHEDULED ABOVE										OPTIONS FOR PUMPS SCHEDULED ABOVE									
GENERAL										A. ELECTRONICALLY COMMUTATED (EC) MOTOR									
1. DESCRIPTION: MAINTENANCE FREE, INLINE, CLOSE COUPLED, VERTICAL OR HORIZONTAL POSITION, CAST IRON CENTRIFUGAL PUMP										B. PROVIDE WITH TWIN CITY HOSE (OR APPROVED EQUAL) STAINLESS STEEL FLEX CONNECTOR.									
PUMP																			
1. PUMP SHALL BE CLASS 30 CAST IRON WITH FLANGE CONNECTIONS.																			
2. IMPELLER SHALL BE CAST BRONZE, DYNAMICALLY BALANCED, KEYED TO SHAFT, AND SECURED BY A LOCKING CAPSCREW.																			
MOTOR																			
1. ELECTRONICALLY COMMUTATED MOTOR (ECM)																			
2. MOTOR SHALL MEET NEMA SPECIFICATIONS AND BE NON-OVERLOADING FOR ENTIRE PUMP CURVE.																			



1 TYPICAL PIPE HANGER DETAIL
M0.1 SCALE : NONE



2 PUMP - INLINE
M0.1 SCALE : NONE



3 CHP-1E CHILLED WATER PIPING DIAGRAM
M0.1 SCALE : NONE

MECHANICAL ABBREVIATIONS

ACFM	ACTUAL CUBIC FEET PER MINUTE
AF	AIR FILTER
AFF/AFG	ABOVE FINISHED FLOOR/GRADE
A	AMPERE
APD	AIR PRESSURE DROP
BFF/BFG	BELOW FINISHED FLOOR/GRADE
BHP	BRAKE HORSEPOWER
BTUH	BRITISH THERMAL UNITS PER HOUR
CFM	CUBIC FEET PER MINUTE
COP	COEFFICIENT OF PERFORMANCE
Cv	VALVE FLOW COEFFICIENT
(D)	DEMOLISH
DB,WB	DRY BULB, WET BULB TEMPERATURE
DG	DOOR GRILLE
DIA	DIAMETER
DN	DOWN
DP	DIFFERENTIAL PRESSURE
(E)	EXISTING
EAT/LAT	ENTERING/LEAVING AIR TEMPERATURE
ESP	EXTERNAL STATIC PRESSURE
EWT/LWT	ENTERING/LEAVING WATER TEMPERATURE
FLA	FULL LOAD AMPERES
FPM	FEET PER MINUTE
FT	FOOT
FT²	SQUARE FOOT
FT³	CUBIC FOOT
GA	GAUGE
GPM	GALLONS PER MINUTE
HP	HORSEPOWER
HZ	HERTZ
IN	INCH
IN²	SQUARE INCH
IN³	CUBIC INCH
KW	KILOWATT
LBS	POUNDS
LRA	LOCKED ROTOR AMPERES
MAX	MAXIMUM
MBH	THOUSAND BRITISH THERMAL UNITS PER HOUR
MCA	MINIMUM CIRCUIT AMPACITY
MIN	MINIMUM
MOC	MAXIMUM OVERCURRENT PROTECTION
(N)	NEW
PSI	POUNDS PER SQUARE INCH
PSIG	POUNDS PER SQUARE INCH GAUGE
R	REGISTER
RPM	REVOLUTIONS PER MINUTE
TDH	TOTAL DYNAMIC HEAD
TG	TRANSFER GRILLE
TSP	TOTAL STATIC PRESSURE
TYP	TYPICAL
V	VOLTS
W	WATT
WC/WG	WATER COLUMN/GAUGE

MECHANICAL SYMBOL LEGEND

SYMBOL	ABBR.	DESCRIPTION
	SA	SUPPLY AIR
	RA	RETURN AIR
	EA	EXHAUST AIR
	OA	OUTSIDE AIR
		POSITIVE PRESSURE DUCT SECTION - FIRST SIZE IS TOP
		NEGATIVE PRESSURE DUCT SECTION - FIRST SIZE IS TOP
		DUCT SIZE - FIRST SIZE IS SIDE SHOWN
		FLEXIBLE DUCT
		FLEXIBLE DUCT CONNECTOR
	MVD	MANUAL VOLUME DAMPER
	OBD	OPPOSED BLADE DAMPER
		MOTORIZED ACTUATOR
	TSTAT	THERMOSTAT OR TEMPERATURE SENSOR @ 48" AFF
	SW	SIDE WALL DIFFUSER
	BFP	BACKFLOW PREVENTER
	BV	BALL VALVE
	BFV	BUTTERFLY VALVE
	CV	CHECK VALVE
	FCV	FLOW CONTROL (BALANCE) VALVE
	PRV	PRESSURE REDUCING VALVE
	PTRV	PRESSURE AND TEMPERATURE RELIEF VALVE
	TCV	TEMPERATURE CONTROL VALVE (2-WAY OR 3-WAY)
	TDV	TRIPLE DUTY VALVE
	STR	STRAINER
		UNION
		PIPE BREAK
		PIPE CAP OR PLUG
	ELL	PIPE ELBOW
		PIPE ELBOW DOWN
		PIPE ELBOW UP
		PIPE TEE
		PIPE RISER
		PIPE DROP
		PIPE BRANCH, TOP CONNECTION
		PIPE BRANCH, BOTTOM CONNECTION
	FLEX	FLEXIBLE PIPE CONNECTOR
		WATER METER
		PRESSURE SENSOR, TEMPERATURE SENSOR WITH WELL
		PRESSURE GAUGE, TEMPERATURE GAUGE
	P	PUMP
	CHS/CHR	CHILLED WATER SUPPLY/RETURN PIPING
	HWS/HWR	HOT WATER SUPPLY/RETURN PIPING
	D	EQUIPMENT OR CONDENSATE DRAIN PIPING
	CW	DOMESTIC COLD WATER
	DHW	DOMESTIC HOT WATER
	DHWR	DOMESTIC HOT WATER RETURN
	G	NATURAL GAS
	POC	POINT OF CONNECTION
	POC	POINT OF DISCONNECT

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BUILDING E CHILLED WATER IMPROVEMENT
701 LONG VALLEY ROAD, GARDNERVILLE, NV 89460
MECHANICAL ABBREVIATIONS, LEGEND,
SCHEDULES, AND DETAILS

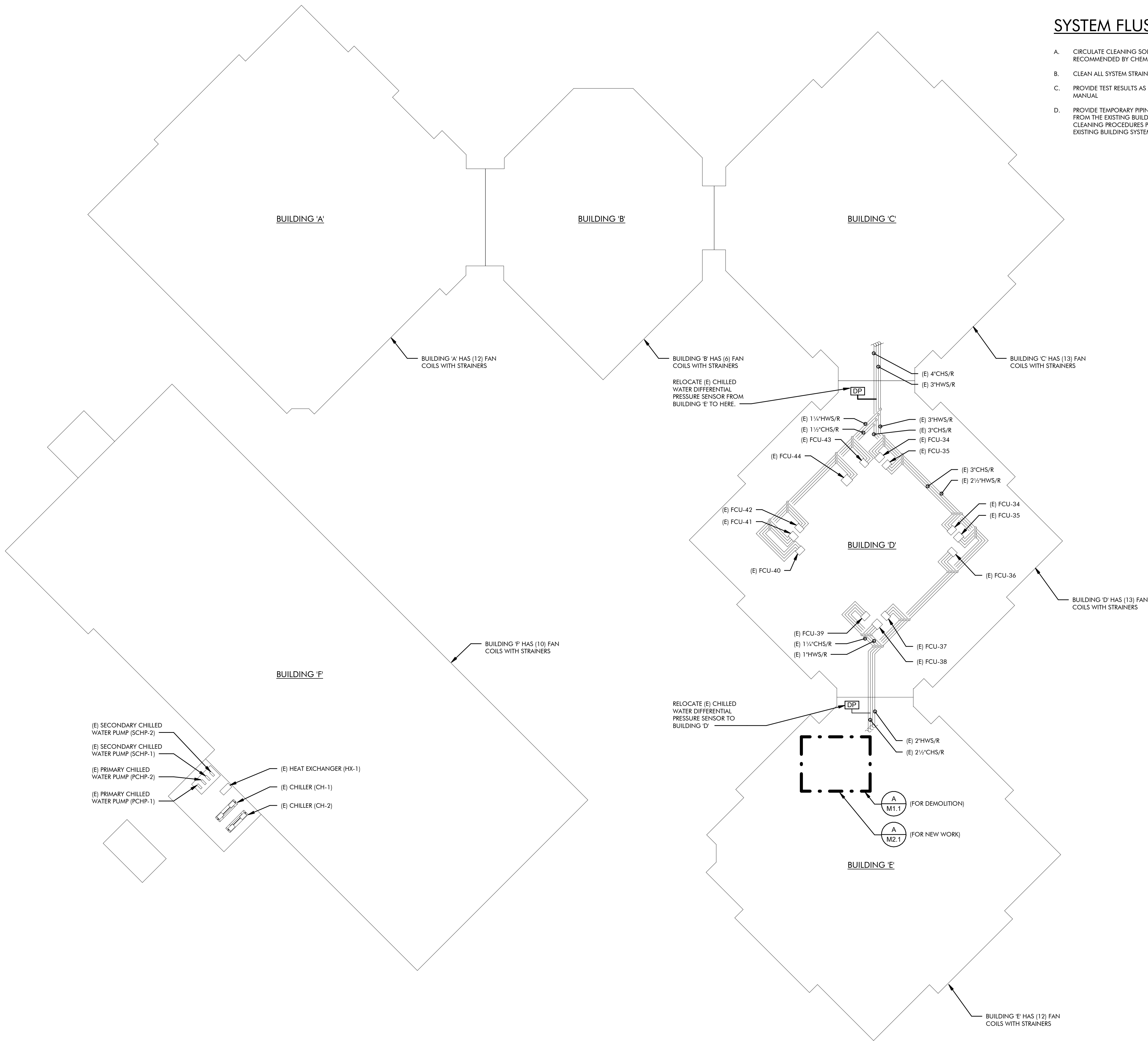
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PLOT DATE:



OVERALL BUILDING PIPING DIAGRAM
SCALE : NONE

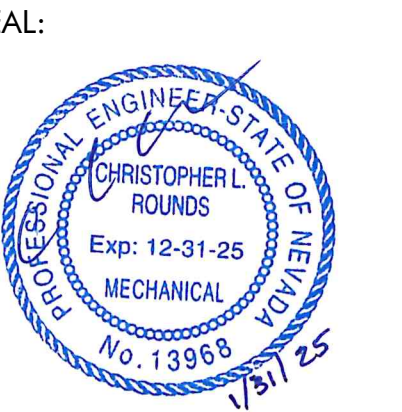
SYSTEM FLUSHING NOTE:

- A. CIRCULATE CLEANING SOLUTION FOR A MINIMUM OF 48 HOURS OR AS RECOMMENDED BY CHEMICAL MANUFACTURER'S INSTRUCTIONS.
- B. CLEAN ALL SYSTEM STRAINERS AND DEAD END PIPING LEGS.
- C. PROVIDE TEST RESULTS AS PART OF THE OPERATION AND MAINTENANCE MANUAL.
- D. PROVIDE TEMPORARY PIPING, VALVES, AND PUMPING SYSTEM ISOLATED FROM THE EXISTING BUILDING SYSTEM AS NEEDED TO PERFORM CLEANING PROCEDURES PRIOR TO FINAL CONNECTION TO THE EXISTING BUILDING SYSTEM.

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MECHANICAL BUILDING 'D' PIPING DIAGRAM

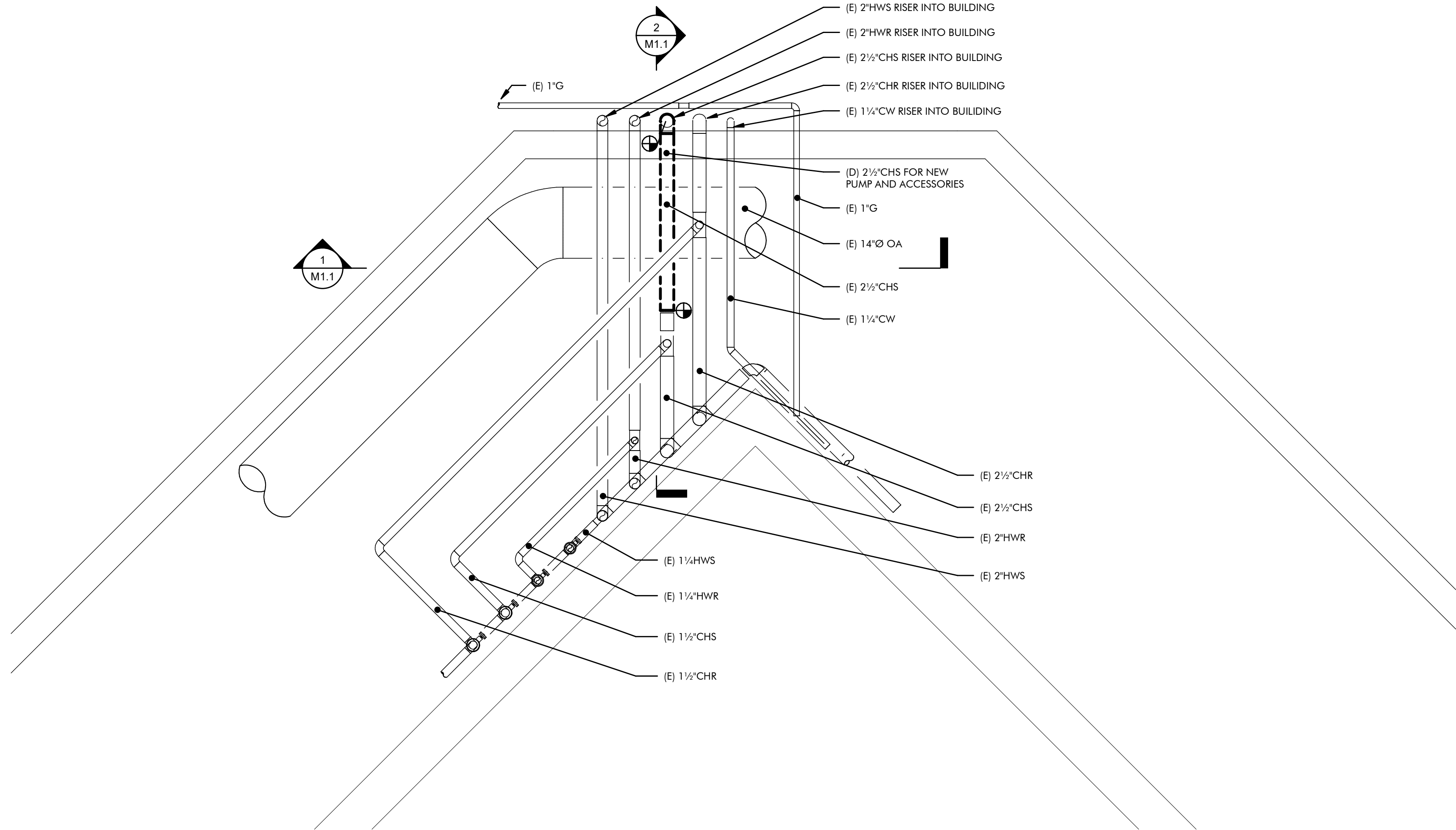
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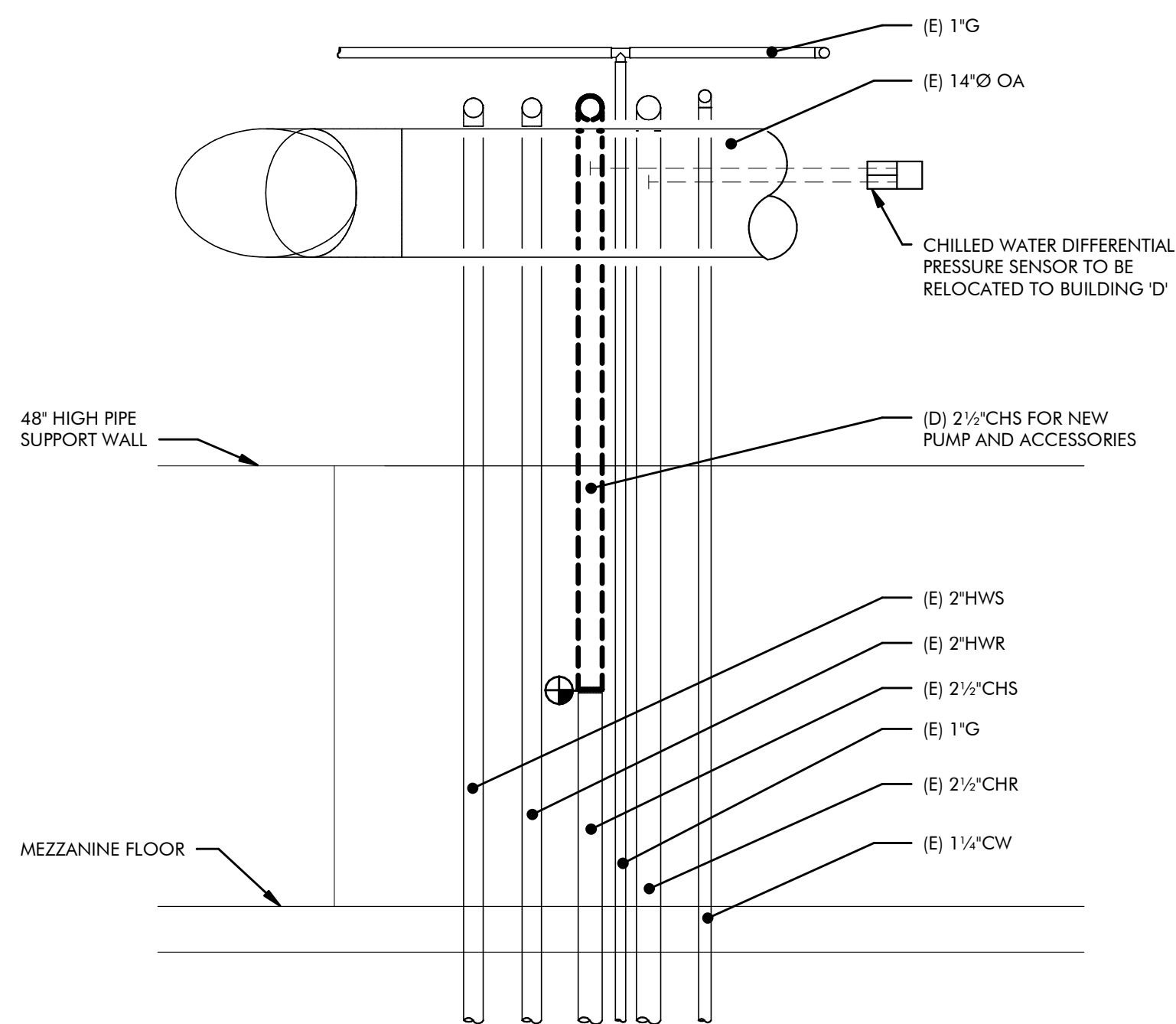
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DATE: 1/31/2025
PROJECT NO: 158324
SHEET NUMBER:

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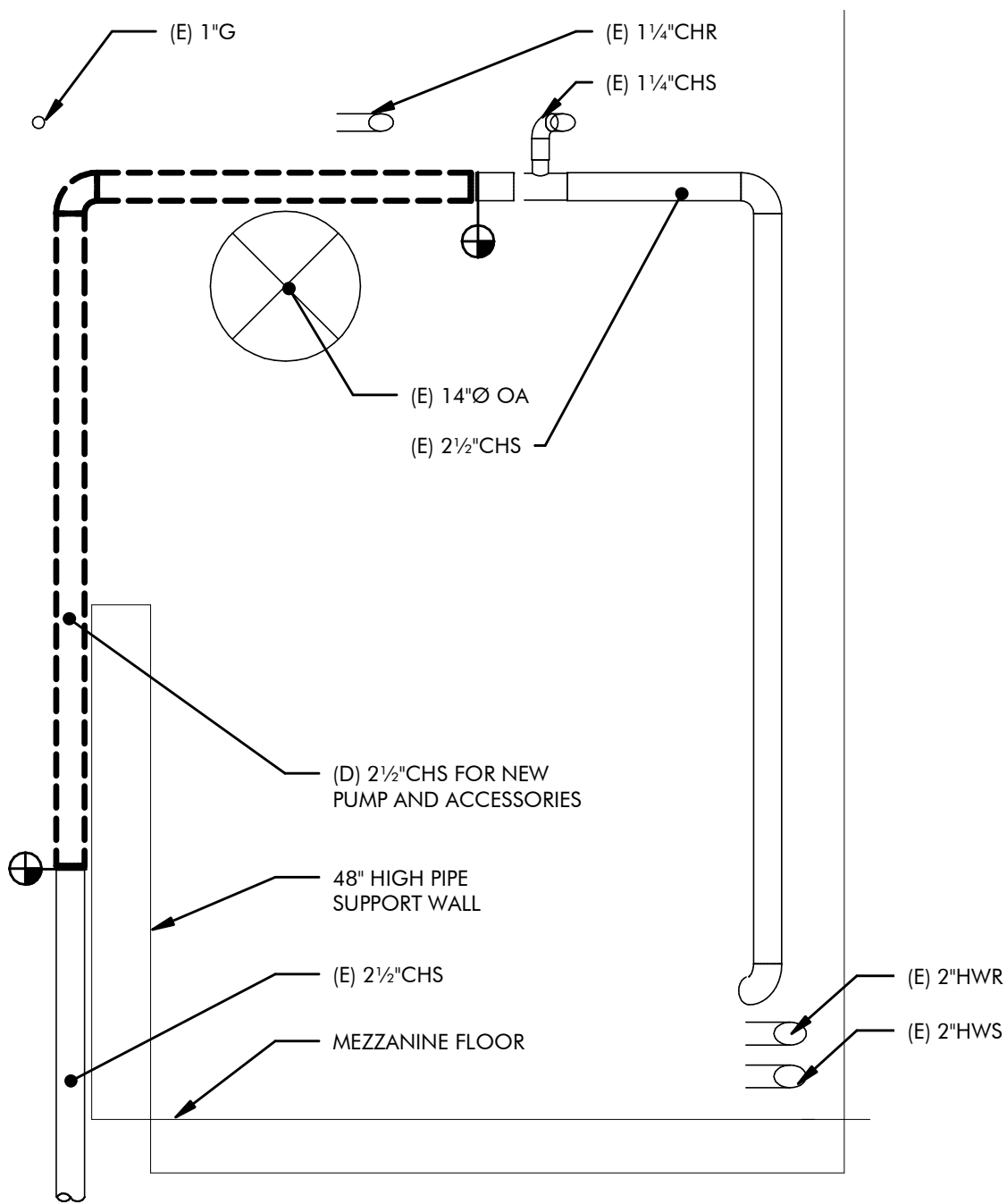
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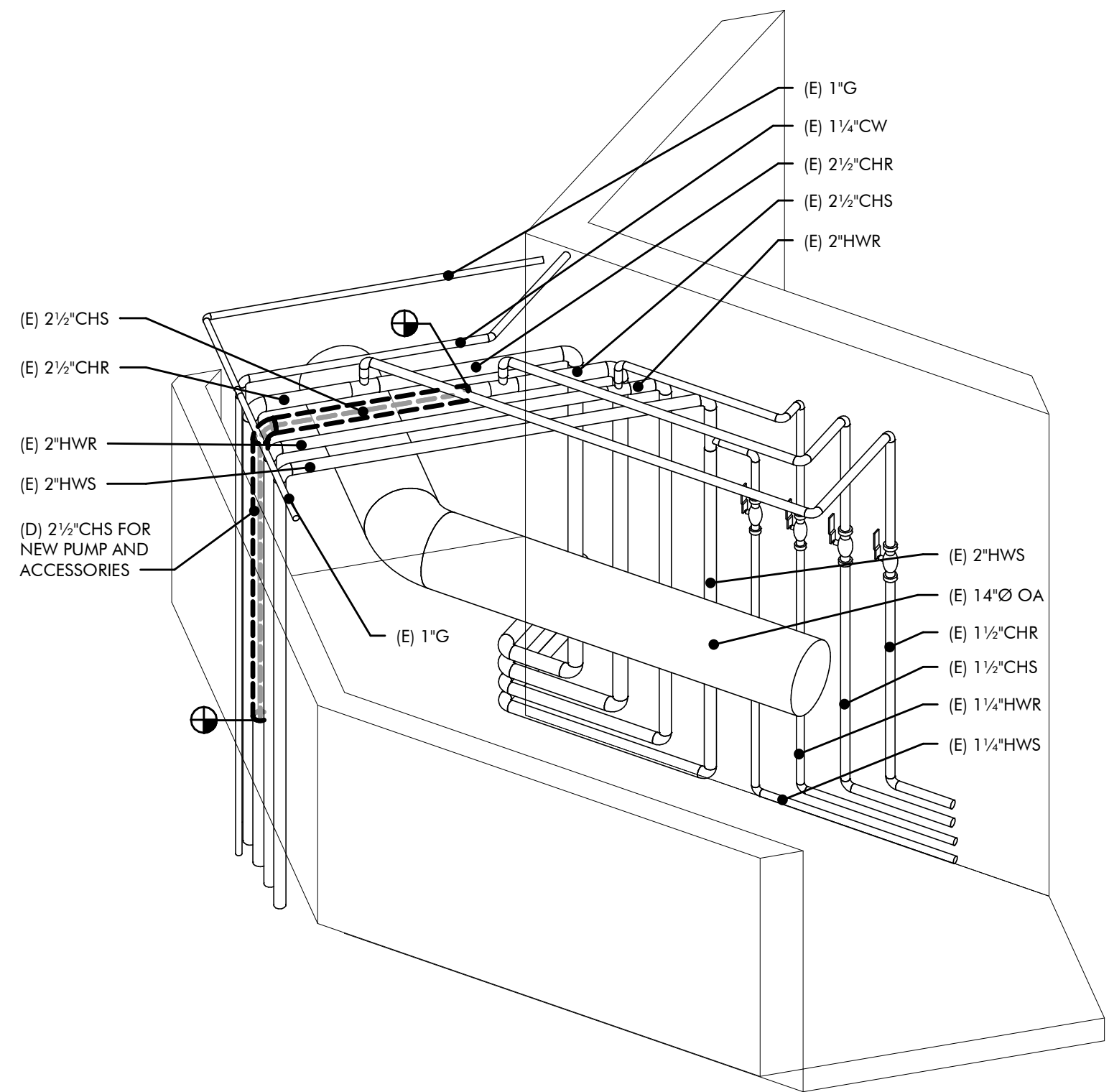
1 ENLARGED CHILLED WATER PUMP DEMOLITION FLOOR PLAN BUILDING 'E'
M1.1 SCALE: 3/4" = 1'-0"



1 CHILLED WATER DEMOLITION SECTION 1
M1.1 SCALE: 3/4" = 1'-0"



2 CHILLED WATER DEMOLITION SECTION 2
M1.1 SCALE: 3/4" = 1'-0"



3 CHILLED WATER PUMP DEMOLITION ISOMETRIC
M1.1 SCALE : NONE

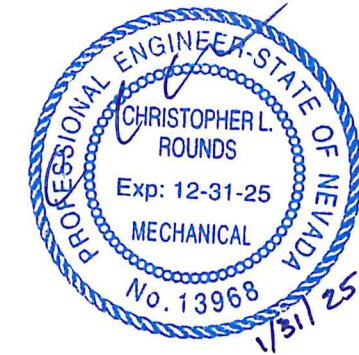


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ENLARGED CHILLED WATER PUMP
MECHANICAL DEMOLITION FLOOR PLAN

REVISIONS:

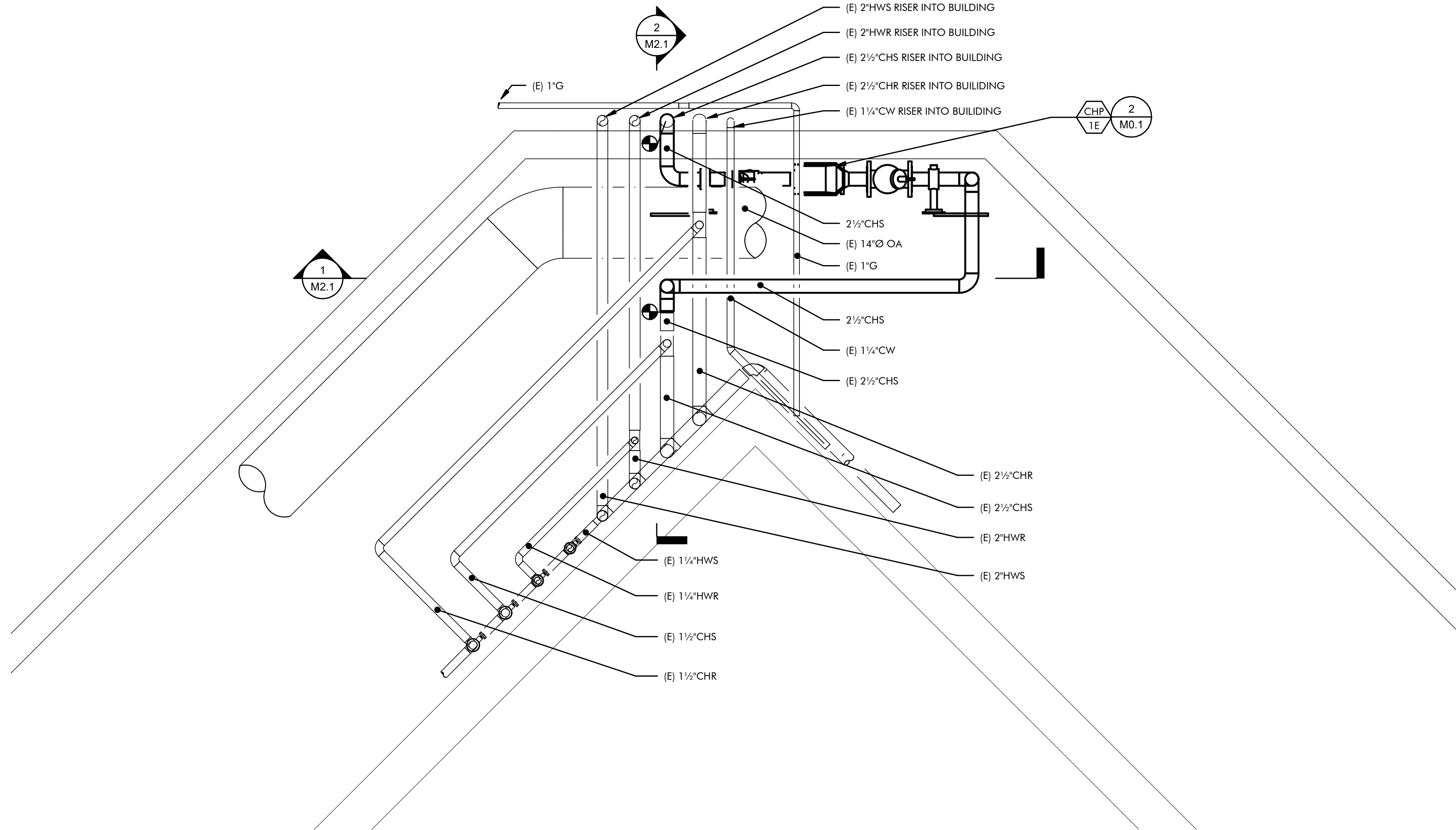
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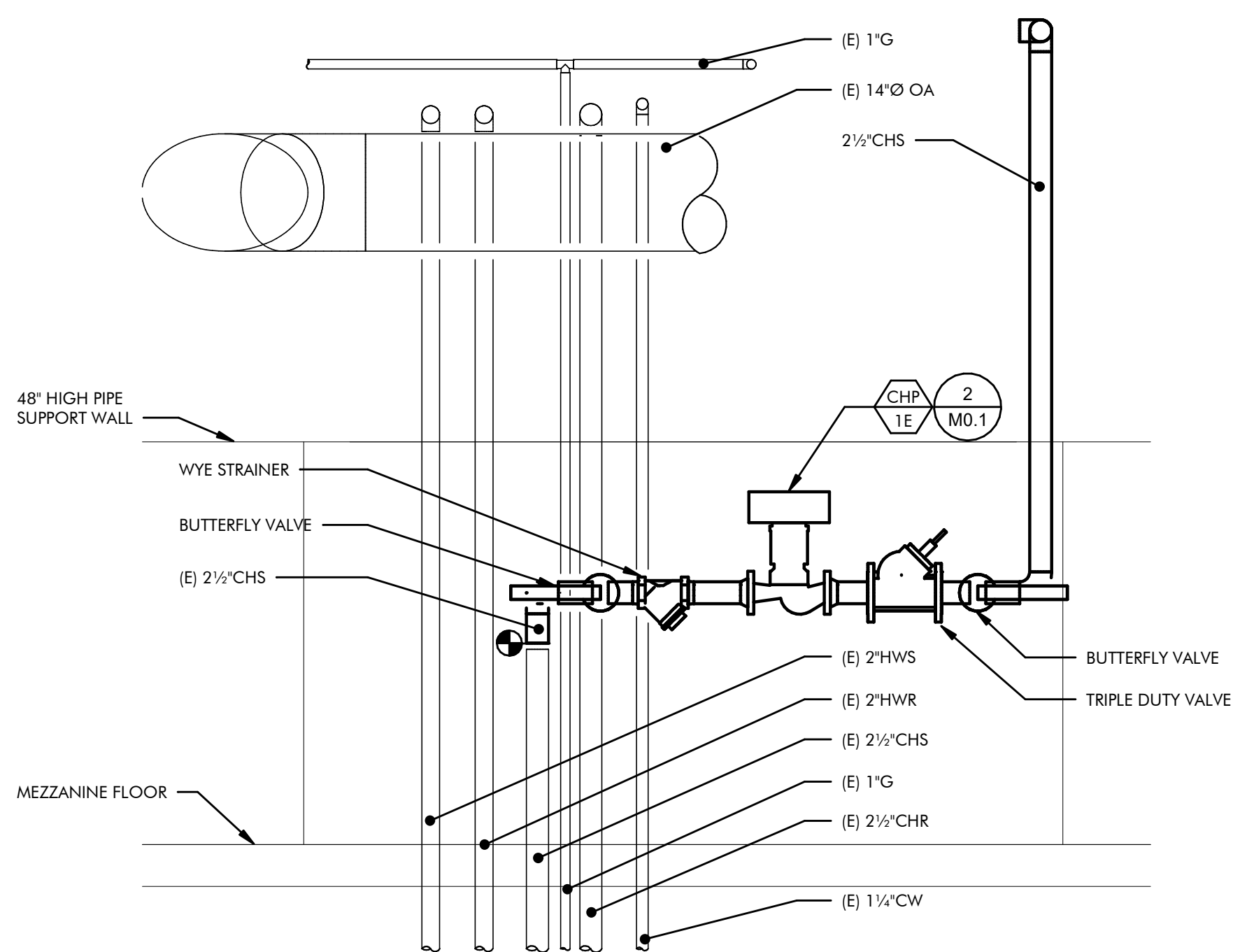
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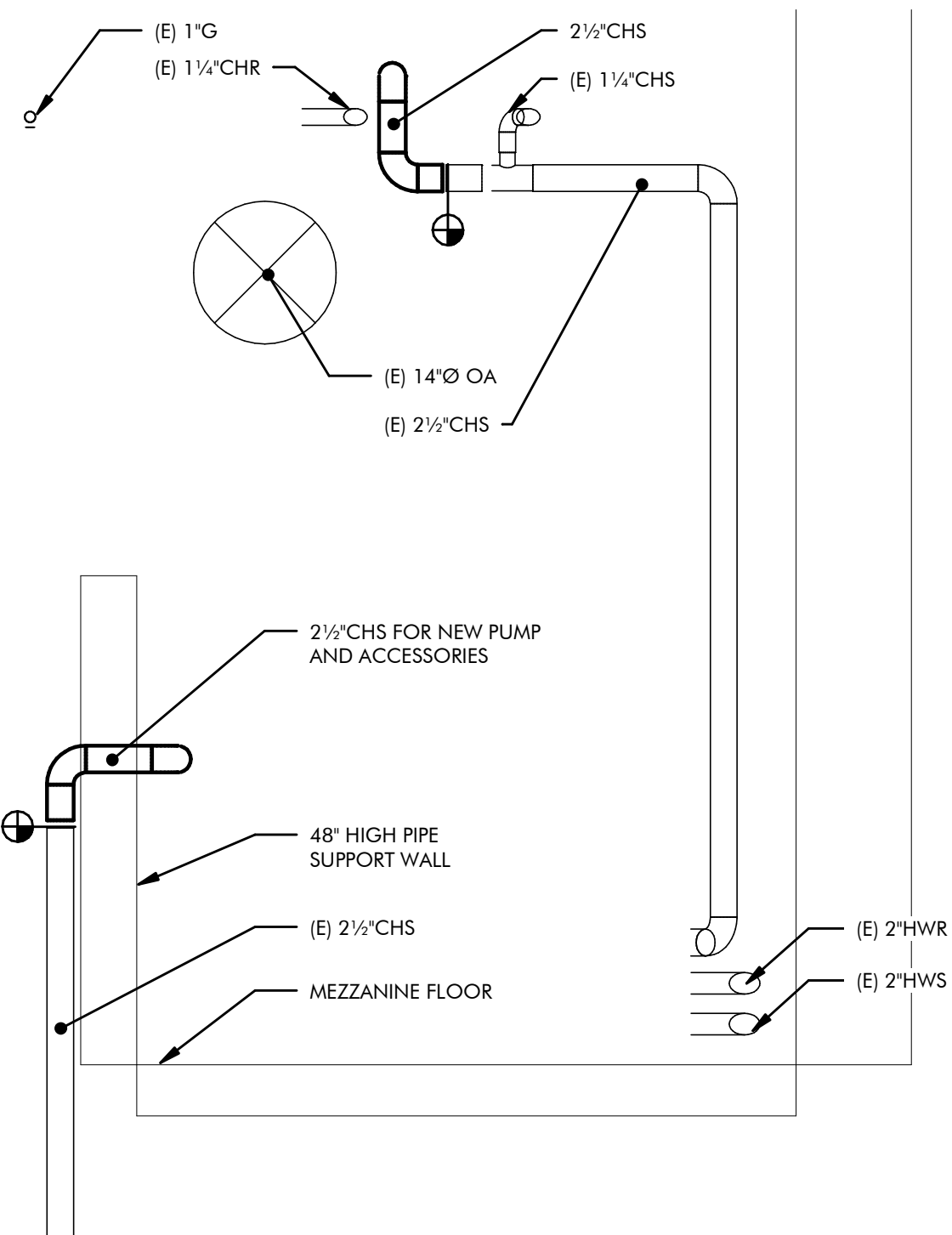
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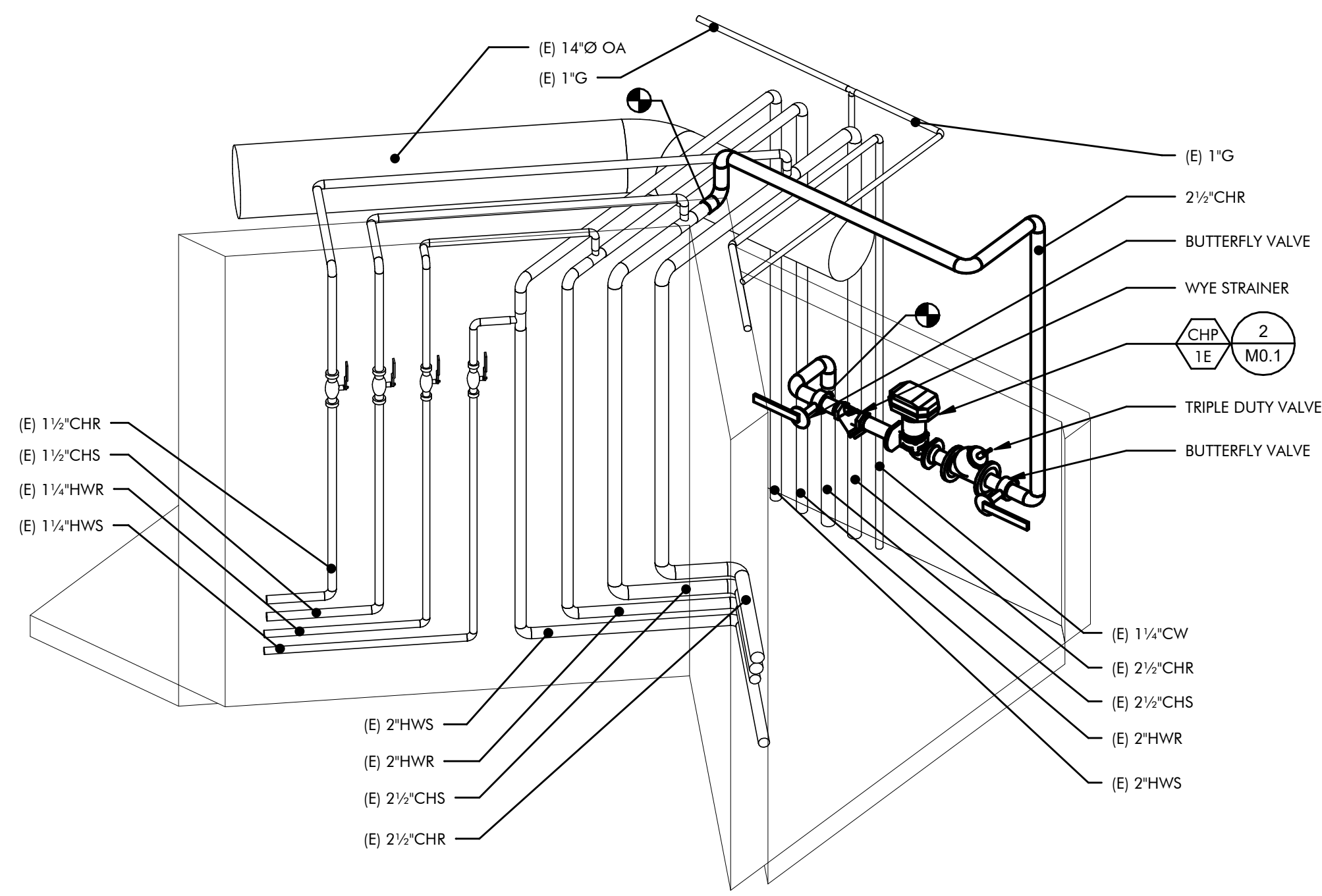
1 ENLARGED CHILLED WATER PUMP FLOOR PLAN BUILDING 'E'
M2.1 SCALE: 3/4" = 1'-0"



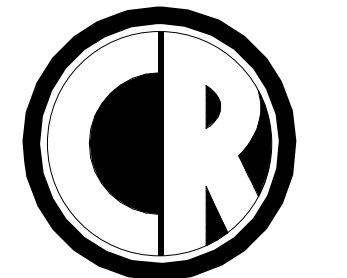
1 CHILLED WATER SECTION 1
M2.1 SCALE: 3/4" = 1'-0"



2 CHILLED WATER SECTION 2
M2.1 SCALE: 3/4" = 1'-0"



3 CHILLED WATER PUMP ISOMETRIC
M2.1 SCALE : NONE

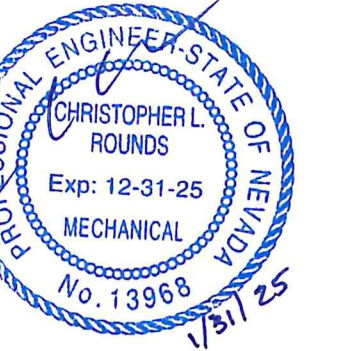


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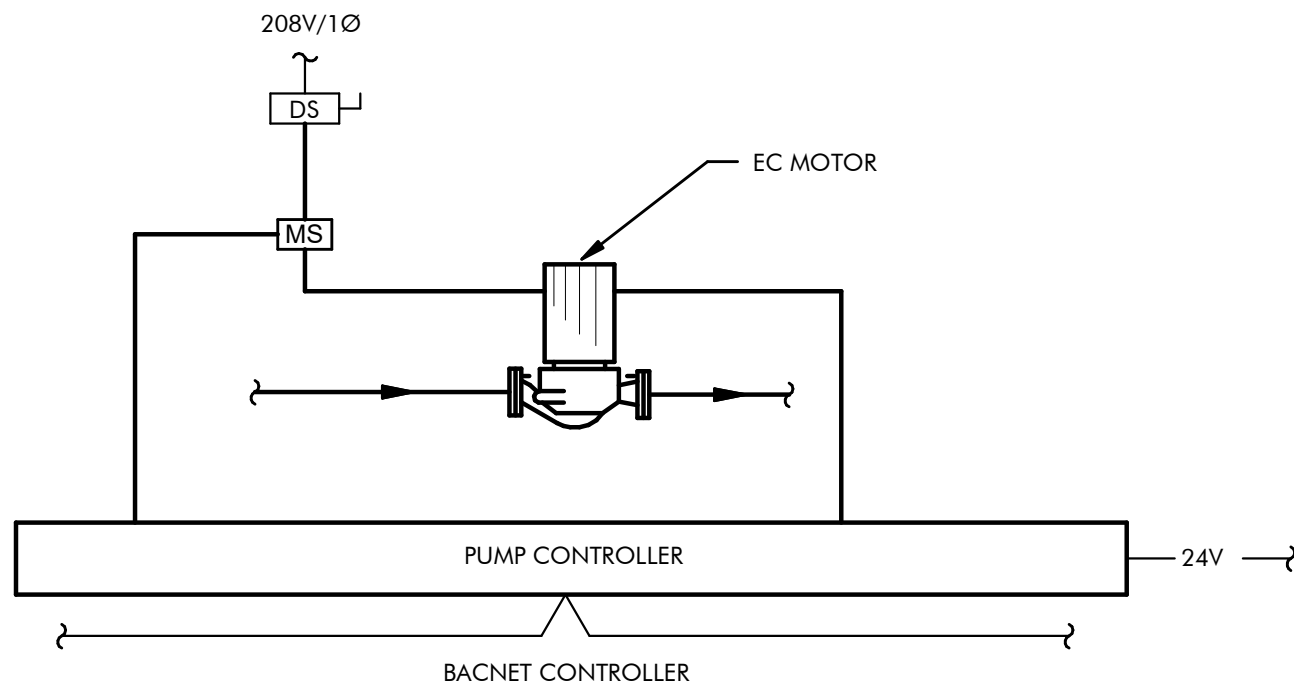
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PAU WA LU MIDDLE SCHOOL
BUILDING E CHILLED WATER IMPROVEMENT
701 LONG VALLEY ROAD, GARDNERVILLE, NV 89460
ENLARGED CHILLED WATER PUMP
MECHANICAL FLOOR PLAN

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PLOT DATE:

1 BUILDING 'E' CHILLED WATER TERTIARY PUMP CONTROL DIAGRAM
M6.1 SCALE : NONE



BUILDING 'E' CHILLED WATER TERTIARY PUMP SEQUENCE OF OPERATION

- WHEN ANY EXISTING FAN COIL IN BUILDING 'E' CALLS FOR COOLING, BMS SHALL TURN ON PUMP
- PUMPS INTERNAL PROGRAMMING SHALL BE IN CONSTANT PRESSURE MODE. PRESSURE TO BE DETERMINED WITH TEST AND BALANCE
- BMS SHALL MONITOR PUMP OPERATION

CONTROLS SYMBOL LEGEND

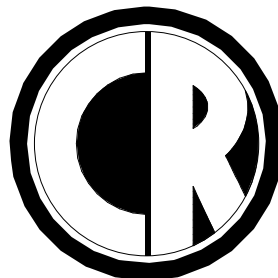
SYMBOL	ABBR.	DESCRIPTION
[AS]	AS	AVERAGING SENSOR
[BSP]	BSP	BUILDING STATIC PRESSURE SENSOR (WITH PROBES)
[CO]	CO ₂	CARBON DIOXIDE SENSOR
[CS]	CS	CURRENT SENSOR/SWITCH
[DP]	DP	DIFFERENTIAL PRESSURE SENSOR
[DSP]	DSP	DUCT STATIC PRESSURE SENSOR
[DS]	DS	DISCONNECT SWITCH (FUSED)
[ESD]	ESD	EMERGENCY SHUT-DOWN SWITCH (BREAK-GLASS TYPE)
[FSD]	FSD	COMBINATION FIRE/SMOKE DAMPER
[FMS]	FMS	FLOW MEASURING STATION
[FS]	FS	FLOW SWITCH
[HDS]	HDS	HIGH STATIC PRESSURE SENSOR
[M]	M	MOTORIZED ACTUATOR
[MS]	MS	MOTOR STARTER
[OA]	OA	OUTSIDE AIR TEMPERATURE/HUMIDITY SENSOR
[OS]	OS	OCCUPANCY SENSOR
[OSP]	OSP	OUTDOOR STATIC PRESSURE SENSOR
[R]	R	RELAY (POLES AND VOLTAGE AS REQUIRED)
[RTS]	RTS	ROOM TEMPERATURE SENSOR
[SD]	SD	SMOKE DAMPER
[S]	SD	SMOKE DETECTOR (PRODUCTS OF COMBUSTION DETECTOR)
[T]	TS	TEMPERATURE SENSOR (PENCIL TYPE)
[T]	TSTAT	THERMOSTAT OR TEMPERATURE SENSOR @ 48" AFF
[TX]	TX	TRANSFORMER (SIZE & VOLTAGE AS REQUIRED)
[E]		BY ELECTRICAL CONTRACTOR
[P]		BY PLUMBING CONTRACTOR
[M]		BY MECHANICAL CONTRACTOR
[OBD]	OBD	OPPOSED BLADE DAMPER
[PBD]	PBD	PARALLEL BLADE DAMPER
[TCV]	TCV	TEMPERATURE CONTROL VALVE (2-WAY OR 3-WAY)
[P] [T]		PRESSURE SENSOR, TEMPERATURE SENSOR WITH WELL
[P] [T]		PRESSURE GAUGE, TEMPERATURE GAUGE
[P]	P	PUMP
		POWER WIRING BY ELECTRICAL CONTRACTOR
		CONTROL WIRING

CONTROLS ABBREVIATIONS

AFF/AFG	ABOVE FINISHED FLOOR/GRADE
BSP	BUILDING STATIC PRESSURE SENSOR (WITH PROBES) CO CARBON MONOXIDE
DDC	DIRECT DIGITAL CONTROL SYSTEM
EA	EXHAUST AIR
HPS/HPR	HEAT PUMP WATER SUPPLY/RETURN PIPING
MAX	MAXIMUM
MOD	MODULATING ACTUATOR (SPRING RETURN - U.N.O.)
MIN	MINIMUM
NC	NORMALLY CLOSED
NO	NORMALLY OPEN
OA	OUTSIDE AIR
RA	RETURN AIR
SA	SUPPLY AIR
TCP	TEMPERATURE CONTROL PANEL
TYP	TYPICAL
UNO	UNLESS NOTED OTHERWISE
VFD	VARIABLE FREQUENCY DRIVE
2-POS	TWO-POSITION ACTUATOR (SPRING RETURN - U.N.O.)

CONTROL NOTES

- ALL WIRING TO BE IN CONDUIT. PLENUM RATED CABLE WITH J-HOOKS IS ALLOWED FOR ABOVE CEILING INSTALLATION.
- CONTROL SYSTEM CONTRACTOR SHALL PROVIDE A COMPLETE DIRECT DIGITAL CONTROL SYSTEM. PROVIDE AND INSTALL ALL NECESSARY WIRING TO MAKE SYSTEM OPERATIONAL. ALL WIRING SHALL BE IN CONDUIT WITH ANY SPLICES MADE IN JUNCTION BOXES. CONTROL DIAGRAMS AND SEQUENCE OF OPERATION ON REFER TO DRAWINGS.
- CONTROLS CONTRACTOR SHALL CONNECT NEW CONTROLLERS TO THE CONTROL NETWORK AND ADD NEW GRAPHICS. COORDINATE ALL WORK WITH LCSD MAINTENANCE PRIOR TO BID.
- THE THERMOGRAPHIC FLOOR PLAN SHALL BE UPDATED WITH THE NEW FLOOR PLAN AND ZONING, INCLUDING THE ROOM TEMPERATURE SENSORS.
- CONTROLS CONTRACTOR TO COORDINATE UNIT LABELING ON GRAPHICS, THERMOSTAT, AND CONTROLLER WITH LCSD MAINTENANCE PRIOR TO INSTALLATION.
- CONTROLS CONTRACTOR:
CERRIS SYSTEMS
4750 LONGLEY LANE #106
RENO, NV 89502

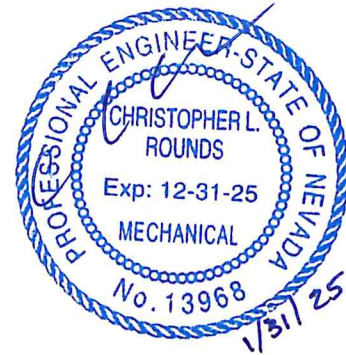


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701 LONG VALLEY ROAD, GARDNERVILLE, NV 89460
MECHANICAL CONTROL DIAGRAMS AND
SEQUENCE OF OPERATION

REVISIONS:

REV.	DESCRIPTION	DATE
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ELECTRICAL SYMBOLS AND NOMENCLATURE

	SINGLE-OUTLET RECEPTACLE		SINGLE-PHASE, 1-POLE CIRCUIT PATH (1/2" CONDUIT, (2) - #10 CU, UNLESS OTHERWISE NOTED) ABOVE FLOOR
	DOUBLE-OUTLET 'DUPLEX' RECEPTACLE		SINGLE-PHASE, 2-POLE CIRCUIT PATH (1/2" CONDUIT, (3) - #10 CU, UNLESS OTHERWISE NOTED) ABOVE FLOOR
	THREE-PHASE (3W) RECEPTACLE (CONFIGURATION AS NOTED)		THREE-PHASE, 1-POLE CIRCUIT PATH (1/2" CONDUIT, (4) - #10 CU, UNLESS OTHERWISE NOTED) ABOVE FLOOR
	QUADRUPLE-OUTLET 'QUAD' RECEPTACLE		RETURN CIRCUIT TO PANEL 'HOMERUN' (CIRCUIT AS NOTED) ABOVE FLOOR
	SPECIAL RECEPTACLE (VOLTAGE/CONFIGURATION AS NOTED)		CIRCUIT BREAKER (AMPS/POLES AS NOTED)
	JUNCTION BOX		FUSE (AMPS/POLES AS NOTED)
	FLOOR MOUNT RECEPTACLE		SHEET NOTE INDICATOR
	THERMOSTAT		SHEET/EQUIPMENT NOTE INDICATOR
	SAFETY DISCONNECT SWITCH (SIZE/VOLTAGE/CONFIGURATION AS NOTED)		EQUIPMENT NOTE INDICATOR
	COMBINATION SAFETY SWITCH/MAGNETIC STARTER		REVISION 'DELTA' NOTE INDICATOR
	TELEPHONE/DATA JUNCTION BACKBOX		FEEDER NOTE INDICATOR
	SINGLE-POLE TOGGLE SWITCH (VOLTAGE AS REQUIRED)	48"	48" MOUNTING HEIGHT AFF. (ACTUAL HEIGHT AS NOTED)
	MULTI-STATION 'THREE-WAY' TOGGLE SWITCH (VOLTAGE AS REQUIRED)	AFF.	ABOVE FINISHED FLOOR
	SOLID STATE DIMMING SWITCH (VOLTAGE AS REQUIRED)	AFG.	ABOVE FINISHED GRADE
	MOTOR-RATED TOGGLE SWITCH (VOLTAGE AS REQUIRED)	ATS.	AUTOMATIC TRANSFER SWITCH
	KEYED TOGGLE SWITCH (VOLTAGE AS REQUIRED)	C	CONDUIT
	CABLE TELEVISION OUTLET	CB	CIRCUIT BREAKER
	PANELBOARD (NAME/AMP/PHASE/VOLTAGE/CONFIGURATION AS NOTED)	CC	CONTROLS CONTRACTOR
	TRANSFORMER (NAME/KVA RATING/PHASE/VOLTAGE AS NOTED)	CLG	CEILING
	INDICATES MECHANICAL EQUIPMENT	(E)	EXISTING
	PHOTO ELECTRIC CELL	EC	ELECTRICAL CONTRACTOR
	TIME CLOCK	FACP	FIRE ALARM CONTROL PANEL
	CONTACTOR (CONFIGURATION AS NOTED)	F.B.O.	FURNISHED BY OTHERS
	DUCT DETECTOR FIRE ALARM SYSTEM COMPONENT	GFI	GROUND FAULT INTERRUPTING TYPE
	SMOKE DETECTOR FIRE ALARM SYSTEM COMPONENT	HID	HIGH INTENSITY DISCHARGE
	HEAT DETECTOR FIRE ALARM SYSTEM COMPONENT	LTG	LIGHTING
	FLOW SWITCH FIRE ALARM SYSTEM COMPONENT	NTS	NOT TO SCALE
	TAMPER SWITCH FIRE ALARM SYSTEM COMPONENT	MC	MECHANICAL CONTRACTOR
	HORN/STROBE COMBINATION FIRE ALARM SYSTEM COMPONENT	MCB	MAIN CIRCUIT BREAKER
	MANUAL PULL STATION	MSB	MAIN SWITCH BOARD
	SINGLE-PHASE, 1-POLE CIRCUIT PATH (1/2" CONDUIT, (2) - #10 CU, UNLESS OTHERWISE NOTED) ABOVE FLOOR	(N)	NEW
	SINGLE-PHASE, 2-POLE CIRCUIT PATH (1/2" CONDUIT, (3) - #10 CU, UNLESS OTHERWISE NOTED) ABOVE FLOOR	NL	NIGHT LIGHT
	THREE-PHASE, 1-POLE CIRCUIT PATH (1/2" CONDUIT, (4) - #10 CU, UNLESS OTHERWISE NOTED) ABOVE FLOOR	TYP	TYPICAL
	RETURN CIRCUIT TO PANEL 'HOMERUN' (CIRCUIT AS NOTED) ABOVE FLOOR	UG	UNDER GROUND
	MOTOR (HORSEPOWER AS NOTED)	UN	UNLESS OTHERWISE NOTED
	SHUNT TRIP STATION	WP	WEATHER PROOF
		XTMR	TRANSFORMER

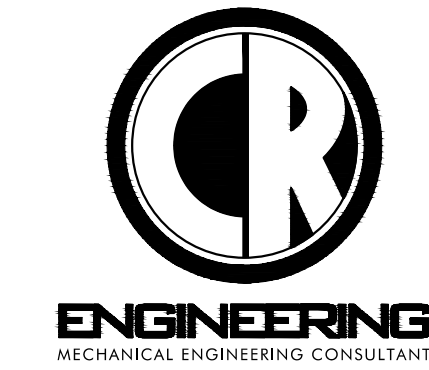
MECHANICAL EQUIPMENT CONNECTION SCHEDULE:

MEQ #	DISCONNECTING MEANS	VOLTS / # / FLA	(E) CKT	LOAD KVA	(N) CKT	CONDUIT & WIRE	NOTE #3 & #4	NOTES
	30A/NF/2P 250V, NI DISC. SAFETY SWITCH	208 / 1 / 66	--	131	'LD'-28, 30	1/2" C, (2) - #12 Cu & (1) - #12 Cu GND		LOCKABLE
	JUNCTION BOX & HARDWIRE	120 / 1 / 1	--	0.12	'LD'-21	1/2" C, (2) - #12 Cu & (1) - #12 Cu GND		--

MECHANICAL EQUIPMENT CONNECTION SCHEDULE NOTES:

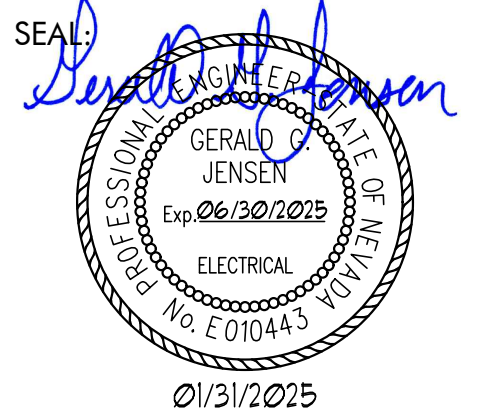
- CONTRACTOR SHALL DISCOVER AND FIELD VERIFY THE SERVING PANEL & BRANCH CIRCUIT AND UPDATE PANEL DIRECTORIES.
- SEE MECHANICAL PLANS FOR EXACT LOCATIONS OF MECHANICAL EQUIPMENT.
- CONTRACTOR'S BID SHALL INCLUDE NEW (OVERHEAD) CONDUITS AND PATHWAYS AS REQUIRED FOR ALL EQUIPMENT CONNECTIONS. NEVERTHELESS, CONTRACTOR MAY REUSE ANY EXISTING CONDUITS, BACK BOXES, AND PATHWAYS THAT ARE MADE AVAILABLE DURING THE DEMOLITION PHASE OF WORK.
- ALL BRANCH CIRCUIT WIRING SHALL BE & PROVIDED WITH PRINTED PERMANENT WIRE MARKERS WHICH CLEARLY IDENTIFY THE SERVING PANEL & CIRCUIT BREAKER.

3-Phase, 4-Wire, Y-Connected Electrical Panelboard Schedule by Jensen Engineering, Inc.																						
Project Name: PAU WA LU MS CHILLED WATER IMPROVEMENT			Line to Neutral Voltage: 120			Bus Material: COPPER			Short Circuit Rating:													
Panel Name: LD			Line to Line Voltage: 208			Bus Rating: 225 AMP			New or Existing: EXISTING													
Panel Location: AS SHOWN ON SHEET E1.0			Main Breaker or Lug Only: EXISTING			Lug/Breaker Rating: 150 AMP			Mounting: EXISTING													
Ckt. No.	Load (VA)	Description	Load Power Factor	One-Way Ckt Length (ft)	Wire Size (AWG)	Corrected z' (D-to-Neutral)	VDROP (%)	Breaker Poles	Phase	Breaker Poles	Corrected z' (D-to-Neutral)	Wire Size (AWG)	One-Way Ckt Length (ft)	Load Power Factor	Description	Load (VA)	Ckt. No.					
1	1080	(E) LOAD						1 20	●	20 1					(E) LOAD	1080	2					
3	1080	(E) LOAD						1 20	●	20 1					(E) LOAD	1080	4					
5	1080	(E) LOAD						1 20	●	20 1					(E) LOAD	1080	6					
7	0	(E) SPARE						1 20	●	20 1					(E) LOAD	1700	8					
9	0	(E) SPARE						1 20	●	20 1					(E) LOAD	1700	10					
11	0	(E) SPARE						1 20	●	30 1					(E) LOAD	1700	12					
13	1080	(E) LOAD						1 20	●	20 1					(E) LOAD	1080	14					
15	1080	(E) LOAD						1 20	●	20 1					(E) LOAD	1080	16					
17	1080	(E) LOAD						1 20	●	20 1					(E) LOAD	1080	18					
19	1080	(E) LOAD						1 20	●	20 1					(E) LOAD	1000	20					
21	120	(N) DPS-1						1 20	●	20 1					(E) SPARE	0	22					
23	1700	(E) LOAD						1 20	●	20 1					(E) SPARE	0	24					
25	1700	(E) LOAD						1 20	●	20 1					(E) SPARE	0	26					
27	1700	(E) LOAD						1 20	●	20 2					(N) CHP-1E	686	28					
29	1700	(E) LOAD						1 20	●	20 2					(N) CHP-1E	686	30					
4940	3980	5560	Total Load (VA)		Notes: 1. Corrected impedance calculated using Neher-McGrath method for determining resistance in AC circuits. 2. Circuit length used for calculating voltage drop; not to be used for estimating or pricing. 3. Wire size used for calculating voltage drop; not to be used for estimating or pricing. See electrical drawing										Total Load (VA): 4860 4546 4546							
																+25% of Lighting Load (VA): 0 0 0						
																+25% of Largest Motor Load (VA): 0 0 0						
																Combined Total Load (VA): 9800 8526 10106						
																Average Line Current (Amps): 81.67 71.05 84.22						
																Average Total Current (Amps): 79.01						
																Total Connected Load (KVA): 28.43						



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Electrical Engineers
9655 Gateway Drive
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Ph. (775) 852-2288
kyle.jensen@jeneng.com
web: www.jeneng.com

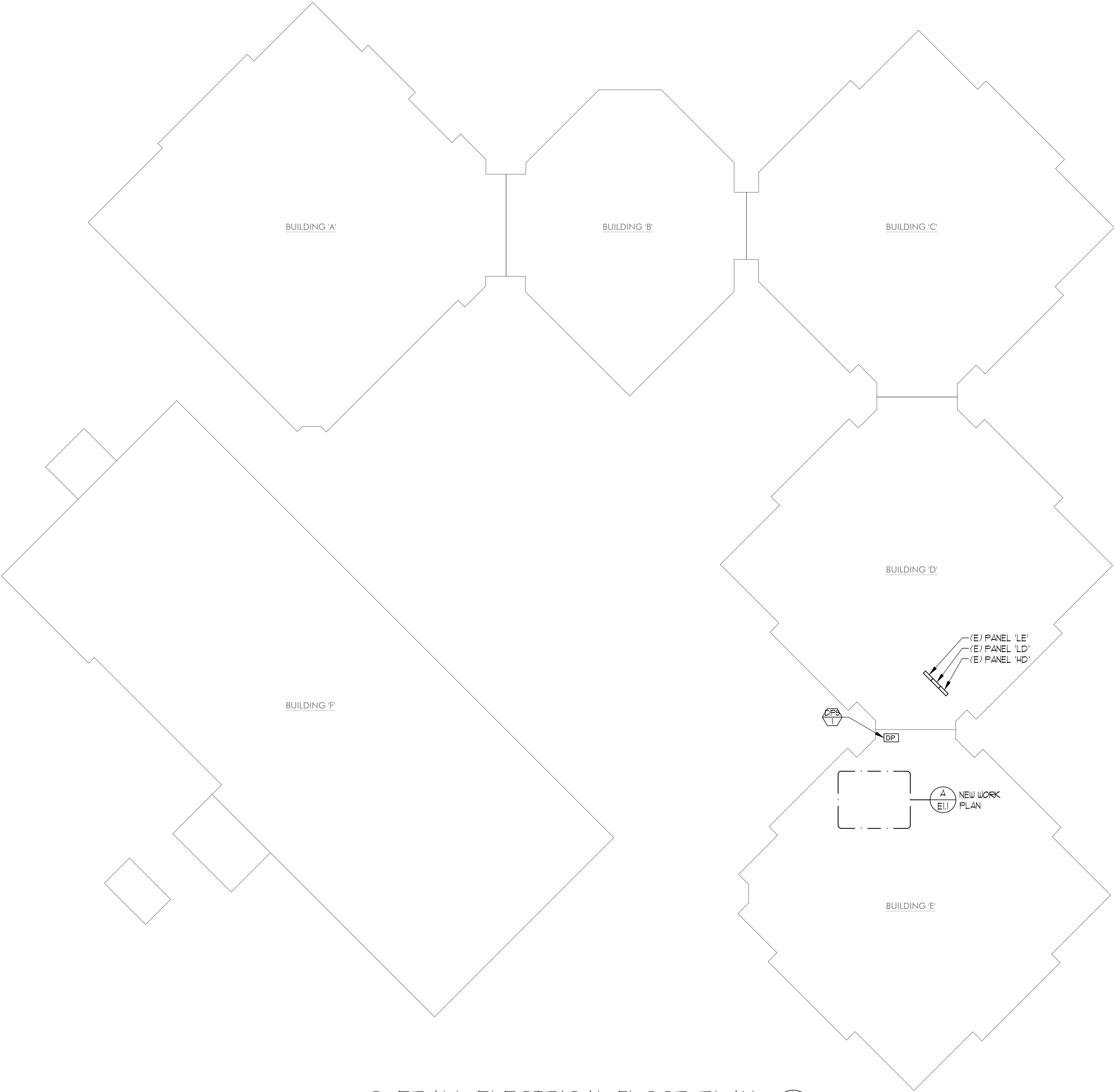
DOUGLAS COUNTY SCHOOL DISTRICT
PAU WA LU MIDDLE SCHOOL
BUILDING E CHILLED WATER IMPROVEMENT
701 LONG VALLEY ROAD, GARDNERVILLE, NV 89460
ELECTRICAL SYMBOLS & MECHANICAL EQUIPMENT CONNECTION SCHEDULE

REVISIONS:		
REV.	DESCRIPTION	DATE
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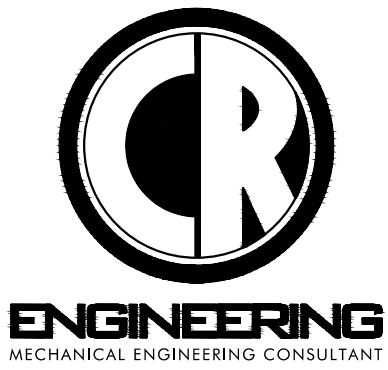
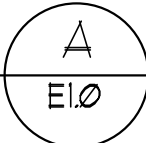
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DESIGNED BY: KPJ
CHECKED BY: GGJ
APPROVED BY: GGJ
DATE: 01/31/2025
PROJECT NO: N225JK

SHEET NUMBER:

E0.1

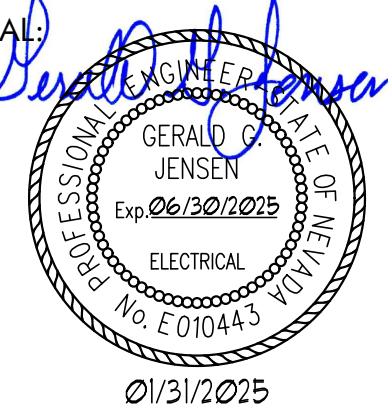


OVERALL ELECTRICAL FLOOR PLAN
NOT TO SCALE

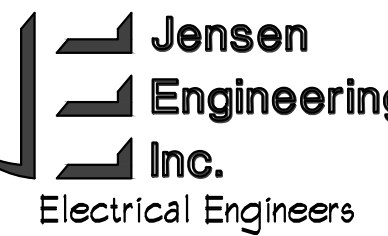


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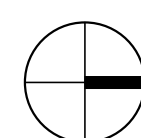
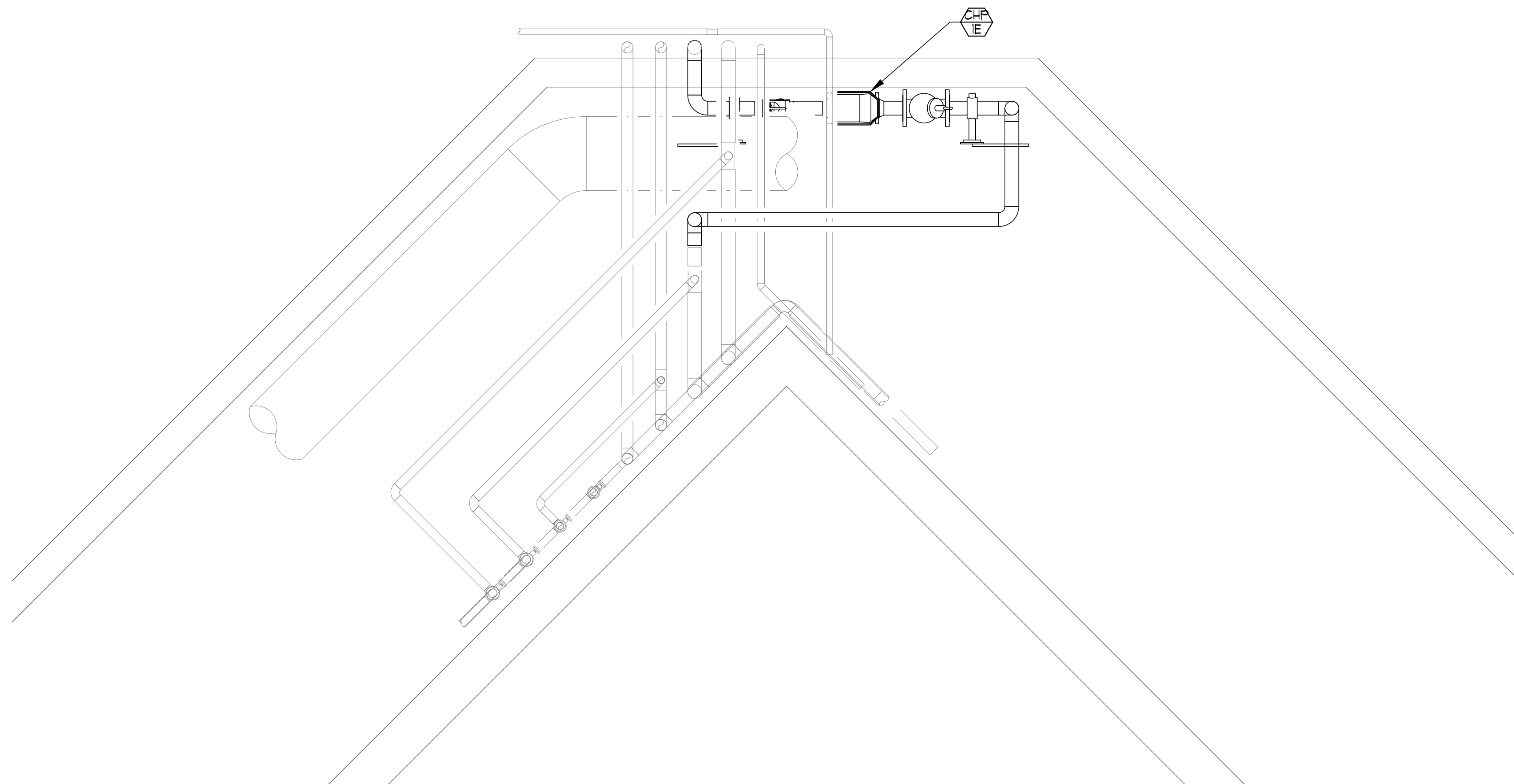
DOUGLAS COUNTY SCHOOL DISTRICT
PAU WAI LU MIDDLE SCHOOL
BUILDING E CHILLED WATER IMPROVEMENT
701 LONG VALLEY ROAD, GARDNERVILLE, NV 89460
OVERALL ELECTRICAL FLOOR PLAN

REVISIONS:		
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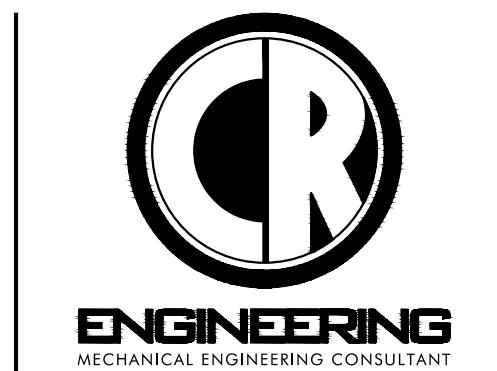
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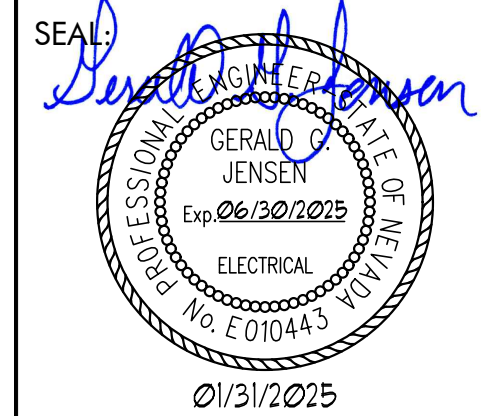
ENLARGED CHILLED WATER PUMP FLOOR PLAN

SCALE: 3/4" = 1'-0"



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DOUGLAS COUNTY SCHOOL DISTRICT
PAU WA LU MIDDLE SCHOOL
BUILDING E CHILLED WATER IMPROVEMENT
701 LONG VALLEY ROAD, GARDNERVILLE, NV 89460

ENLARGED CHILLED WATER PUMP
NEW WORK PLAN

REVISIONS:		
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DESIGNED BY: KPJ
CHECKED BY: GGJ
APPROVED BY: GGJ
DATE: 01/31/2025
PROJECT NO: N225JK

SHEET NUMBER:

E1.1

PIÑON HILLS ELEMENTARY SCHOOL COOLING TOWER REPAIR

1479 STEPHANIE WAY
MINDEN, NV 89423

FOR

DOUGLAS COUNTY SCHOOL DISTRICT

1126 AIRPORT ROAD, BUILDING E-1
MINDEN, NV 89423
PWP-DO-2025-166

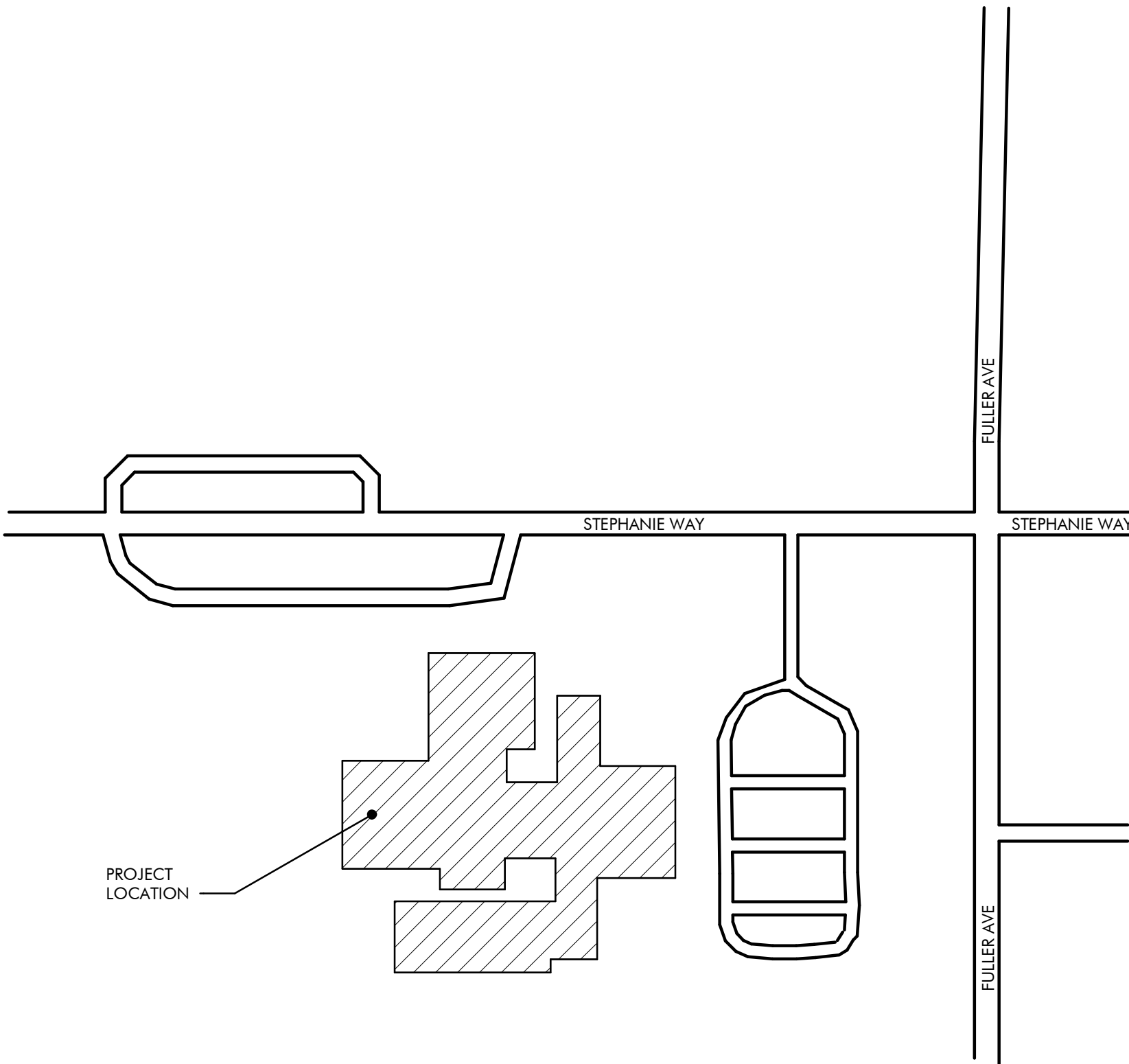
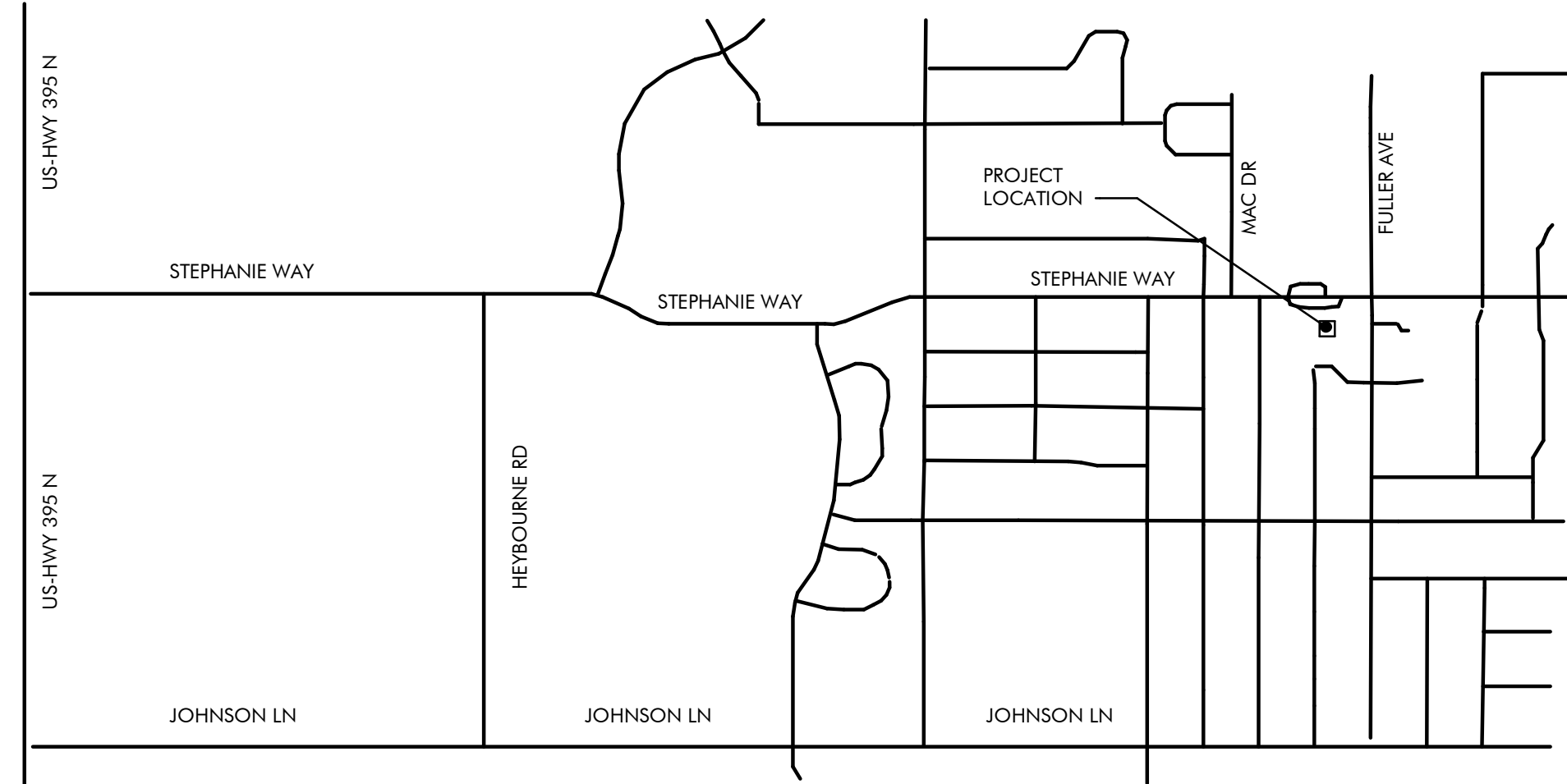


Douglas County
School District

VICINITY MAP

LOCATION MAP

DIRECTORY



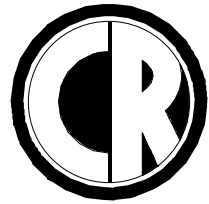
OWNER

DOUGLAS COUNTY SCHOOL DISTRICT
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CONTACTS: PHIL DEMUS
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PROJECT MANAGER

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SHEET INDEX

GENERAL INFORMATION

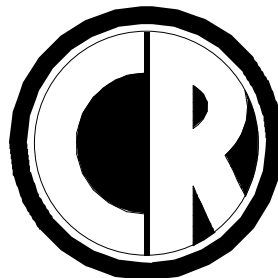
T0.1 TITLE SHEET

MECHANICAL

M2.0 MECHANICAL FLOOR PLAN

BUILDING CODES

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

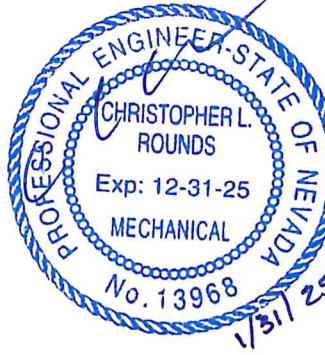


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CONSULTANT:

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PIÑON HILLS ELEMENTARY SCHOOL
COOLING TOWER REPAIR
1479 STEPHANIE WAY, MINDEN, NV 89423

TITLE SHEET

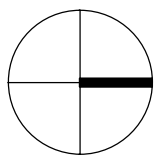
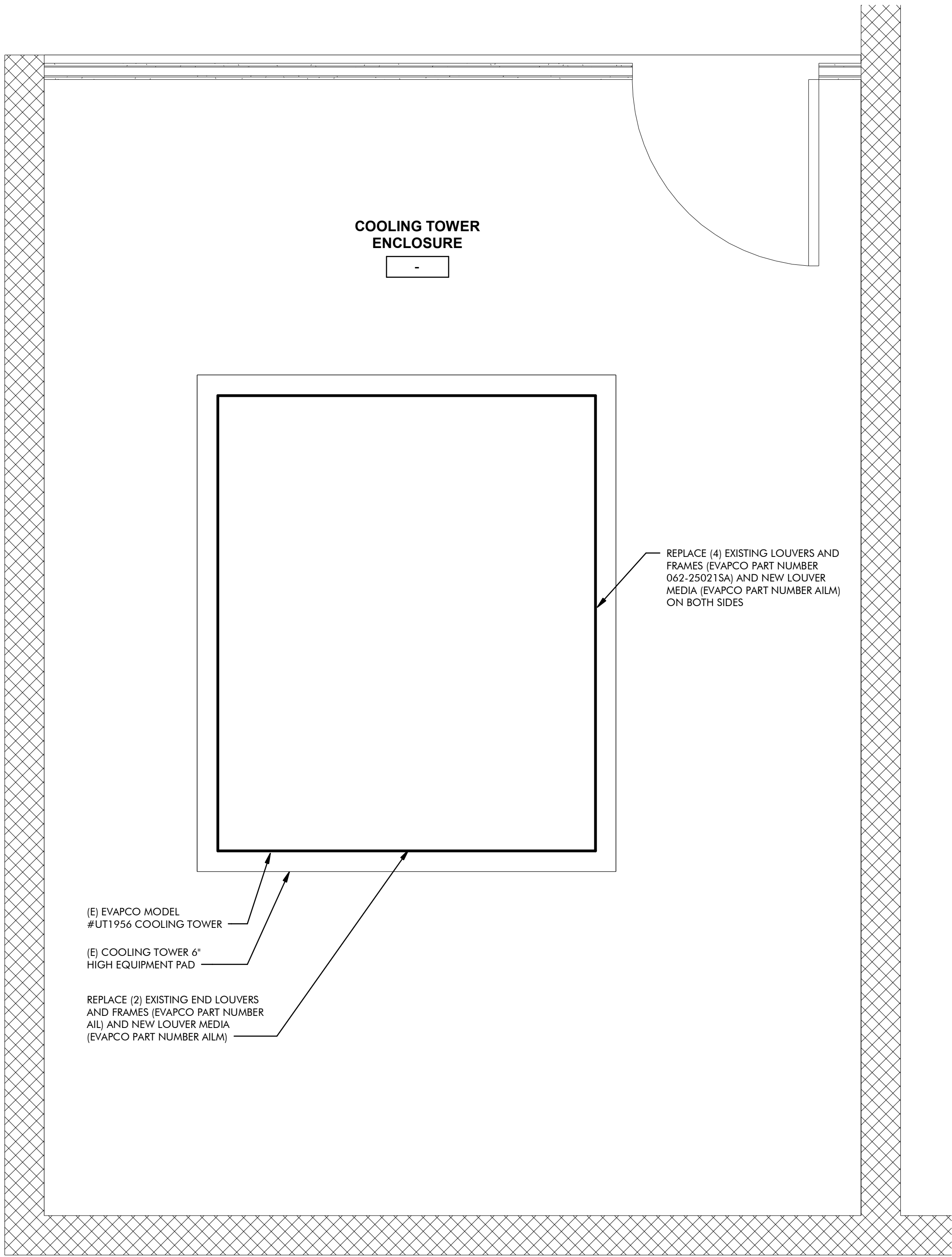
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DRAWN BY: RLT
DESIGNED BY: CL
CHECKED BY: CL
APPROVED BY: CLR
DATE: 1/31/2025
PROJECT NO: 158324

SHEET NUMBER:

T0.1

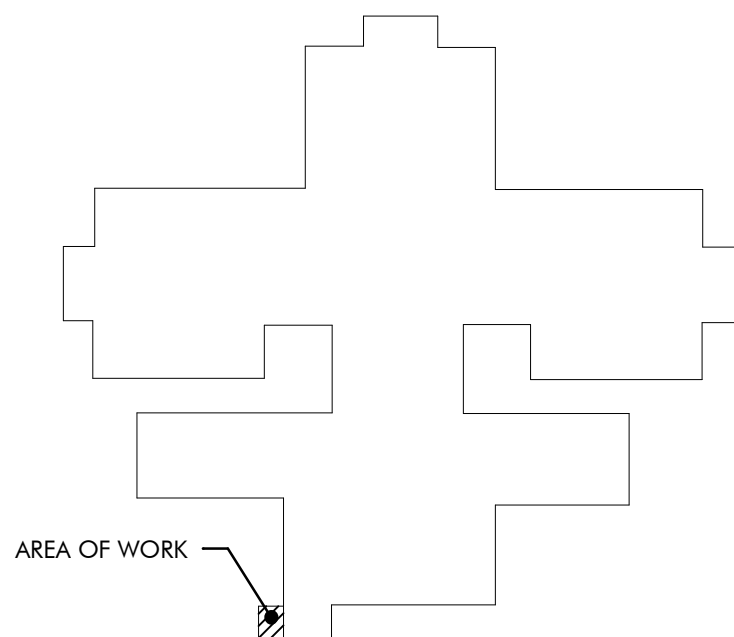
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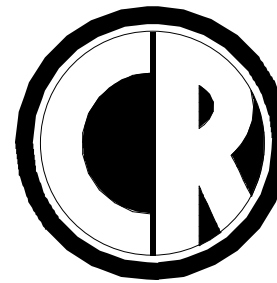
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M2.0

ENLARGED COOLING TOWER MECHANICAL FLOOR PLAN

SCALE: 3/4" = 1'-0"



KEY PLAN

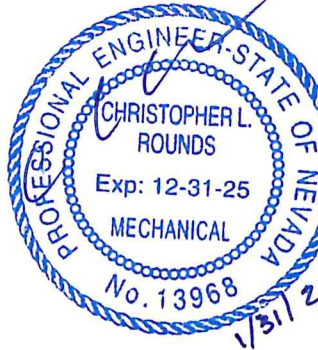


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PIÑON HILLS ELEMENTARY SCHOOL
COOLING TOWER REPAIR
1479 STEPHANIE WAY, MINDEN, NV 89423
MECHANICAL FLOOR PLAN

REVISIONS:

REV.	DESCRIPTION	DATE
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CHECKED BY: CL
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DATE: 1/31/2025
PROJECT NO: 158324

SHEET NUMBER:

M2.0

GEORGE WHITTELL HIGH SCHOOL BOILER REPLACEMENT

240 WARRIOR WAY
ZEPHRY COVE, NV 89448

FOR

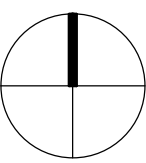
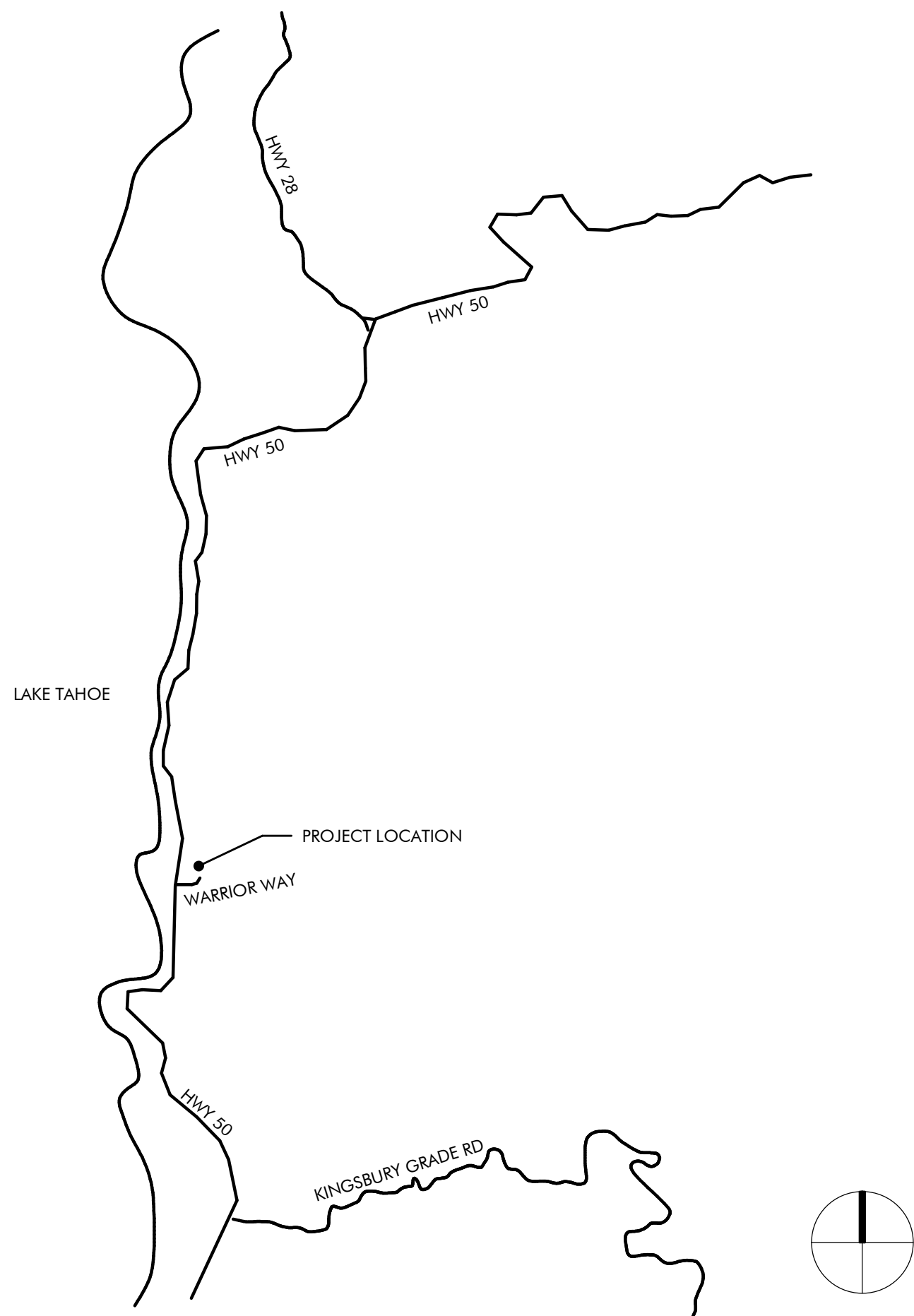
DOUGLAS COUNTY SCHOOL DISTRICT

1126 AIRPORT ROAD, BUILDING E-1
MINDEN, NV 89423
PWP-DO-2025-166



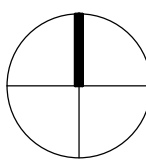
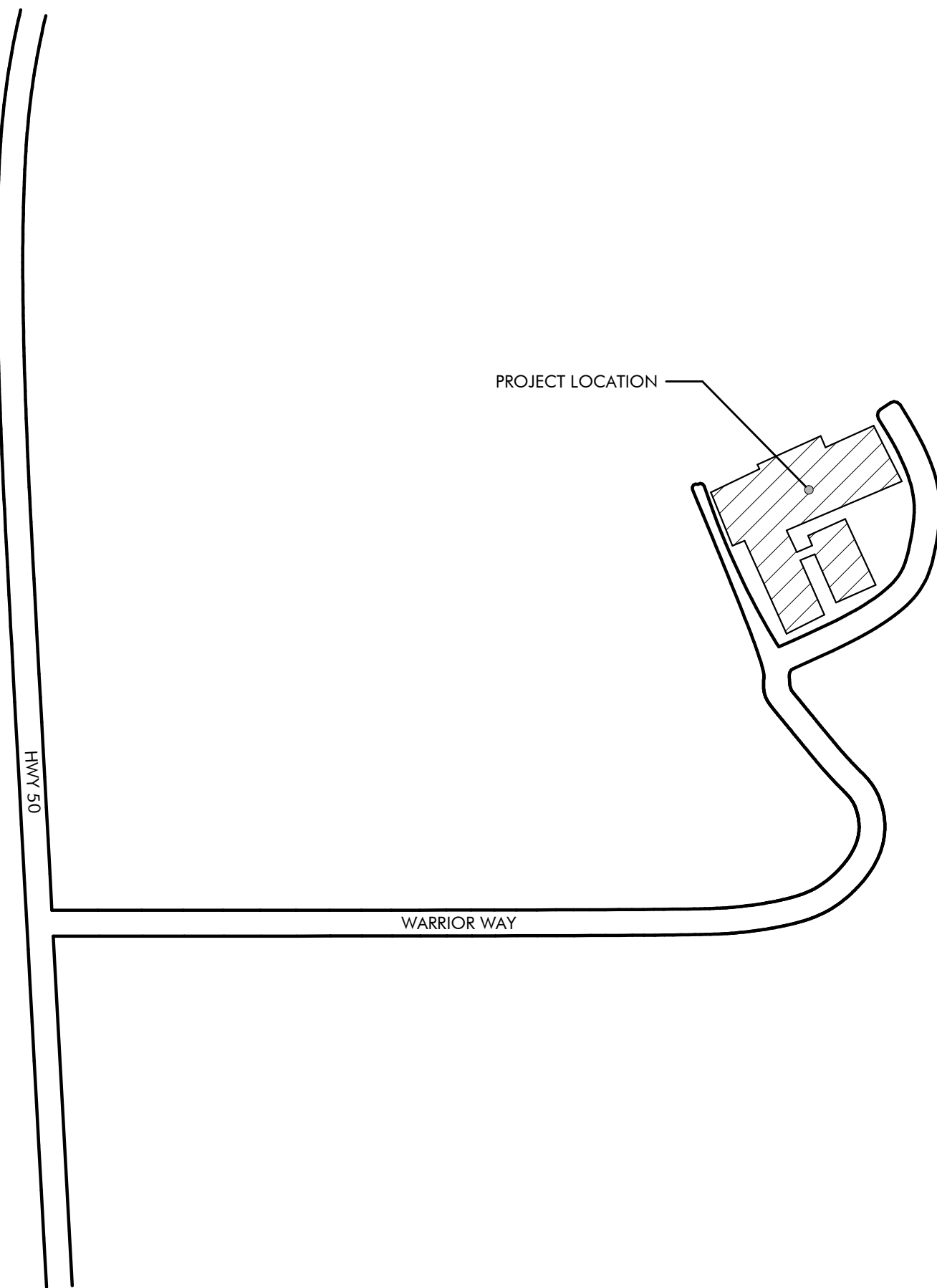
Douglas County
School District

VICINITY MAP



NO SCALE

LOCATION MAP



NO SCALE

DIRECTORY

OWNER

DOUGLAS COUNTY SCHOOL DISTRICT
1126 AIRPORT ROAD, BUILDING E-1
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email: kyle.jensen@jeneng.com web: www.jeneng.com

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SHEET INDEX

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T0.1 TITLE SHEET

MECHANICAL

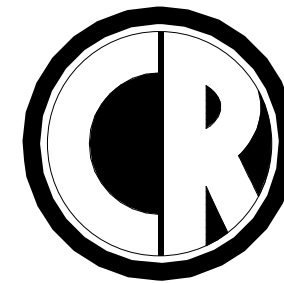
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BUILDING CODES

- 2018 INTERNATIONAL BUILDING CODE
- 2018 INTERNATIONAL FIRE CODE
- 2018 UNIFORM MECHANICAL CODE
- 2018 INTERNATIONAL ENERGY CONSERVATION CODE
- 2018 UNIFORM PLUMBING CODE
- 2017 NATIONAL ELECTRICAL CODE

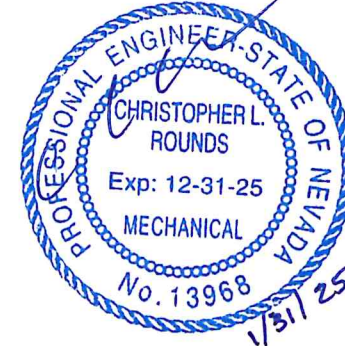


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TITLE SHEET

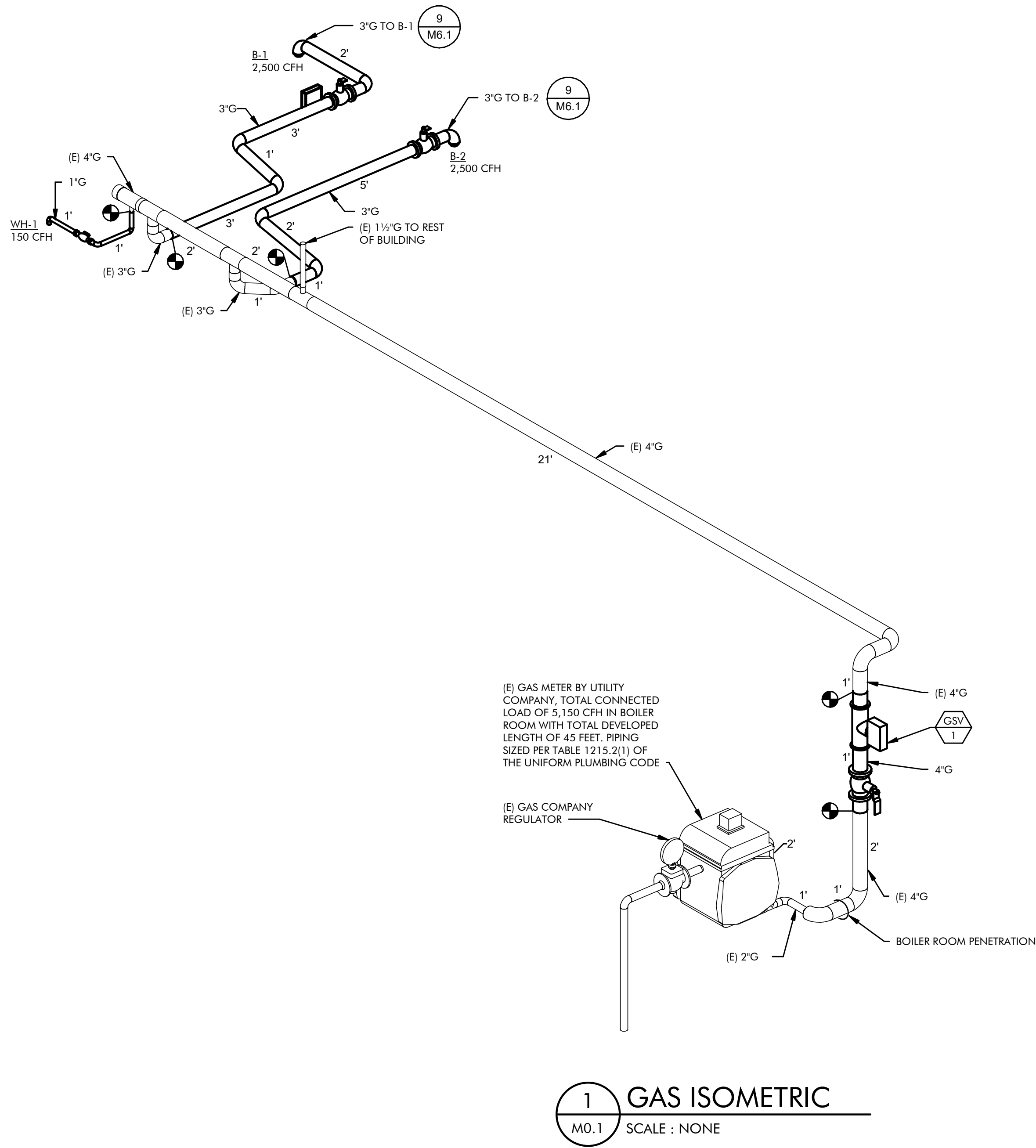
REVISIONS:

REV.	DESCRIPTION	DATE
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DRAWN BY: RL
DESIGNED BY: CL
CHECKED BY: CL
APPROVED BY: CLR
DATE: 1/31/2025
PROJECT NO: 158324

SHEET NUMBER:

T0.1

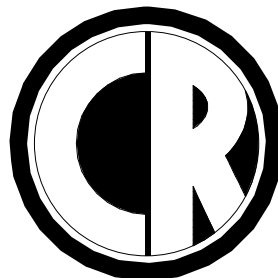


MECHANICAL ABBREVIATIONS

ACFM	ACTUAL CUBIC FEET PER MINUTE
AF	AIR FILTER
AFF/AFG	ABOVE FINISHED FLOOR/GRADE
A	AMPERE
APD	AIR PRESSURE DROP
BFF/BFG	BELOW FINISHED FLOOR/GRADE
BHP	BRAKE HORSEPOWER
BTUH	BRITISH THERMAL UNITS PER HOUR
CFM	CUBIC FEET PER MINUTE
COP	COEFFICIENT OF PERFORMANCE
Cv	VALVE FLOW COEFFICIENT
(D)	DEMOLISH
DB,WB	DRY BULB, WET BULB TEMPERATURE
DG	DOOR GRILLE
DIA	DIAMETER
DN	DOWN
DP	DIFFERENTIAL PRESSURE
(E)	EXISTING
EAT/LAT	ENTERING/LEAVING AIR TEMPERATURE
ESP	EXTERNAL STATIC PRESSURE
EWT/LWT	ENTERING/LEAVING WATER TEMPERATURE
FLA	FULL LOAD AMPERES
FPM	FEET PER MINUTE
FT	FOOT
FT²	SQUARE FOOT
FT³	CUBIC FOOT
GA	GAUGE
GPM	GALLONS PER MINUTE
HP	HORSEPOWER
HZ	HERTZ
IN	INCH
IN²	SQWARE INCH
IN³	CUBIC INCH
KW	KILOWATT
LBS	POUNDS
LRA	LOCKED ROTOR AMPERES
MAX	MAXIMUM
MBH	THOUSAND BRITISH THERMAL UNITS PER HOUR
MCA	MINIMUM CIRCUIT AMPACITY
MIN	MINIMUM
MOCp	MAXIMUM OVERCURRENT PROTECTION
(N)	NEW
PSI	POUNDS PER SQUARE INCH
PSIG	POUNDS PER SQUARE INCH GAUGE
R	REGISTER
RPM	REVOLUTIONS PER MINUTE
TDH	TOTAL DYNAMIC HEAD
TG	TRANSFER GRILLE
TSP	TOTAL STATIC PRESSURE
TYP	TYPICAL
V	VOLTS
W	WATT
WC/WG	WATER COLUMN/GAUGE

MECHANICAL SYMBOL LEGEND

SYMBOL	ABBR.	DESCRIPTION
	SA	SUPPLY AIR
	RA	RETURN AIR
	EA	EXHAUST AIR
	OA	OUTSIDE AIR
		POSITIVE PRESSURE DUCT SECTION - FIRST SIZE IS TOP
		NEGATIVE PRESSURE DUCT SECTION - FIRST SIZE IS TOP
		DUCT SIZE - FIRST SIZE IS SIDE SHOWN
		FLEXIBLE DUCT
		FLEXIBLE DUCT CONNECTOR
	MVD	MANUAL VOLUME DAMPER
	OBD	OPPOSED BLADE DAMPER
		MOTORIZED ACTUATOR
	TSTAT	THERMOSTAT OR TEMPERATURE SENSOR @ 48" AFF
	SW	SIDE WALL DIFFUSER
	BFP	BACKFLOW PREVENTER
	BV	BALL VALVE
	BFV	BUTTERFLY VALVE
	CV	CHECK VALVE
	FCV	FLOW CONTROL (BALANCE) VALVE
	PRV	PRESSURE REDUCING VALVE
	PTRV	PRESSURE AND TEMPERATURE RELIEF VALVE
	TCV	TEMPERATURE CONTROL VALVE (2-WAY OR 3-WAY)
	TDV	TRIPLE DUTY VALVE
	STR	STRAINER
		UNION
		PIPE BREAK
		PIPE CAP OR PLUG
	ELL	PIPE ELBOW
		PIPE ELBOW DOWN
		PIPE ELBOW UP
		PIPE TEE
		PIPE RISER
		PIPE DROP
		PIPE BRANCH, TOP CONNECTION
		PIPE BRANCH, BOTTOM CONNECTION
	FLEX	FLEXIBLE PIPE CONNECTOR
		WATER METER
		PRESSURE SENSOR, TEMPERATURE SENSOR WITH WELL
		PRESSURE GAUGE, TEMPERATURE GAUGE
	P	PUMP
	CHS/CHR	CHILLED WATER SUPPLY/RETURN PIPING
	HWS/HWR	HOT WATER SUPPLY/RETURN PIPING
	D	EQUIPMENT OR CONDENSATE DRAIN PIPING
	CW	DOMESTIC COLD WATER
	DHW	DOMESTIC HOT WATER
	DHWR	DOMESTIC HOT WATER RETURN
	G	NATURAL GAS
	POC	POINT OF CONNECTION
	POC	POINT OF DISCONNECT



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240 WARRIOR WAY, ZEPHYR, NV 89448
MECHANICAL ABBREVIATIONS, LEGEND,
CALCULATIONS, AND GAS ISOMETRICS

REVISIONS:

REV.	DESCRIPTION	DATE
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PLOT DATE:

CONDENSING BOILER SCHEDULE																				
UNIT GENERAL DATA						ELECTRICAL			OUTPUT DATA											UNIT OPTION
	SERVICE	MANUFACTURER	MODEL	OPERATING WEIGHT (LBS)	WATER CONTENT (GALLONS)	VOLTS/Ø/Hz	FLA	MOCP	INPUT (BTUH)	OUTPUT AT ELEVATION (BTUH)	FLUID	FLUID FLOW (GPM)	LWT (°F)	EWT (°F)	MAX WPD (FT WC)	VENT SIZE (IN)	VENT MATERIAL	COMBUSTION AIR SIZE (IN)	COMBUSTION AIR MATERIAL	
1	HEATING HOT WATER SYSTEM	LOCHINVAR	FCB2500	3,500	157	208/3/60	4.5	15	2,500,000	2,050,000	WATER	130	180	150	5	10	UL 1738	10	GALVANIZED	A,B,C,D,E,F,G,H,I,J,K,L,M,N,O,P,Q,R
2	HEATING HOT WATER SYSTEM	LOCHINVAR	FCB2500	3,500	157	208/3/60	4.5	15	2,500,000	2,050,000	WATER	130	180	150	5	10	UL 1738	10	GALVANIZED	A,B,C,D,E,F,G,H,I,J,K,L,M,N,O,P,Q,R
GENERAL NOTES:						OPTIONS/FEATURES:														
1. DESCRIPTION: FULLY MODULATING, STAINLESS STEEL HEAT EXCHANGER, CONDENSING NATURAL GAS FIRED BOILER. 2. OUTPUT IS SHOWN FOR 6,500 FT ELEV. 3. COMBUSTION AIR AND FLUE TO BE SIZED PER MANUFACTURER'S CALCULATION. INDICATED COMBUSTION AIR AND FLUE SIZES ARE SHOWN FOR SPECIFIED BOILER ONLY. CONTRACTOR TO INCLUDE MANUFACTURER'S FLUE AND COMBUSTION AIR CALCULATION WITH SUBMITTALS. 4. SPECIFIED BOILER REQUIRES ALTITUDE DERATE PER THIRD PARTY TESTING IN ACCORDANCE TO ANSI Z21.13. IF SPECIFIED BOILER IS NOT PROVIDED, CONTRACTOR TO PROVIDE LETTER FROM MANUFACTURER INDICATING SUBSTITUTE BOILER HAS BEEN THIRD PARTY TESTED IN ACCORDANCE TO ANSI Z21.13 OR CONTRACTOR IS TO PROVIDE BOILER WITH THE SPECIFIED OUTPUT. LARGER INPUT MAY REQUIRE LARGER GAS PIPING, FLUE, AND COMBUSTION AIR. 5. FLUE MATERIAL TO BE UL1738 COMPLIANT STAINLESS STEEL. COMBUSTION AIR TO BE GALVANIZED SHEET METAL DUCT. PAINT EXTERIOR PORTION OF DUCT TO MATCH BUILDING						A. MODULATING BURNER W/25:1 FIRING TURN DOWN RATIO.					J. CONTACTS ON ANY FAILURE.					R. MANUFACTURER'S FLUE AND COMBUSTION AIR ROOF TERMINATION KIT				
						B. SPARK IGNITION.					K. MANUFACTURER'S CAPSULE TYPE CONDENSATE NEUTRALIZATION KIT.									
						C. ADJUSTABLE HIGH LIMIT AND MANUAL RESET TEMPERATURE CONTROL.					L. FACTORY SYSTEM HEADER SENSOR WITH IMMERSION WELL.									
						D. MANUFACTURER'S LOW-WATER CUTOFF WITH MANUAL RESET, SO THAT BOILER IS COMPLIANT WITH CSD-1 AND NEVADA BOILER CODE.					M. FACTORY TRAINING AND AUTHORIZED START-UP.									
						E. ASME RATED PRESSURE RELIEF VALVE, SET AT 75 PSI.					N. MANUFACTURER' MOTORIZED ISOLATION CONTROL VALVE									
						F. SEQUENTIAL AND DIAGNOSTIC CONTROL PANEL.					O. INTEGRATED BOILER DRAIN VALVE.									
						G. DIGITAL DISPLAY WITH ALARM AND STATUS ON A TOUCH SCREEN.					P. MANUFACTURER'S FLUE DISCHARGE ROOF OUTLET									
						H. VENT MATERIAL SHALL BE UL 1738 COMPLIANT, 444 STAINLESS STEEL					Q. MANUFACTURER'S SEISMIC ANCHORING KIT									
						I. 86% OPERATING THERMAL EFFICIENCY AT 150°F RETURN WATER TEMPERATURE AND 100% INPUT														

VFD SCHEDULE

	EQUIPMENT SERVED	MANUFACTURER	MODEL	ELECTRICAL				OPTIONS
				HP	VOLTS	PHASE	HZ	
1	HWP-1	ABB	ACH580	10	208	3	60	A,B,C,D
2	HWP-2	ABB	ACH580	10	208	3	60	A,B,C,D
GENERAL NOTES:				OPTIONS				
1. ALL DRIVES TO BE SUPPLIED BY CONTROLS CONTRACTOR AND WIRED BY ELECTRICAL CONTRACTOR. CONTROLS CONTRACTOR TO COORDINATE WITH EQUIPMENT MANUFACTURER FOR INSTALLATION AND START-UP REQUIREMENTS				A. MANUFACTURER'S INTERNAL 5% INPUT LINE REACTORS				
				B. PROVIDE AND INSTALL BACNET COMMUNICATION CARDS				
				C. MANUFACTURER'S CIRCUIT BREAKER TYPE DISCONNECT				
2. COORDINATE EXACT LOCATION WITH ELECTRICAL DRAWINGS.				D. MANUFACTURER'S INTERNAL DC LINE CHOKE				

PUMP SCHEDULE

UNIT GENERAL DATA																							
	SERVICE	MANUFACTURER	MODEL	OPERATING WEIGHT (LBS)	SIZE	TYPE	FLOW (GPM)	TDH (FT)	FLUID	IMP. DIA. (IN)	MIN EFF. (%)	SUCTION (IN)	DISCH. (IN)	TRIPLE DUTY VALVE MODEL	TRIPLE DUTY VALVE SIZE (IN)	TRIPLE DUTY PRESS DROP (PSI)	SUCTION DIFFUSER MODEL	FRAME SIZE	MOTOR			UNIT OPTION	
																			HP	FLA	V/Ph/Hz		RPM
HWP-1	HEATING HOT WATER SYSTEM	TACO	2509D	500	3 x 2½	BASE	240	85	WATER	9.5	78	3	2½	N/A	N/A	N/A	SDS40030-5	215T	10	N/A	208/3/60	1,760	A,B,C,D,E
HWP-2	HEATING HOT WATER SYSTEM	TACO	2509D	500	3 x 2½	BASE	240	85	WATER	9.5	78	3	2½	N/A	N/A	N/A	SDS40030-5	215T	10	N/A	208/3/60	1,760	A,B,C,D,E
HWP-B1	B-1	GRUNDFOS	MAGNA 3 80-100	50	N/A	INLINE	130	20	WATER	N/A	75	3	3	MPV	3	3.0	N/A	N/A	1	4.6	208/1/60	3,300	A,B,D
HWP-B2	B-2	GRUNDFOS	MAGNA 3 80-100	50	N/A	INLINE	130	20	WATER	N/A	75	3	3	MPV	3	3.0	N/A	N/A	1	4.6	208/1/60	3,300	A,B,D
INFORMATION FOR BASE MOUNTED PUMPS SCHEDULED ABOVE							INFORMATION FOR BASE MOUNTED PUMPS SCHEDULED ABOVE											OPTIONS FOR PUMPS SCHEDULED ABOVE					
GENERAL							GENERAL											A. ODP PREMIUM EFFICIENCY MOTOR					
1. DESCRIPTION: MAINTENANCE FREE, BASE MOUNTED, END SUCTION, CAST IRON CENTRIFUGAL PUMP.							1. DESCRIPTION: MAINTENANCE FREE, INLINE, CLOSE COUPLED, VERTICAL OR HORIZONTAL POSITION, CAST IRON CENTRIFUGAL PUMP											B. PROVIDE WITH TWIN CITY HOSE (OR APPROVED EQUAL) STAINLESS STEEL FLEX CONNECTOR.					
PUMP							PUMP											C. PUMPS TO BE LASER ALIGNED BY MANUFACTURERS REPRESENTATIVE. PROVIDE REPORT WITH CLOSE OUT DOCUMENT.					
1. PUMP VOLUTE SHALL BE CLASS 30 CAST IRON.							1. PUMP SHALL BE CLASS 30 CAST IRON WITH FLANGE CONNECTIONS.											D. TUNGSTEN CARBIDE OR SILICONE CARBIDE SEAL, SUITABLE FOR USE IN GLYCOL SYSTEMS.					
2. BEARING HOUSING ASSEMBLY SHALL HAVE REGREASABLE BALL BEARINGS.							2. IMPELLER SHALL BE CAST BRONZE, DYNAMICALLY BALANCED, KEYED TO SHAFT, AND SECURED BY A LOCKING CAPSCREW.											E. PROVIDE AND INSTALL AEGIS SHAFT GROUNDING RINGS					
3. IMPELLER SHALL BE CAST BRONZE, DYNAMICALLY BALANCED, KEYED TO SHAFT, AND SECURED BY A LOCKING CAPSCREW.							MOTOR																
MOTOR							1. TOTALLY ENCLOSED FAN COOLED (TEFC) FOR OUTDOOR APPLICATION																
1. PREMIUM EFFICIENCY.							2. MOTOR SHALL MEET NEMA SPECIFICATIONS AND BE NON-OVERLOADING FOR ENTIRE PUMP CURVE.																
2. MOTOR SHALL MEET NEMA SPECIFICATIONS AND BE NON-OVERLOADING FOR ENTIRE PUMP CURVE.							3. MOTOR SHALL BE INVERTER-DUTY																

EQUIPMENT SCHEDULE

	BACKFLOW PREVENTER WILKINS 1" LEAD-FREE REDUCED PRESSURE PRINCIPLE BACKFLOW ASSEMBLY MODEL #975XL-U (OR APPROVED EQUAL) WITH 1" AIR GAP ASSEMBLY AND UNION LEAD-FREE BALL VALVES. THE VALVE SHALL BE LEAD-FREE BRONZE MAIN BODY, BRONZE ACCESS COVER, SEAT RINGS AND ALL INTERNAL POLYMERS SHALL BE NSF RATED, AND SEAT DISC ELASTOMERS SHALL BE SILICONE. THE ASSEMBLY SHALL BE RATED TO 180°F AND SUPPLIED WITH FULL PORT BALL VALVES. THE CHECK VALVE SHALL BE ACCESSIBLE FOR MAINTENANCE WITHOUT REMOVING THE PRESSURE RELIEF VALVE. AIR GAP SHALL BE INCLUDED IN INSTALLATION. ASSEMBLY MUST BE APPROVED BY FOUNDATION FOR CROSS-CONNECTION CONTROL AND HYDRAULIC RESEARCH AT THE UNIVERSITY OF SOUTHERN CALIFORNIA. BACKFLOW PREVENTER SHALL BE NSF-61"LEAD FREE" COMPLIANT.
	CHEMICAL FEED TANK NU-CALGON MODEL 20L (OR APPROVED EQUAL) FLAT BOTTOM, MILD STEEL, 2-GALLON CHEMICAL FEEDER WITH 3/4" QUARTER-TURN CAP AND 3/4" NPT PORTS. PROVIDE AND INSTALL MANUFACTURER'S FLOW INDICATOR AND FILTER. PROVIDE WITH MANUFACTURER'S WALL BRACKET.
	DOMESTIC CIRCULATOR PUMP TACO MODEL 00346-SF2 LOW-LEAD STAINLESS CASING CIRCULATOR PUMP WITH EC MOTOR. INCLUDE WITH MANUFACTURER'S AQUASTAT AND TIME CLOCK. MAXIMUM WORKING PRESSURE OF 125 PSI. PUMP SELECTED FOR 5 GPM AT 20 FEET TDH. PUMP IS UL LISTED AND CSA APPROVED. ELECTRICAL: 115V/1Ø/60Hz, 1/40 HP, 0.52 A, AND 3,250 RPM.
	GAS SHUT-OFF VALVE WIS MODEL WVM54-120 (OR APPROVED EQUAL) NORMALLY CLOSED, POWERED OPEN GAS SHUT OFF VALVE. VALVE TO BE CONSTRUCTED OF CAST ALUMINUM WITH STAINLESS STEEL CORES AND SPRINGS. VALVE TO BE CSA CERTIFIED AND UL LISTED FOR NATURAL GAS USE. VALVE TO BE 4". ELECTRICAL: 120V/1/60, FLA: 1.0 A
	PRESSURE REDUCING VALVE WILKINS MODEL 500XL3-DU-G (OR APPROVED EQUAL) 1" PRESSURE REDUCING VALVE WITH DOUBLE UNION AND TAPPED AND PLUGGED WITH GAUGE. VALVE SHALL BE LEAD-FREE BRONZE BODY WITH PRESSURE GAUGE BEFORE AND AFTER VALVE. SEE PIPING DIAGRAM FOR OUTLET PRESSURE SETTING.
	WATER HEATER LOCHINVAR CONDENSING COMMERCIAL GAS WATER HEATER MODEL #51WA150N (OR APPROVED EQUAL). HEATER SHALL HAVE AN INPUT OF 150,000 BTUH, AND A MINIMUM RECOVERY OF 175 GPH AT 100°F TEMPERATURE RISE. TANK SHALL BE 90 GALLONS WITH NON-CFC FOAM INSULATION, GLASS LINED STEEL TANK, AND STAINLESS STEEL HEAT EXCHANGER. PROVIDE COMPLETE WITH ELECTRONIC CONTROLS, MAGNESIUM ANODE ROD, DIELECTRIC FITTINGS, BRASS DRAIN VALVE, TRIPLE PASS FLUE SYSTEM, HAND HOLE CLEAN OUT, BUILT-IN POWER CORD, AND RELIEF VALVE. SET THERMOSTAT AT 120°F. UNIT SHALL HAVE A MINIMUM EFFICIENCY OF 96.0%. WATER HEATER SHALL HAVE 5 TO 1 MODULATION. PROVIDE AND INSTALL POLYPROPYLENE MANUFACTURER'S CONCENTRIC VENT KIT, LOW WATER CUT-OFF, AND MANUFACTURER'S CONDENSATE NEUTRALIZATION KIT. WT: 2,000 LBS ELEC: 120V/1Ø/60Hz
	WATER METER SEAMETRICS MODEL MUNR-100-16-07 (OR APPROVED EQUAL) BRASS WATER METER WITH REED SWITCH WITH 1 GALLON PER PULSE. PROVIDE AND INSTALL MANUFACTURER'S CONTROL CONNECTOR.

AIR/DIRT SEPARATOR SCHEDULE

UNIT GENERAL DATA					FLOW DATA						
	SERVICE	MANUFACTURER	MODEL	OPERATING WEIGHT (LBS)	OPERATING FLOW (GPM)	MAXIMUM FLOW (GPM)	PRESS. DROP (FT WC)	INLET (IN)	OUTLET (IN)	OPTIONS	
1	HEATING HOT WATER	TACO	4905ADM-125	325	250	306	5	5	5	A	
GENERAL NOTES:			CONSTRUCTION				OPTIONS				
1. DESCRIPTION: COALESCING TYPE AIR ELIMINATOR			1. SHELL SHALL BE CONSTRUCTED OF EPOXY COATED STEEL.				A. MANUFACTURERS ON/OFF MAGNETIC CONTROLS				
DESIGN PRESSURE AND TEMPERATURE			2. UNIT SHALL HAVE AN AUTOMATIC AIR VENT AT THE TOP OF THE SHELL.								
1. AIR/DIRT SEPARATOR SHALL BE RATED FOR 125 PSIG @ 250°F			3. COALESCING MEDIUM SHALL BE STAINLESS STEEL.								
2. UNIT SHALL BE ASME STAMPED			4. UNIT SHALL HAVE A BLOW DOWN VALVE AND SKIM VALVE.								

EXPANSION TANK SCHEDULE

UNIT GENERAL DATA														
ET ~	SERVICE	MANUFACTURER	MODEL	OPERATING WEIGHT (LBS)	TANK VOLUME (GALLONS)	MINIMUM ACCEPT. VOLUME (GALLONS)	OPERATING PRESSURE (PSI)			OPERATING TEMP (°F)		ESTIMATED SYSTEM VOLUME (GALLONS)	OPTIONS	
							MIN	MAX	ATM	MIN	MAX			
1	HEATING HOT WATER	TACO	CA300-125	1,000	79	40	20	60	12.5	40	200	850	A,B	
2	DOMESTIC HOT WATER	AMTROL	ST-12C-DD	75	6.4	3	10	40	12.5	40	150	N/A		
GENERAL NOTES (HEATING HOT WATER):				DESIGN PRESSURE AND TEMPERATURE						OPTIONS				
1. HEATING HOT WATER EXPANSION TANK TO BE REMOVABLE BLADDER TYPE, PRE-CHARGED, THERMAL EXPANSION TANK FOR HYDRONIC SYSTEMS.				1. UNIT TO BE DESIGNED FOR 150 PSI WORKING PRESSURE AND 240°F WORKING TEMPERATURE.						A. MANUFACTURER'S SIGHT GLASS				
				BLADDER						B. MANUFACTURER'S ANCHOR CLIP				
GENERAL NOTES (DOMESTIC HOT WATER):				1. REMOVABLE HEAVY BUTYL RUBBER BLADDER.										
1. DOMESTIC HOT WATER EXPANSION TANK TO BE REMOVABLE BLADDER TYPE, PRE-CHARGED, THERMAL EXPANSION TANK FOR DOMESTIC POTABLE SYSTEMS. TO BE NSF-61 RATED.				TANK										
CONSTRUCTION														
1. TANK SHALL BE CONSTRUCTED IN ACCORDANCE WITH SECTION VII OF THE ASME BOILER AND PRESSURE VESSEL CODE AND STAMPED 150 PSI WORKING PRESSURE.														

COMcheck Software Version COMcheckWeb
Mechanical Compliance Certificate

Project Information
Energy Code: 2018 IECC
Project Title: 158324 George Whittell HS
Location: Minden, Nevada
Climate Zone: 5b
Project Type: Alteration

Construction Site: 240 Warrior Way
Zephyr, NV 89448
Owner/Agent: Phil Demus
Douglas County School District
1126 Airport Road, E-1
Minden, NV 89423
Designer/Contractor: Chris Rounds, P.E.
CR Engineering
5434 Longley Ln
Reno, NV 89511

Mechanical Systems List
Quantity/System Type & Description
1 B-1:
Heating: Hot Water Boiler, Capacity 2500 kWh, Gas
Proposed Efficiency: 82.00 % Ec, Required Efficiency: 82.00 % Ec
1 B-2:
Heating: Hot Water Boiler, Capacity 2500 kWh, Gas
Proposed Efficiency: 82.00 % Ec, Required Efficiency: 82.00 % Ec
1 WH-1:
Gas Storage Water Heater, Capacity: 50 gallons, Input Rating: 150 kWh/h w/ Circulation Pump
Proposed Efficiency: 35.00 % Ec, Required Efficiency: 35.00 % Ec

Mechanical Compliance Statement
Compliance Statement: The proposed mechanical alteration project represented in this document is consistent with the building plans, specifications, and other calculations submitted with this permit application. The proposed mechanical systems have been designed to meet the 2018 IECC requirements in COMcheck Version COMcheckWeb and to comply with any applicable mandatory requirements listed in the Inspection Checklist.

CHRIS ROUNDS, P.E.
Name - Title Signature 1/31/2025
Date

COMcheck Software Version COMcheckWeb
Inspection Checklist
Energy Code: 2018 IECC

Requirements: 0.0% were addressed directly in the COMcheck software
Text in the "Comments/Assumptions" column is provided by the user in the COMcheck Requirements screen. For each requirement, the user certifies that a code requirement will be met and how that is documented, or that an exception is being claimed. Where compliance is itemized in a separate table, a reference to that table is provided.

Section # & Req.ID	Plan Review	Complies?	Comments/Assumptions
C103.2 (PR2) ¹	Plans, specifications, and/or calculations provide all information with which compliance can be determined for the mechanical systems and equipment and document where exceptions to the standard are claimed. Load calculations per acceptable engineering standards and handbooks.	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	
C103.2 (PR3) ¹	Plans, specifications, and/or calculations provide all information with which compliance can be determined for the service water heating systems and equipment and document where exceptions to the standard are claimed. Hot water system sized per manufacturer's rating guide.	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	

Additional Comments/Assumptions:

Section # & Req.ID	Footing / Foundation Inspection	Complies?	Comments/Assumptions
C403.12.2 (F03) ¹	Snow/ice melting system and freeze protection systems have sensors and controls configured to limit service for pavement temperature and outdoor temperature. Future connection to controls.	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	

Additional Comments/Assumptions:

Section # & Req.ID	Plumbing Rough-In Inspection	Complies?	Comments/Assumptions
C404.5, C404.5.1, C404.5.2 (PL) ¹	Heated water supply piping conforms to pipe length and volume requirements. Refer to section details.	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	
C404.6.1, C404.6.2 (PL3) ¹	Automatic time switches installed to automatically switch off the recirculating hot-water system or heat trace.	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	
C404.6.3 (PL7) ¹	Pumps that circulate water between a heater and storage tank have controls that limit operation from startup to <= 5 minutes after end of heating cycle.	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	
C404.7 (PL8) ¹	Demand recirculation water systems have controls that start the pump upon receiving a signal from the action of a user of a fixture or appliance and limits the temperature of the water entering the cold-water piping to 104°F.	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	

Additional Comments/Assumptions:

Section # & Req.ID	Mechanical Rough-In Inspection	Complies?	Comments/Assumptions
C402.2.6 (ME41) ¹	Thermally ineffective panel surfaces of sensible heating panels have insulation >= R-5.	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	
C403.12.1 (ME11) ¹	Systems that heat outside the building envelope are radiant heat systems controlled by an occupancy sensing device or timer switch.	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	
C403.2.2 (ME53) ¹	Natural or mechanical ventilation is provided in accordance with International Mechanical Code Chapter 4. Mechanical ventilation has capability to reduce outdoor air supply to minimum per IMC Chapter 4.	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	
C403.7.1 (ME3) ¹	Demand control ventilation provided for spaces >500 ft2 and >25 people/1000 ft2 occupant density and served by systems with air side economizer, auto modulating outside air damper control, or design airflow >3,000 cfm.	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	
C403.7.3 (ME115) ¹	Enclosed parking garage ventilation has automatic contaminant detection and capacity to stage or modulate fans to 50% or less of design capacity.	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	
C403.7.6 (ME141) ¹	HVAC systems serving guestrooms in Group R-1 buildings with > 50 guestrooms. Each guestroom is provided with controls that automatically manage temperature setpoint and ventilation. (See sections C403.7.6.1 and C403.7.6.2).	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	
C403.7.4 (ME57) ¹	Exhaust air energy recovery on systems meeting Table C403.7.4(1) and C403.7.4(2).	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	
C403.7.5 (ME145) ¹	Kitchen exhaust systems comply with replacement air and condition supply air limitations, and satisfy hood rating requirements and maximum exhaust rate criteria.	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	
C403.11.1 (ME60) ¹	HVAC ducts and plenums insulated in accordance with C403.11.1 and C403.11.2, verification may need to occur during Foundation Inspection.	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	
C403.4.3 (ME63) ¹	The heating of fluids in hydronic systems that have been previously mechanically cooled, and the cooling of fluids that have been previously mechanically heated are limited in accordance with Sections C403.4.3.1-C403.4.3.3. Single boiler systems >500,000 Btu/h have multistaged or modulating burner.	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	
C403.4.4 (ME68) ¹	Hydronic systems greater than 200,000 Btu/h designed for variable fluid flow. See section language for full details.	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	

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Section # & Req.ID	Mechanical Rough-In Inspection	Complies?	Comments/Assumptions
C403.3.4 (ME107) ¹	System shutdown requirement met through multiple single-input boilers, one or more modulating boilers, or a combination of single-input and modulating boilers. Boiler input between 1.0 MBtu/h and 5 MBtu/h has 2:1 turndown ratio, boiler input between 5.0 MBtu/h and 10 MBtu/h has 4:1 turndown ratio, boiler input > 10.0 MBtu/h has 5:1 turndown ratio.	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	See the Mechanical Systems list for values.
C403.4.1.1 (ME65) ¹	Heating for vestibules and air curtains with integral heating include automatic control that shut off the heating system when outdoor air temperatures > 45°F. Vestibule heating and cooling systems controlled by a thermostat in the vestibule with heating setpoint <= 60°F and cooling setpoint >= 80°F.	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	
C404.2.1 (ME111) ¹	One-fired water-heating equipment installed in new buildings where a singular piece of water-heating equipment >= 1,000 kWh serves the entire building, thermal efficiency >= 30 ft. Where multiple pieces of water-heating equipment serve the building with combined rating >= 1,000 kWh, the combined input-capacity-weighted-average thermal efficiency >= 30 ft. Exclude input rating of equipment in individual dwelling units and equipment <= 100 kWh.	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	
C408.2.2.1 (ME53) ¹	Air outlets and zone terminal devices have means for air balancing.	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	
C403.5.1, C403.5.2 (ME120) ¹	Refrigerated display cases, walk-in coolers or walk-in freezers served by remote compressors and remote condensers not located in a condensing unit, have fan-powered condensers that comply with Sections C403.5.1 and refrigeration compressor systems that comply with C403.5.2.	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	

Additional Comments/Assumptions:

Section # & Req.ID	Rough-In Electrical Inspection	Complies?	Comments/Assumptions
C405.6 (EL24) ¹	Low-voltage dry-type distribution electric transformers meet the minimum efficiency requirements of Table C405.6.	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	
C405.7 (EL27) ¹	Electric motors meet the minimum efficiency requirements of Tables C405.7(1) through C405.7(4). Efficiency verified through certification under an approved certification program or the equipment efficiency ratings shall be provided by motor manufacturer (where certification programs do not exist).	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	
C405.8.2, C405.8.2.1 (EL28) ¹	Escalators and moving walks comply with ASME A17.1/CSA B44 and have automatic controls configured to reduce speed to the minimum permitted speed in accordance with ASME A17.1/CSA B44 or applicable local code when not conveying passengers.	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	
C405.9 (EL29) ¹	Total voltage drop across the combination of feeders and branch circuits <= 5%.	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	

Additional Comments/Assumptions:

Section # & Req.ID	Final Inspection	Complies?	Comments/Assumptions
C403.3, C408.2.5 (F18) ¹	Furnished O&M manuals for HVAC systems within 30 days of system acceptance.	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	
C403.2.2 (F127) ¹	HVAC systems and equipment capacity does not exceed calculated loads.	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	
C403.4.1.1 (F138) ¹	Thermostatic controls have a 5 °F deadband.	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	
C403.2.4.1.3 (F120) ¹	Temperature controls have setpoint override restrictions.	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	
C403.2.4.2 (F133) ¹	Each zone equipped with setback controls using automatic time clock or programmable control system.	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	
C403.2.4.2.1, C403.2.4.2.2 (F140) ¹	Automatic Controls: Setback to 55°F (heat) and 55°F (cool); 7-day clock, 2-hour occupant override, 10-hour backup.	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	
C404.3 (F111) ¹	Heat traps installed on supply and discharge piping of non-circulating systems.	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	
C404.4 (F125) ¹	All piping insulated in accordance with section details and Table C403.11.3.	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	
C404.6.1 (F112) ¹	Controls are installed that limit the operation of a recirculation pump installed to maintain temperature of a storage tank. System return pipe is a dedicated return pipe or a cold water supply pipe.	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	
C408.1.1 (F157) ¹	Building operations and maintenance documents will be provided to the owner. Documents will cover manufacturers' information, specifications, programming procedures and means of illustrating to owner how building equipment and systems are intended to be installed, maintained, and operated.	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	
C408.2.1.1 (F128) ¹	Commissioning plan developed by registered design professional or approved agency.	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	

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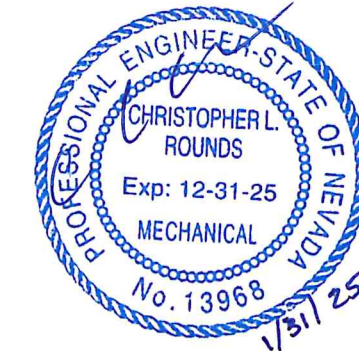
Section # & Req.ID	Final Inspection	Complies?	Comments/Assumptions
C408.2.3 (F110) ¹	HVAC equipment has been tested to ensure proper operation.	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	
C408.2.3 (F110) ¹	HVAC control systems have been tested to ensure proper operation, calibration and adjustment of controls.	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	
C408.2.4 (F123) ¹	Preliminary commissioning report completed and certified by registered design professional or approved agency.	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	
C408.2.5.1 (F17) ¹	Furnished HVAC as-built drawings submitted within 30 days of system acceptance.	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	
C408.2.5.3 (F143) ¹	An air and/or hydronic system balancing report is provided for HVAC systems.	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	
C408.2.5.4 (F130) ¹	Final commissioning report due to building owner within 30 days of receipt of certificate of occupancy.	☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable	

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MECHANICAL COMPLIANCE CERTIFICATE

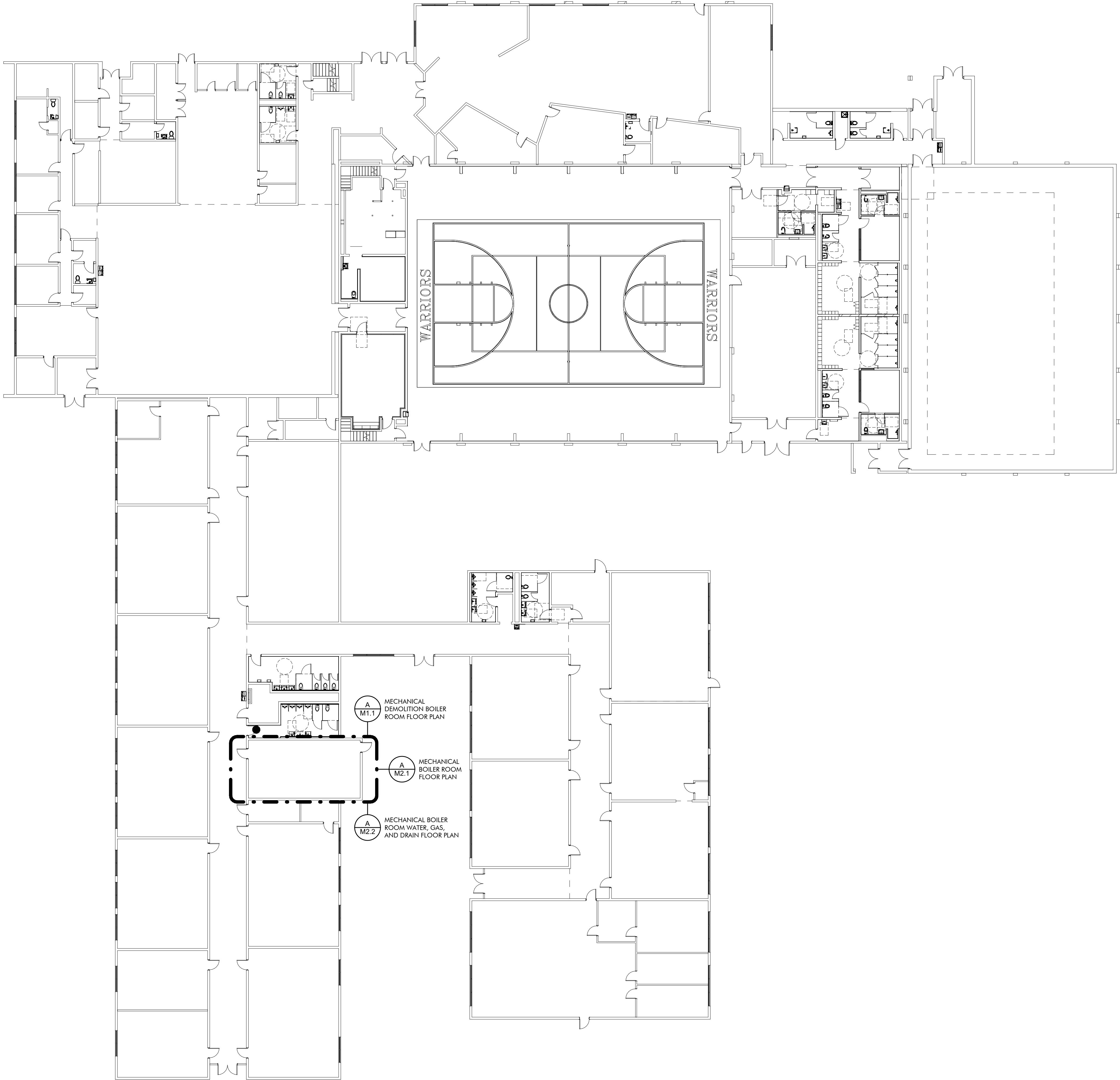
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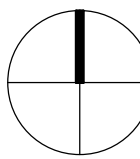
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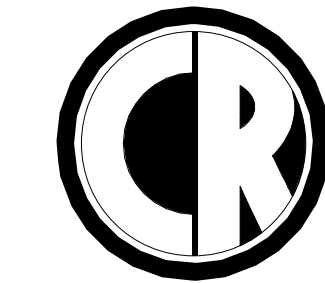
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 **A** MECHANICAL OVERALL FLOOR PLAN
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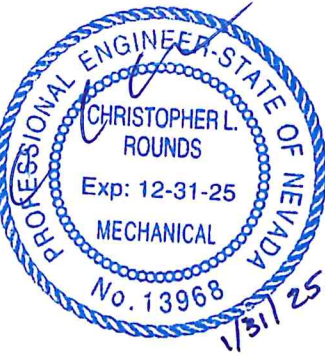


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OVERALL MECHANICAL FLOOR PLAN

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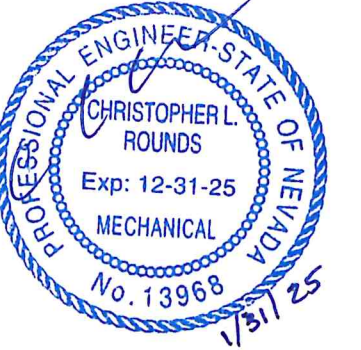
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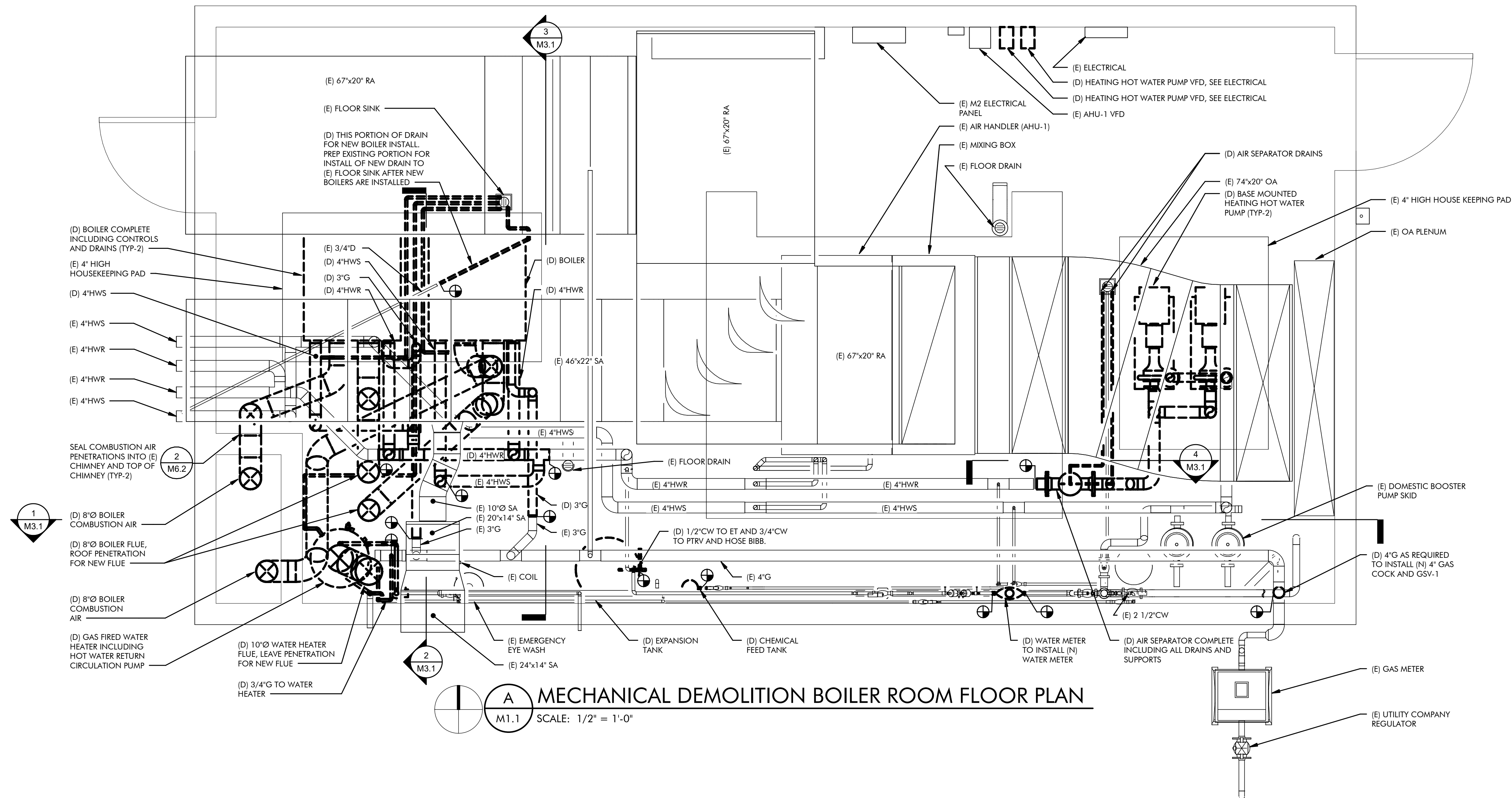
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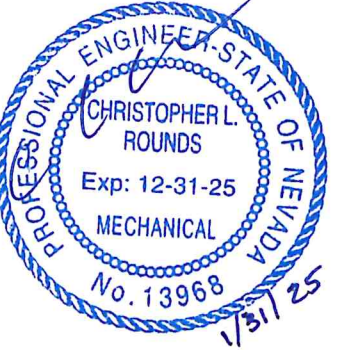
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ENLARGED BOILER ROOM MECHANICAL
FLOOR PLAN

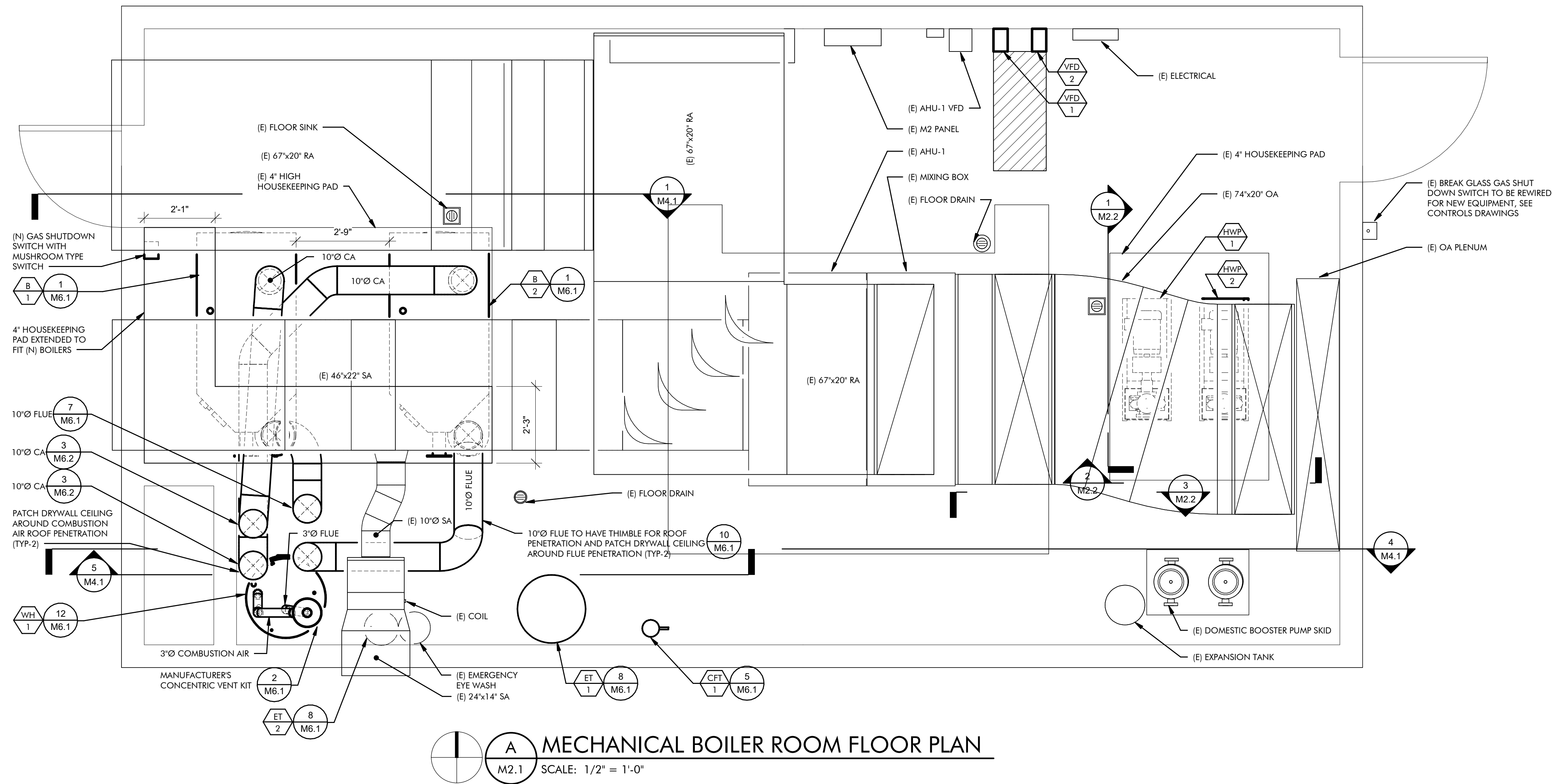
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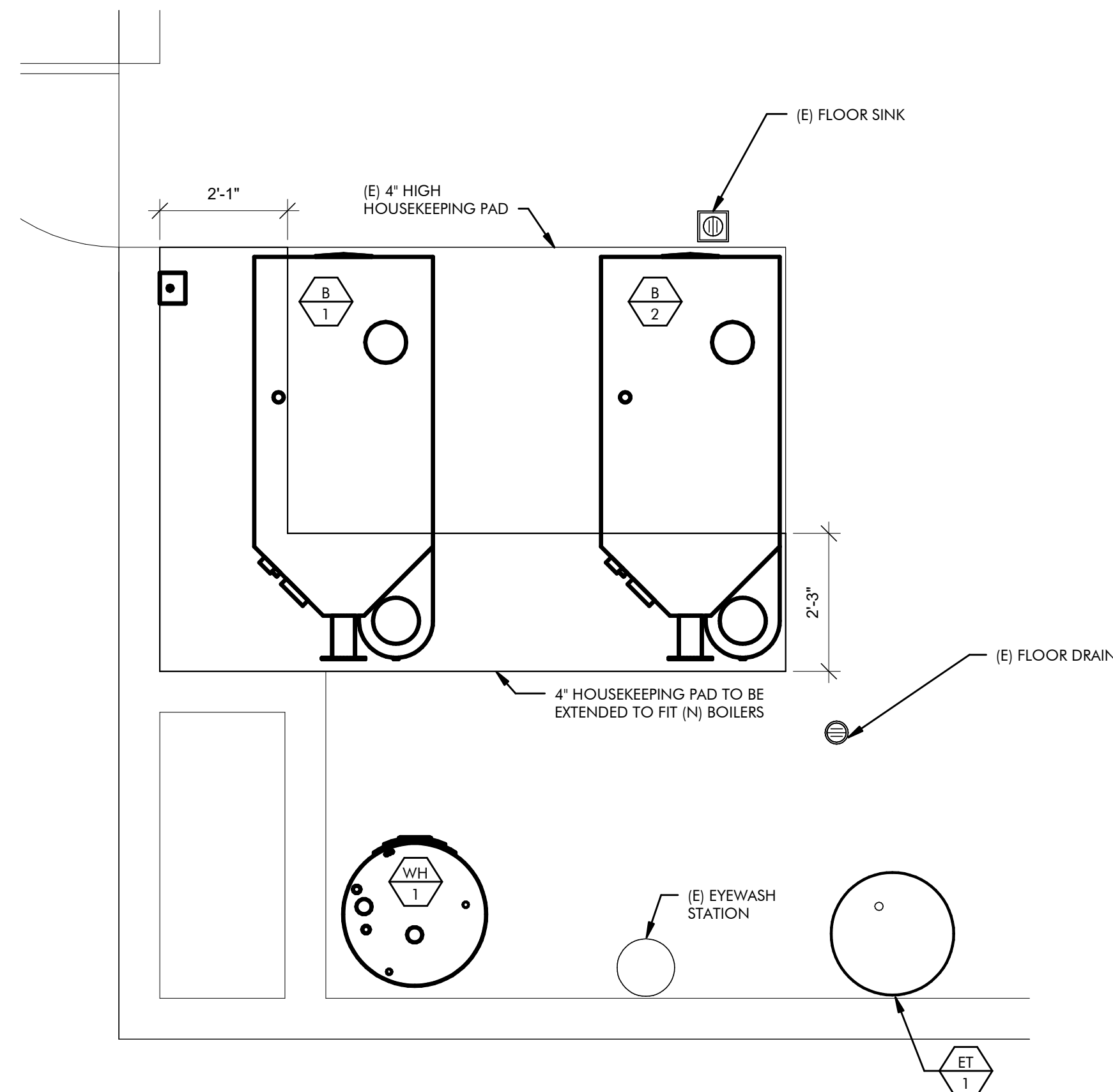
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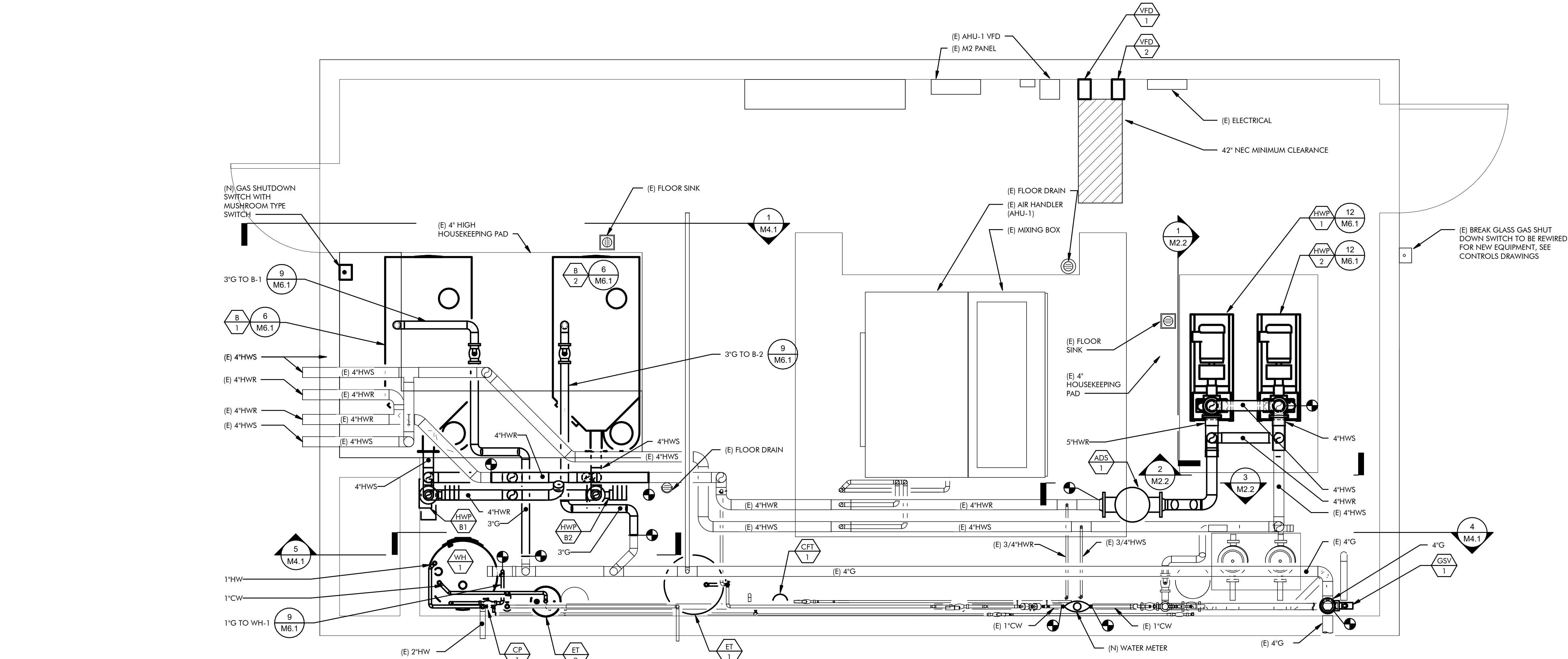
MECHANICAL BOILER ROOM FLOOR PLAN



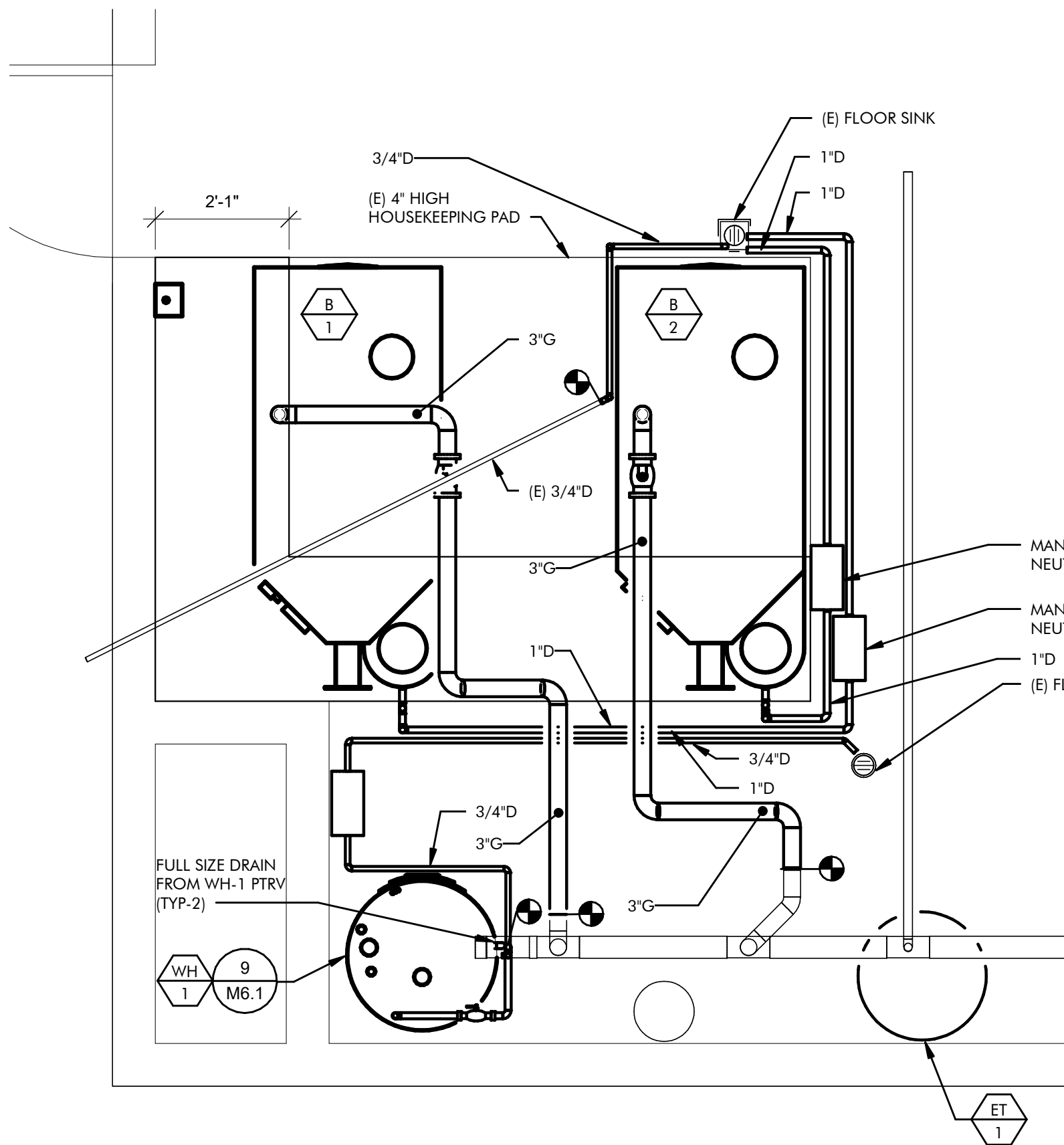
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PLOT DATE:

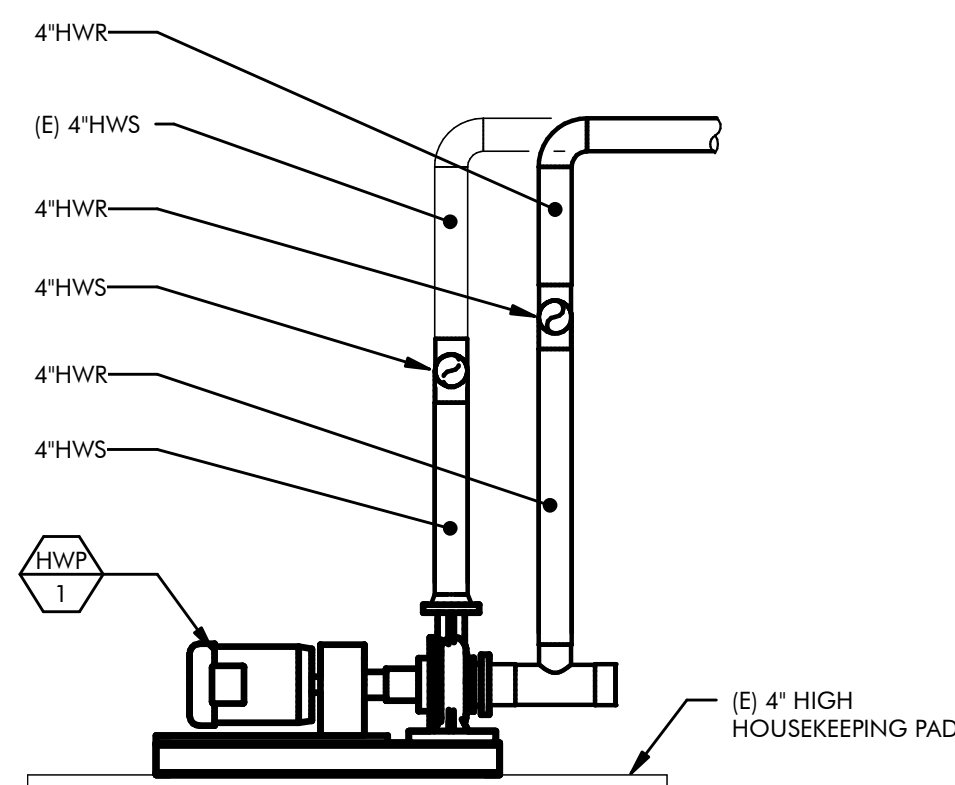
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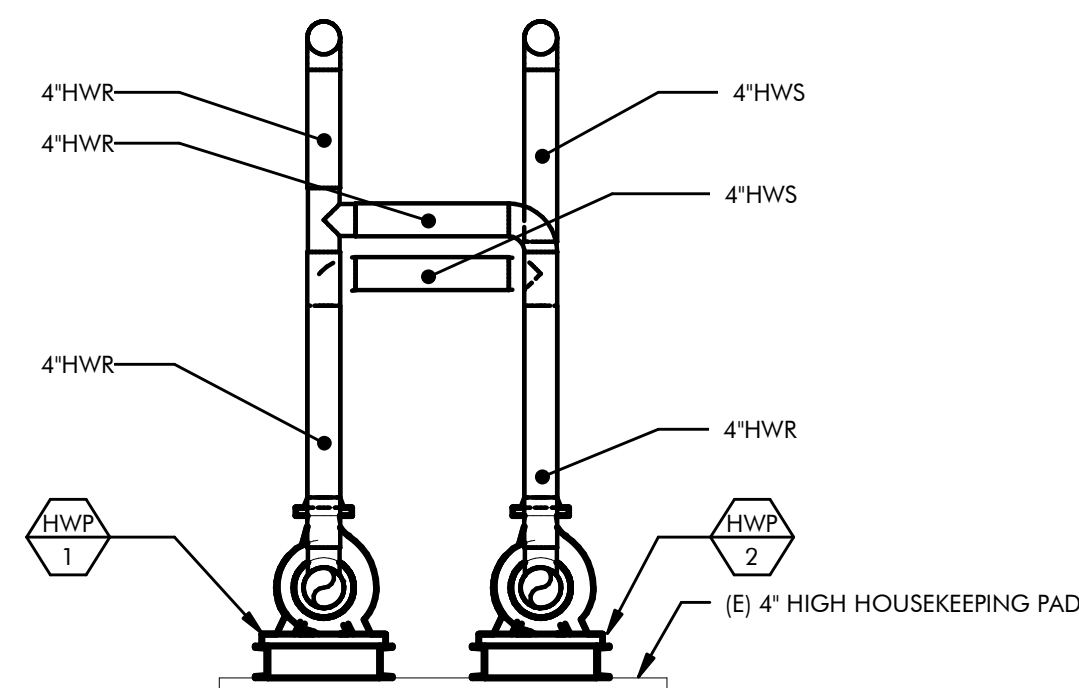
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M2.2 SCALE: 1/2" = 1'-0"



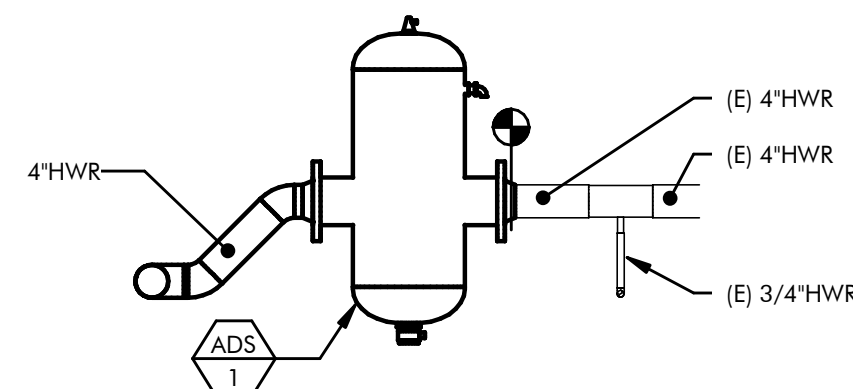
B MECHANICAL BOILER ROOM GAS & DRAIN FLOOR PLAN
M2.2 SCALE: 1/2" = 1'-0"



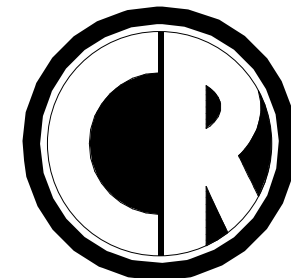
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3 NEW AIR DIRT SEPARATOR SECTION
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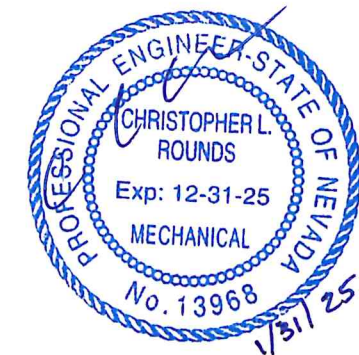


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ENLARGED BOILER ROOM MECHANICAL
PIPING FLOOR PLANS AND SECTIONS

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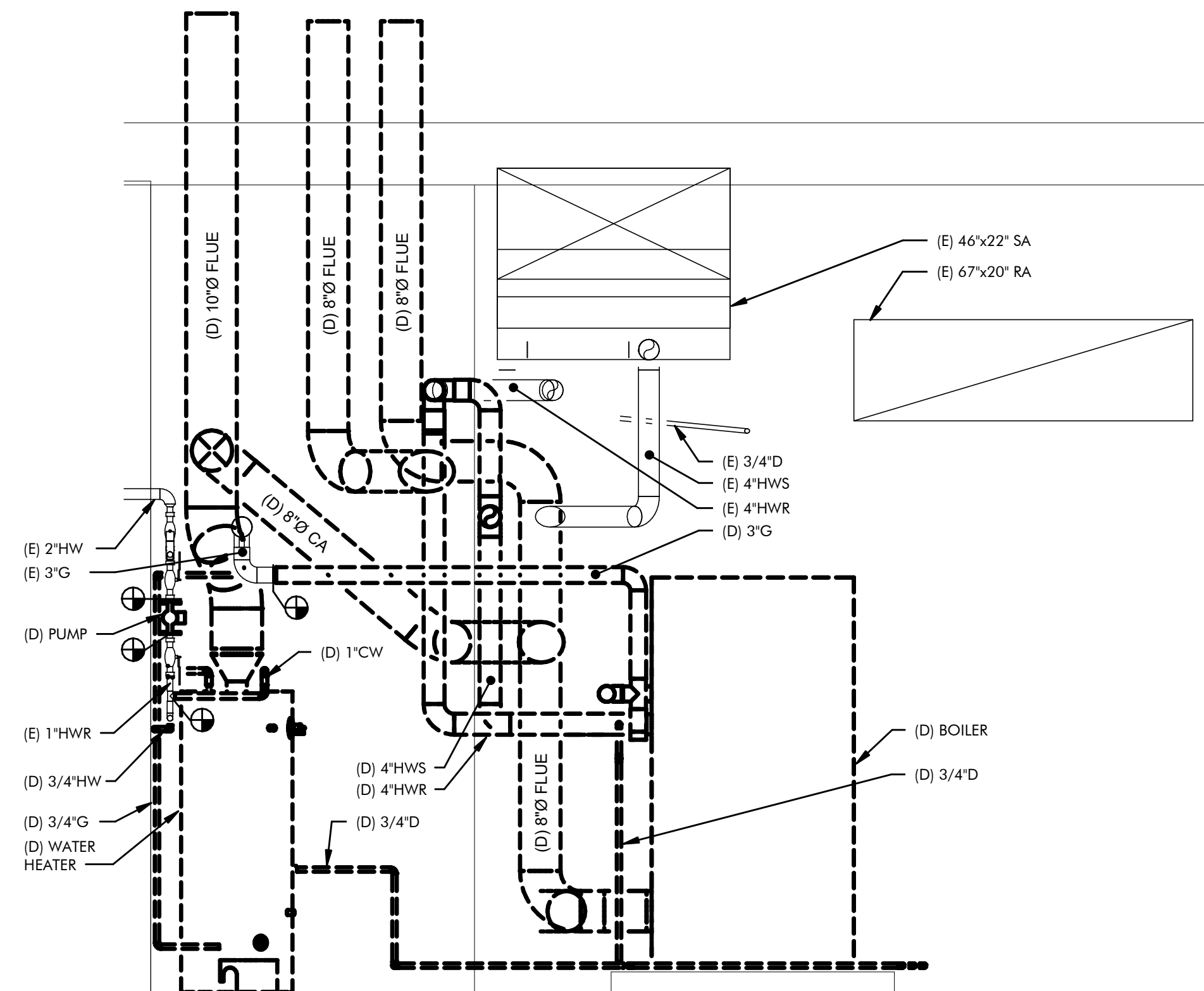
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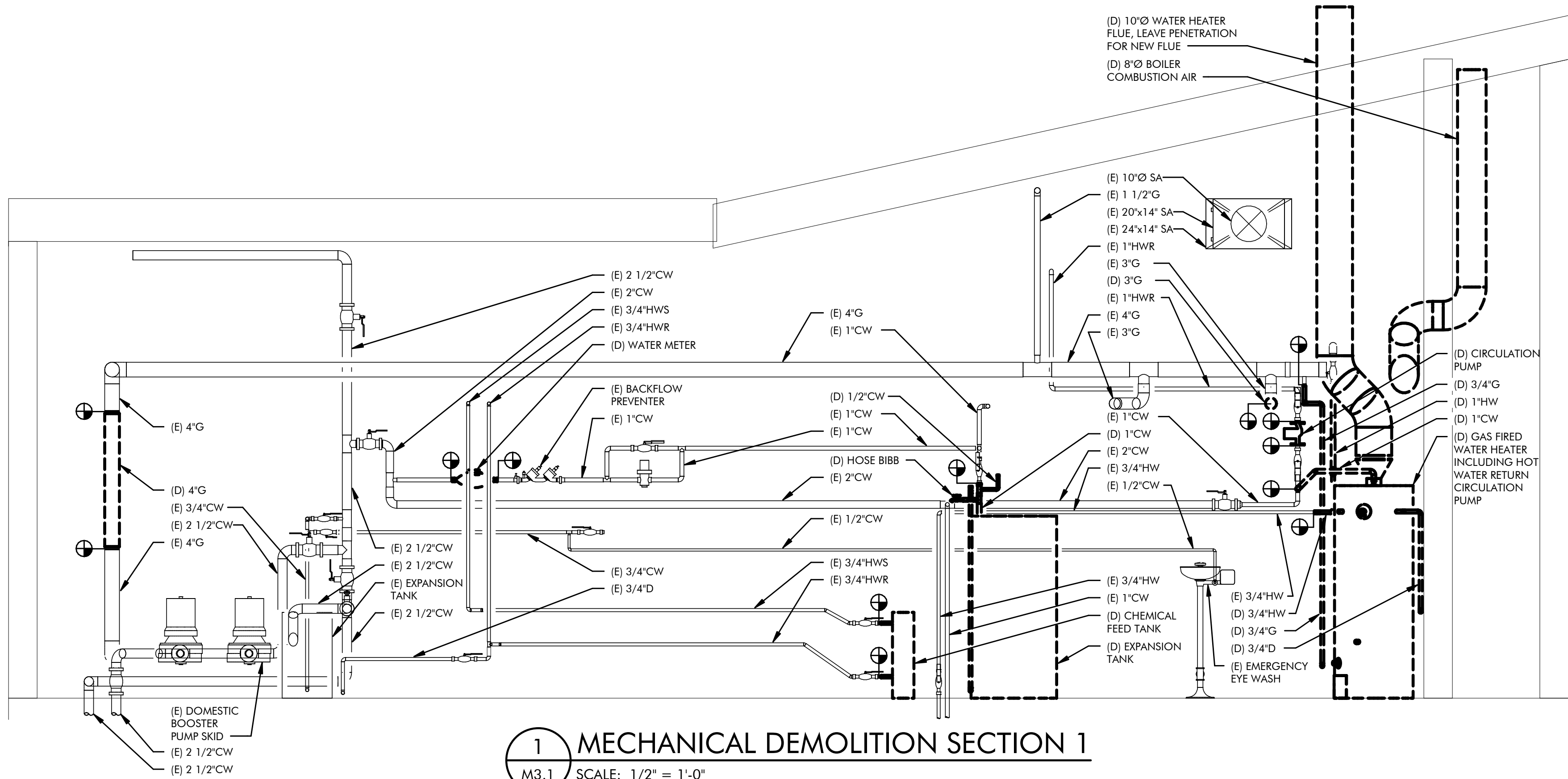
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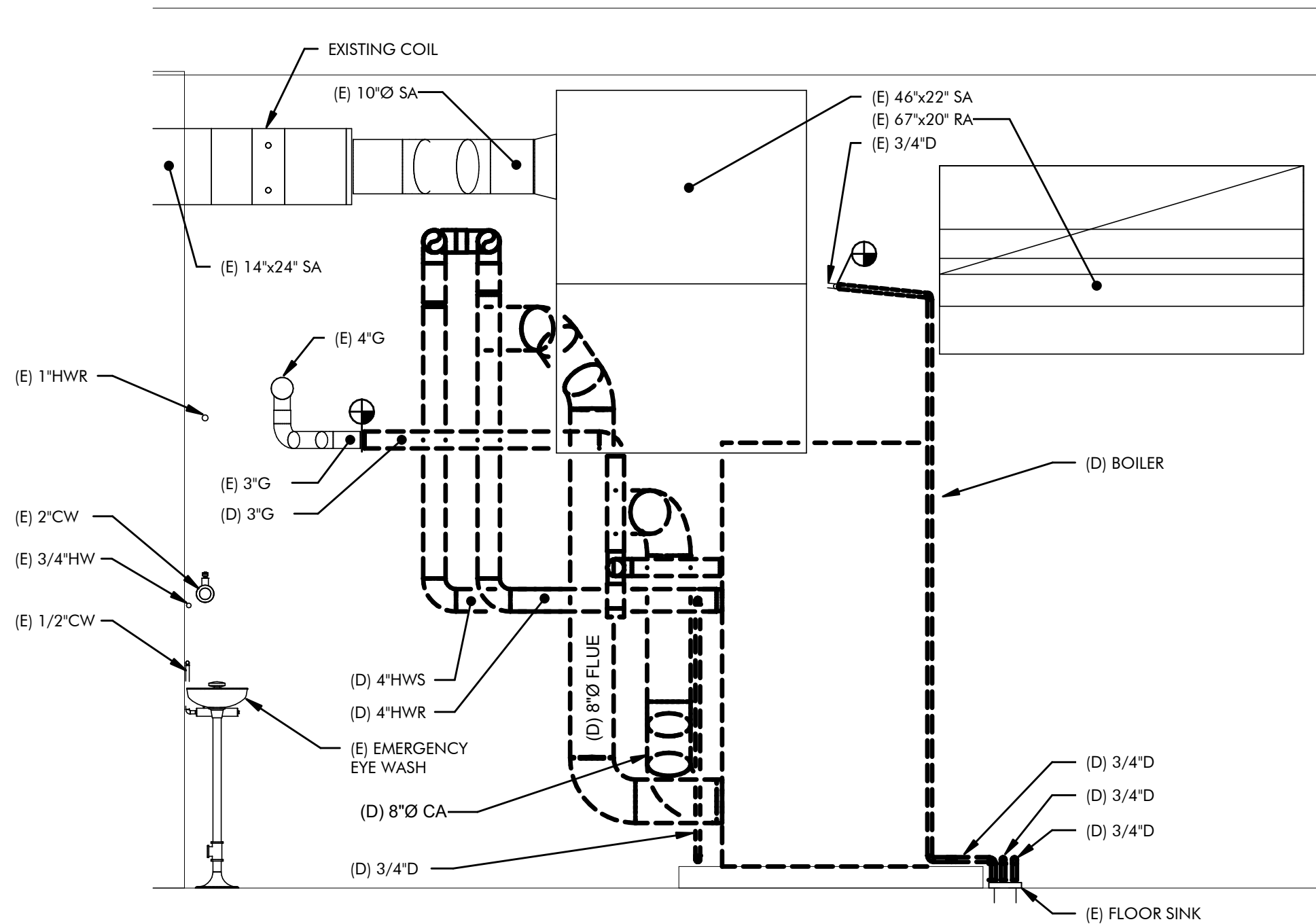
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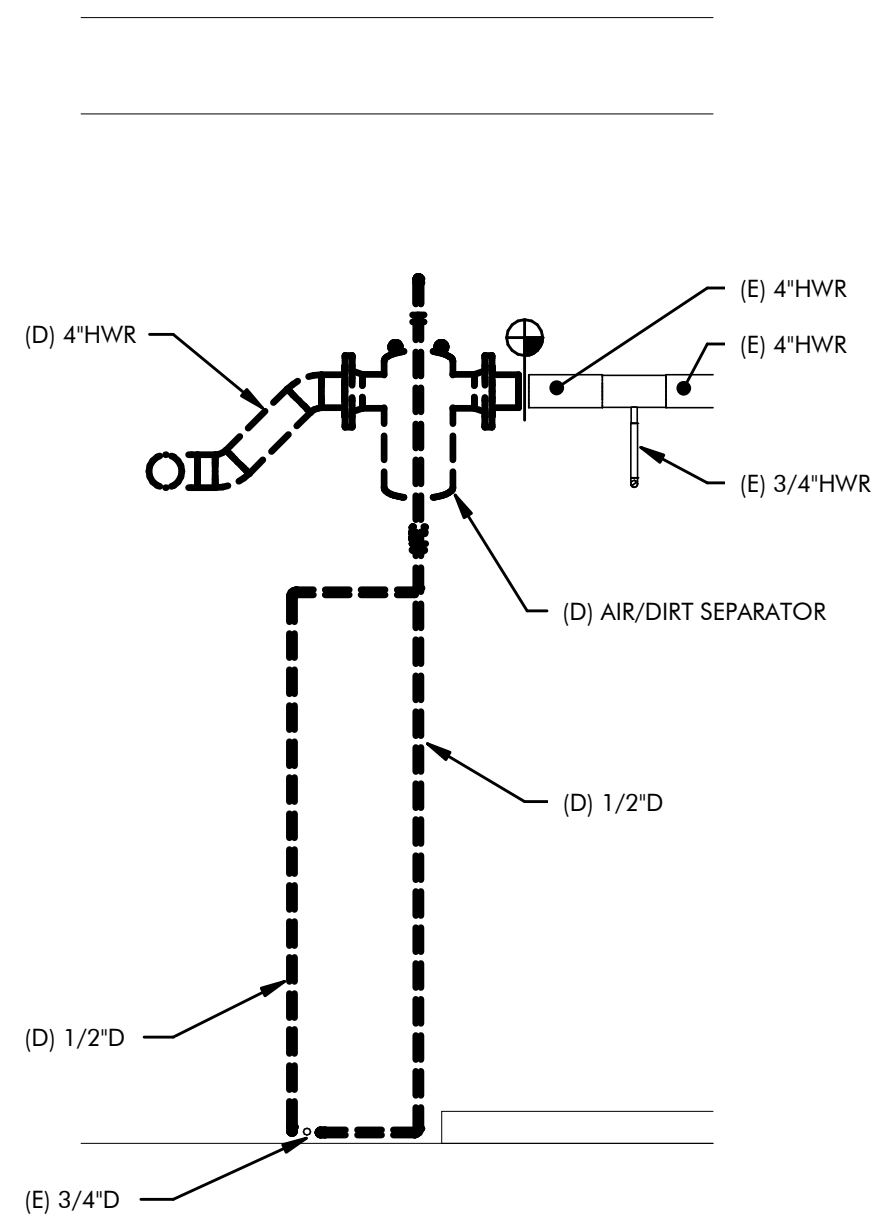
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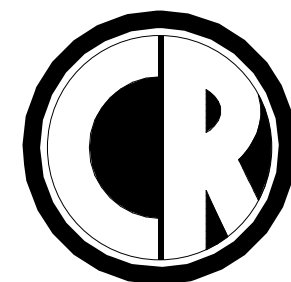
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M3.1 SCALE: 1/2" = 1'-0"



3 MECHANICAL DEMOLITION SECTION 3
M3.1 SCALE: 1/2" = 1'-0"



4 MECHANICAL DEMOLITION SECTION 4
M3.1 SCALE: 1/2" = 1'-0"



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MECHANICAL DEMOLITION SECTIONS AND
ISOMETRICS

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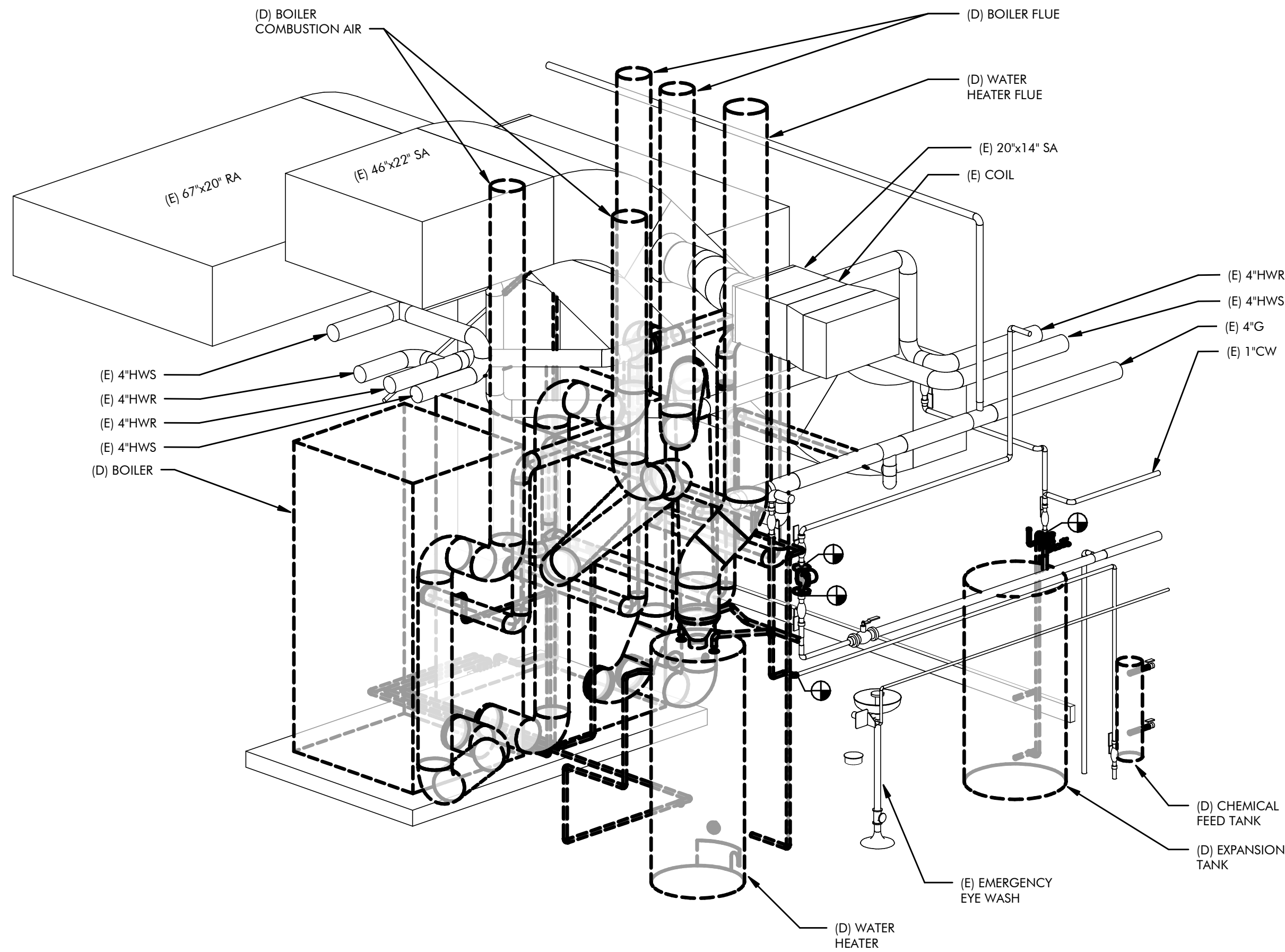
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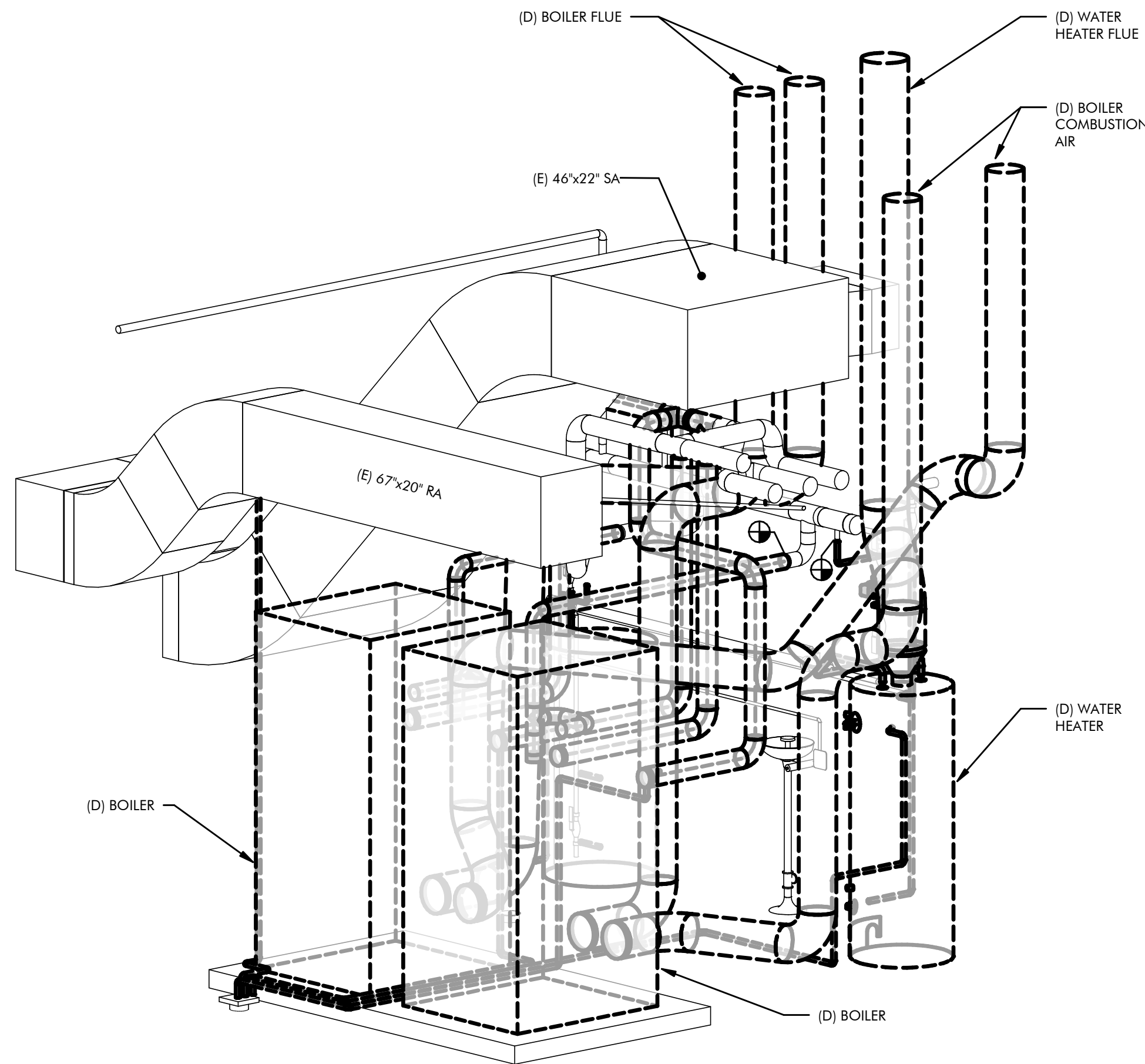
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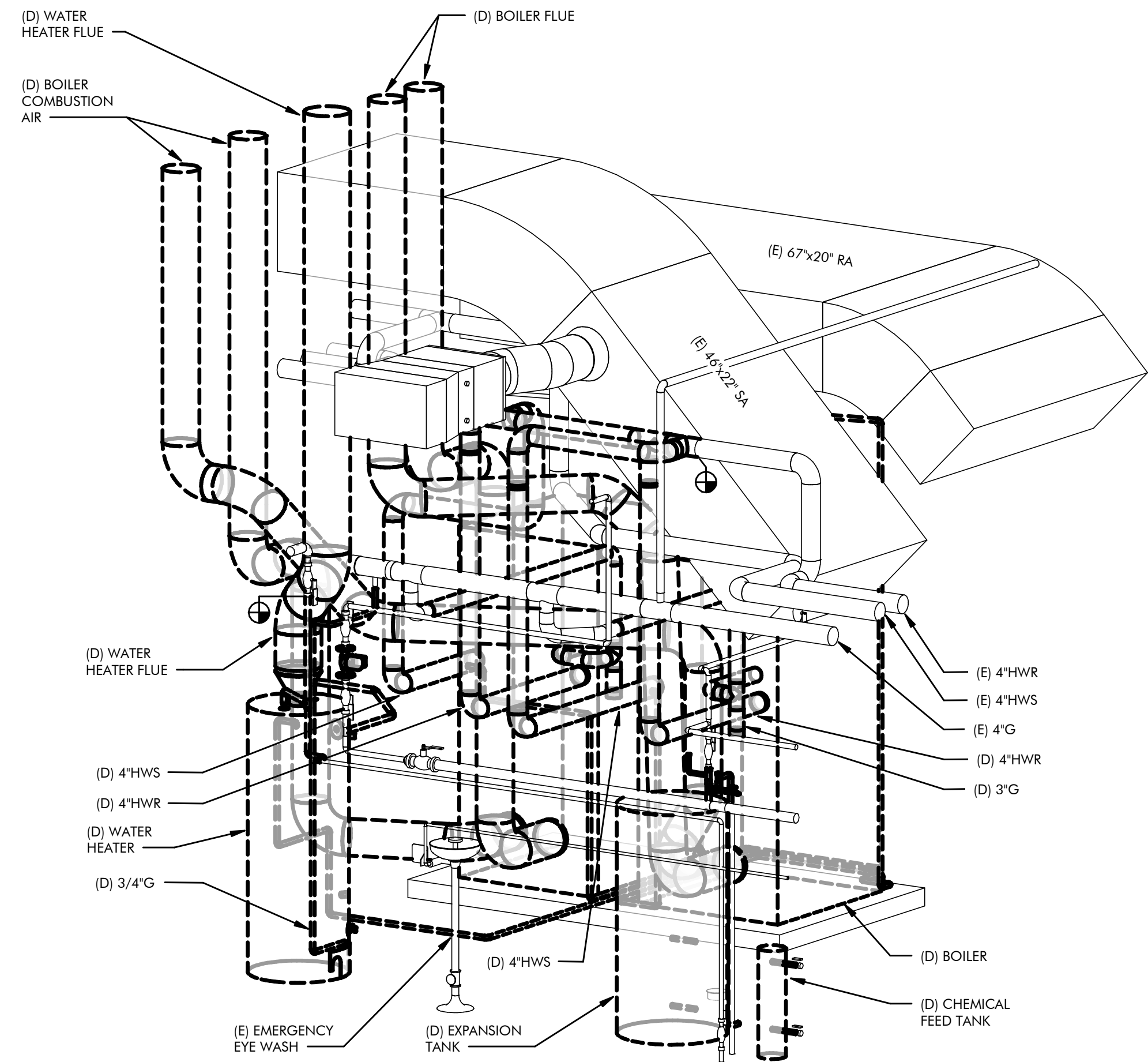
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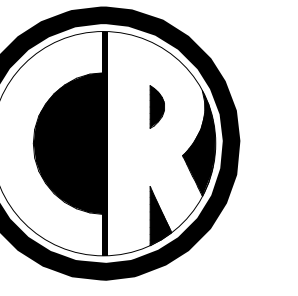
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2 BOILER ROOM DEMOLITION ISOMETRIC 2
M3.2 SCALE : NONE

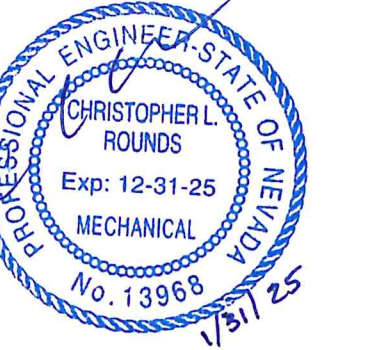


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ISOMETRICS

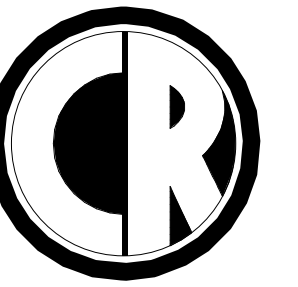
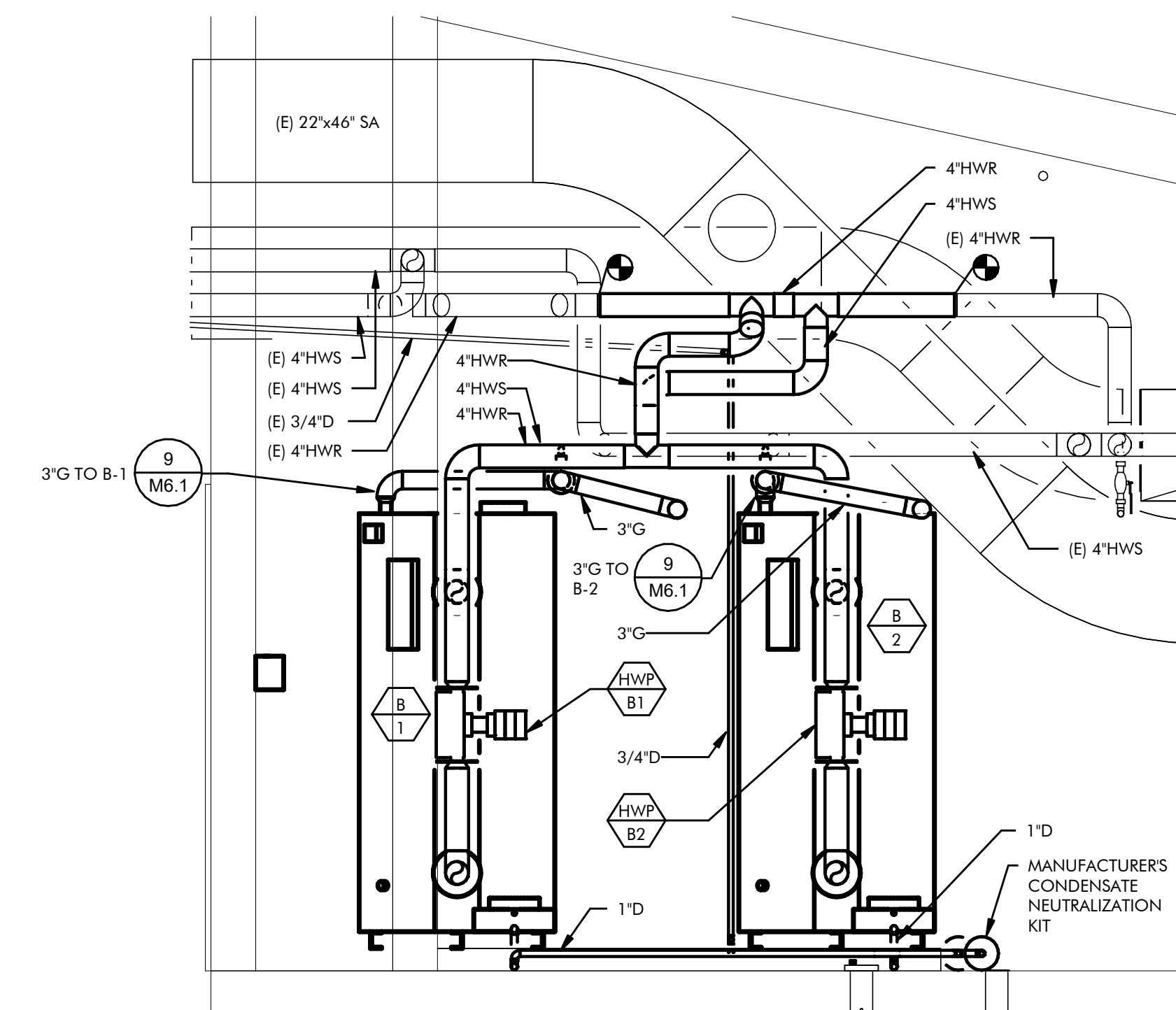
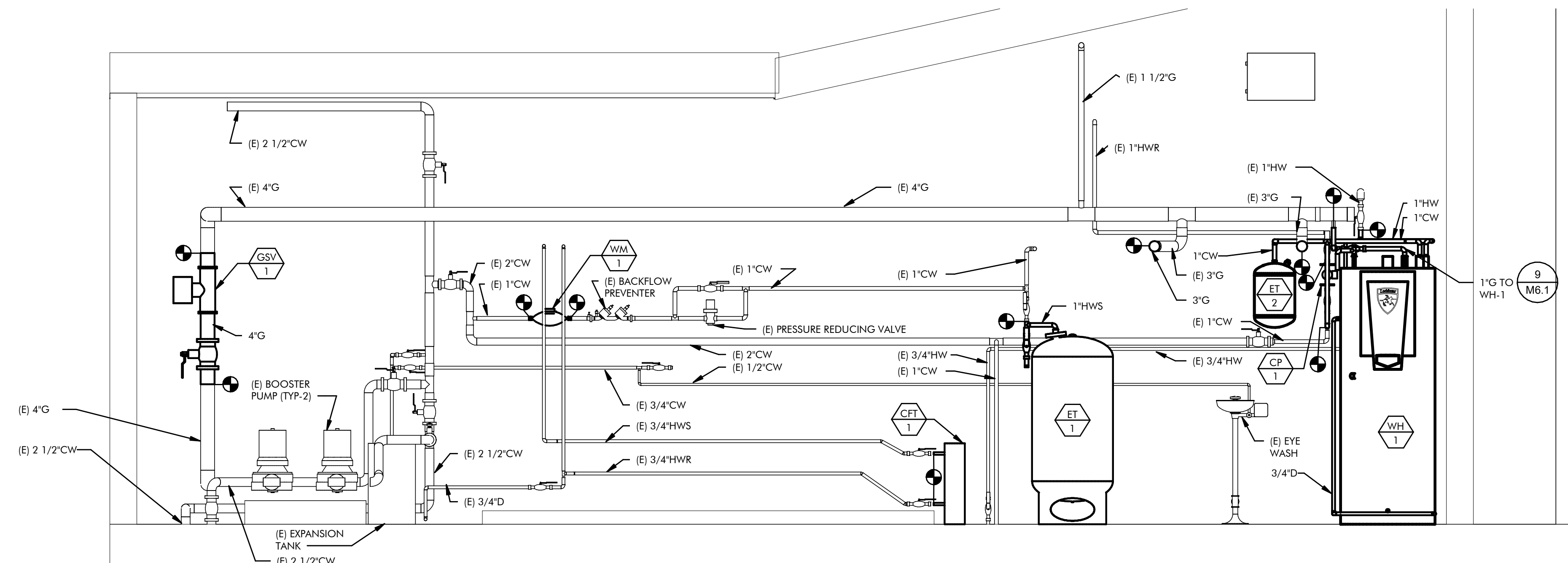
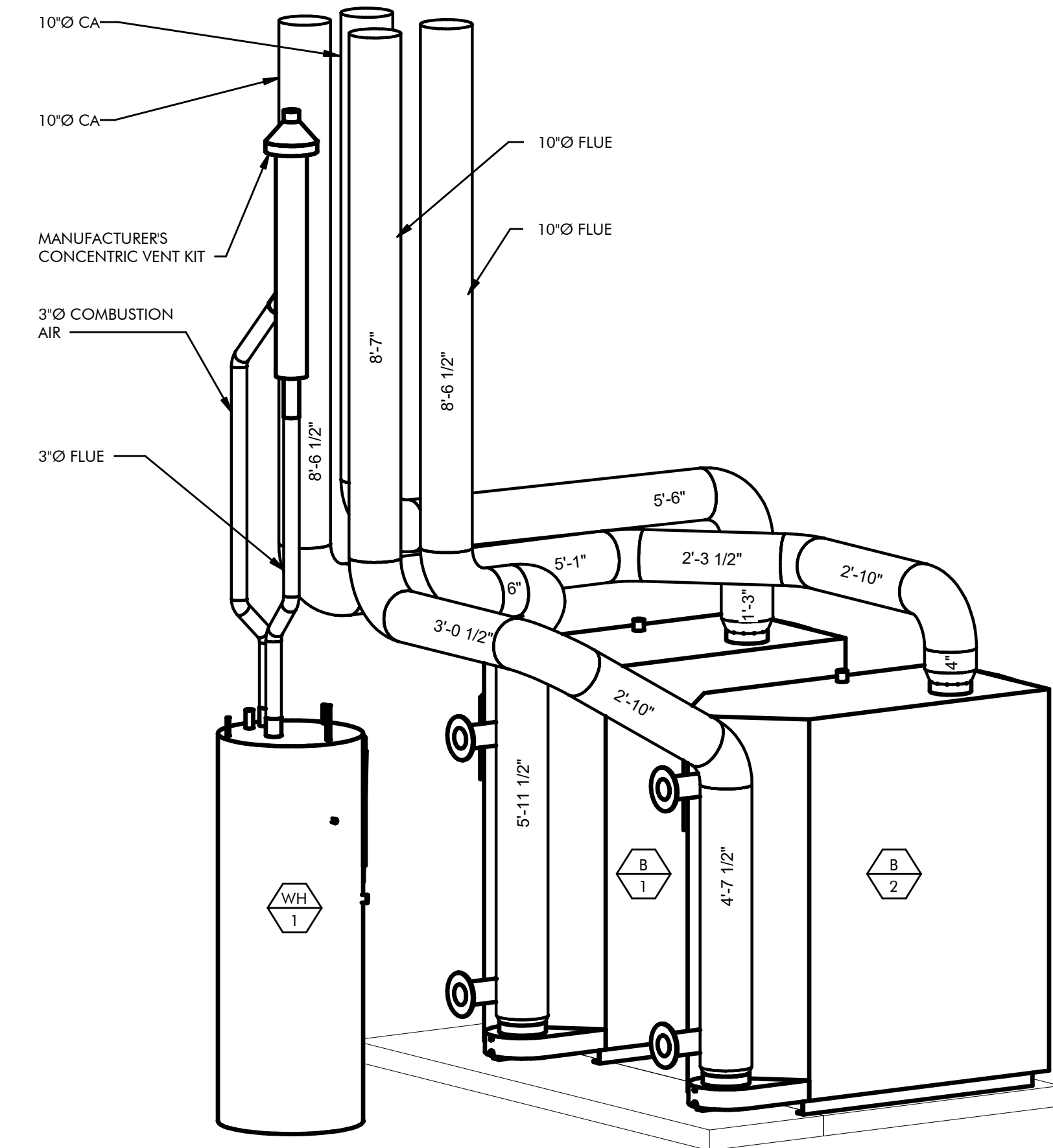
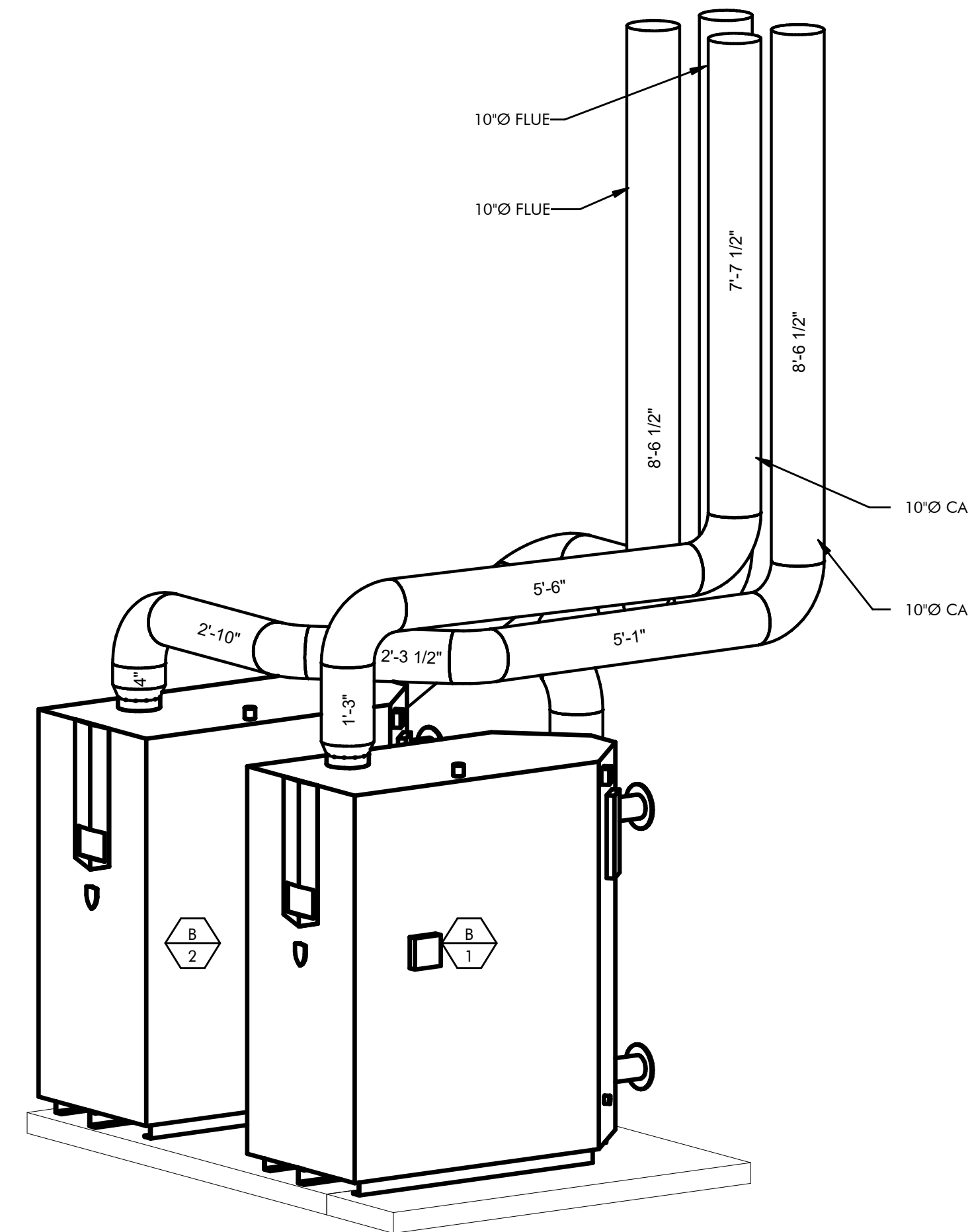
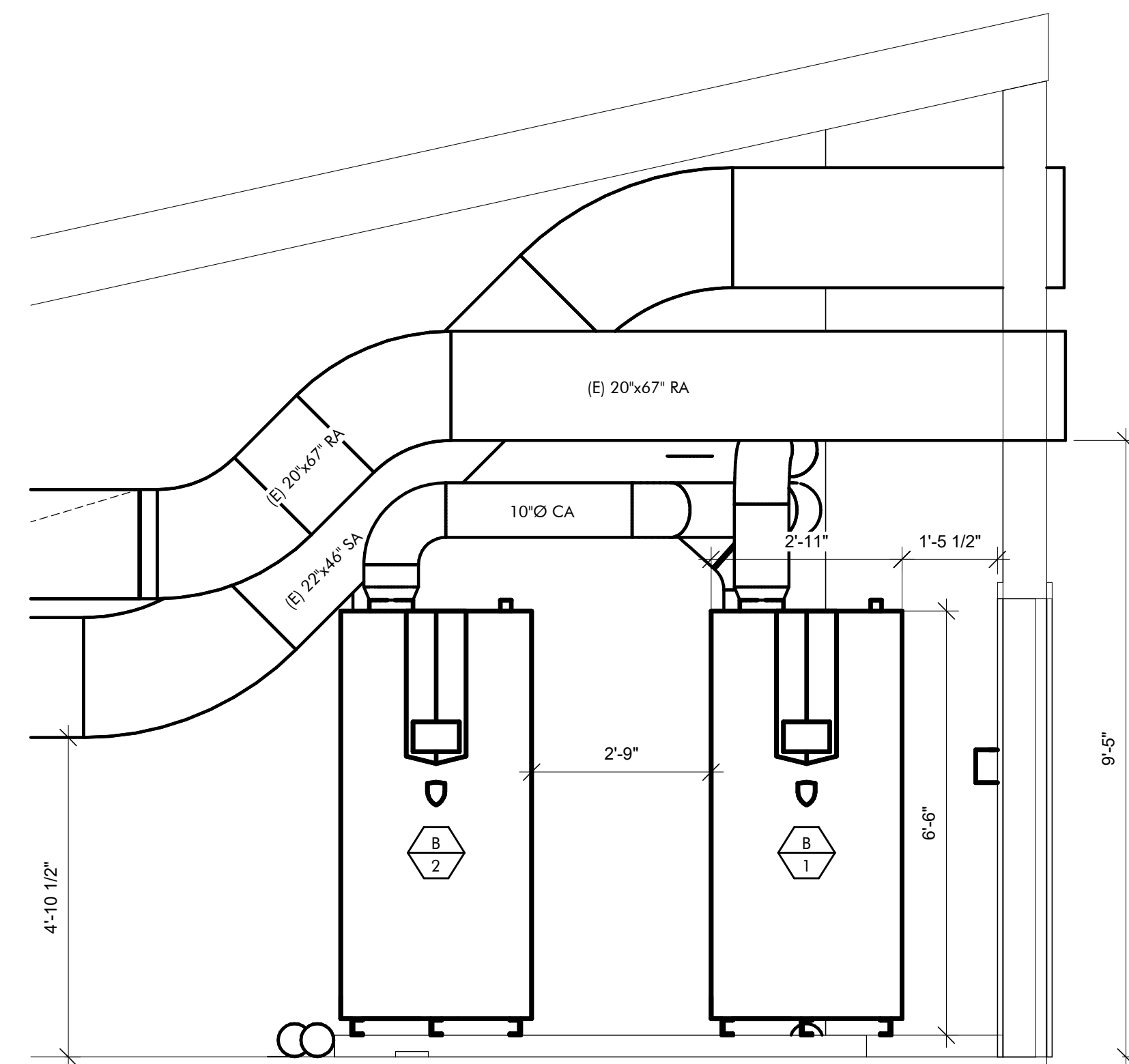
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SHEET NUMBER:

M3.2

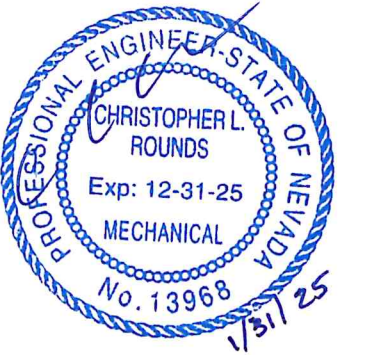


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MECHANICAL SECTION AND ISOMETRICS

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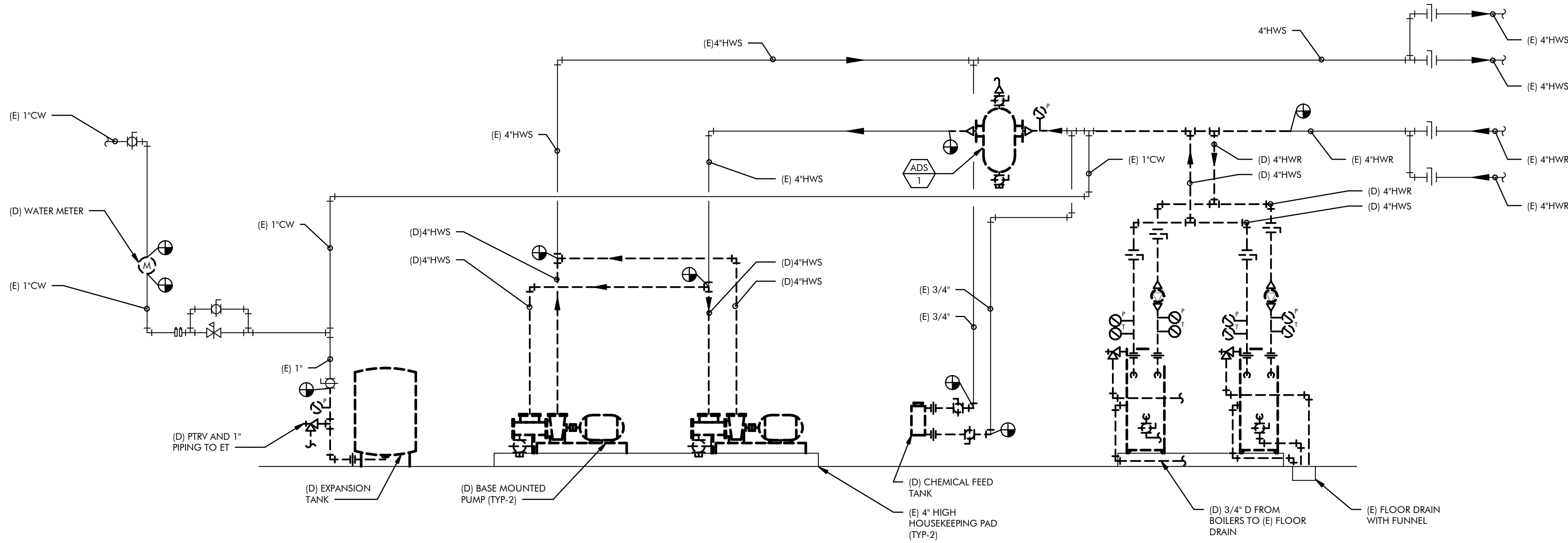
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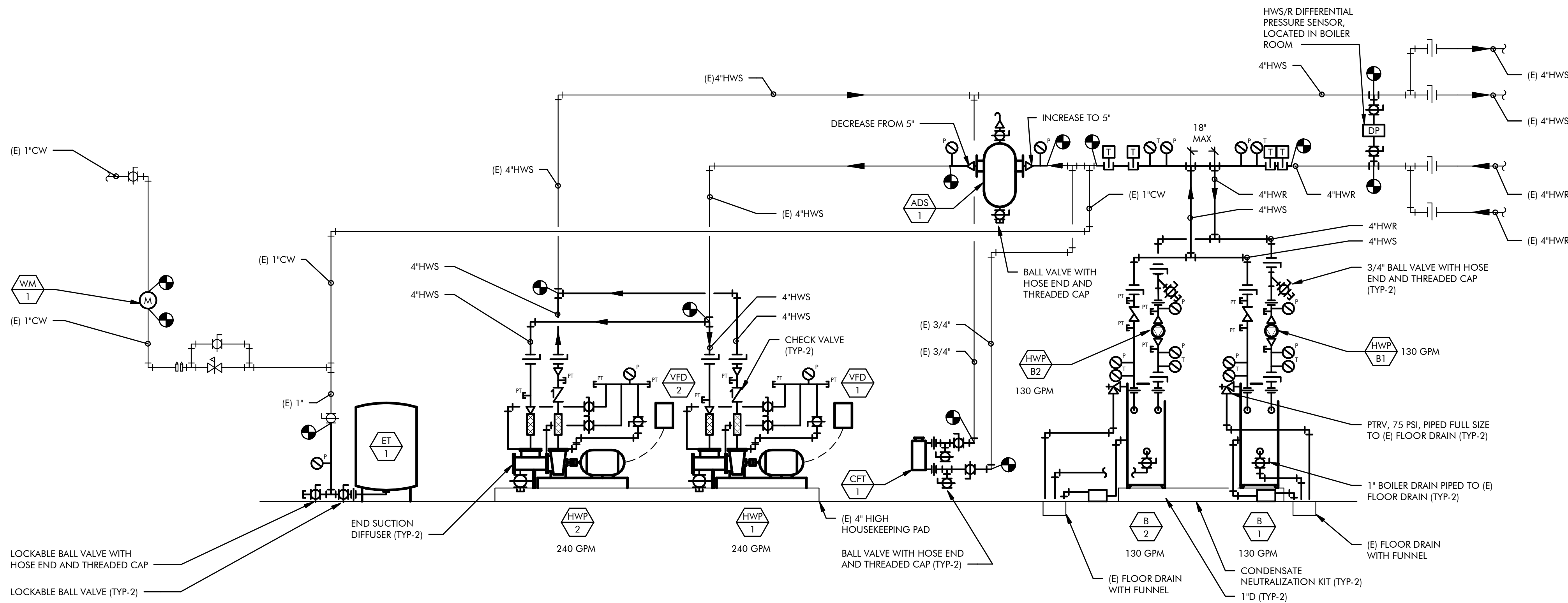
SHEET NUMBER:

M4.1

PLOT DATE:



1 HEATING HOT WATER DEMOLITION PIPING DIAGRAM
M5.1 SCALE : NONE



2 HEATING HOT WATER PIPING DIAGRAM
M5.1 SCALE : NONE

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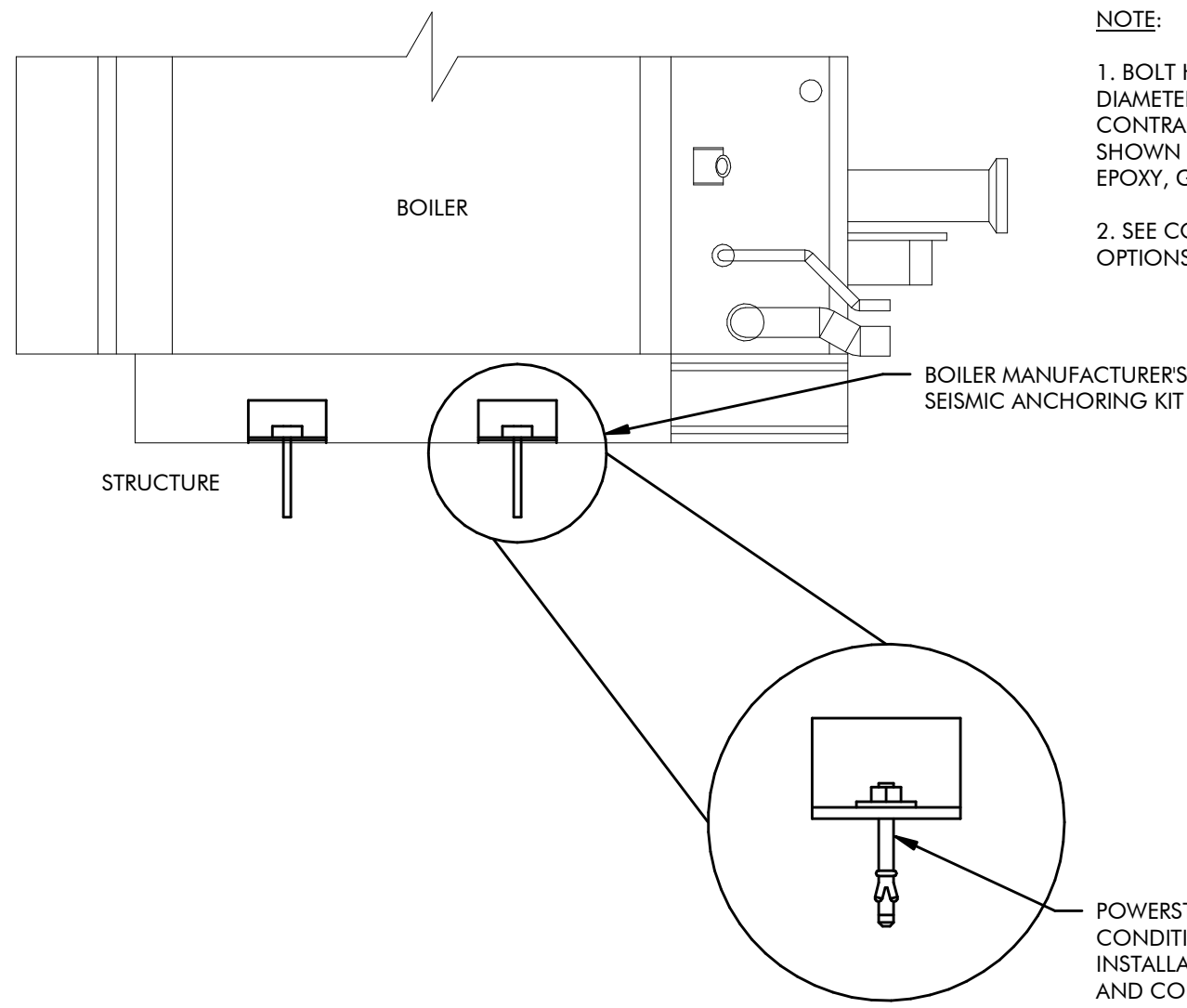


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MECHANICAL DEMOLITION AND NEW PIPING
DIAGRAMS

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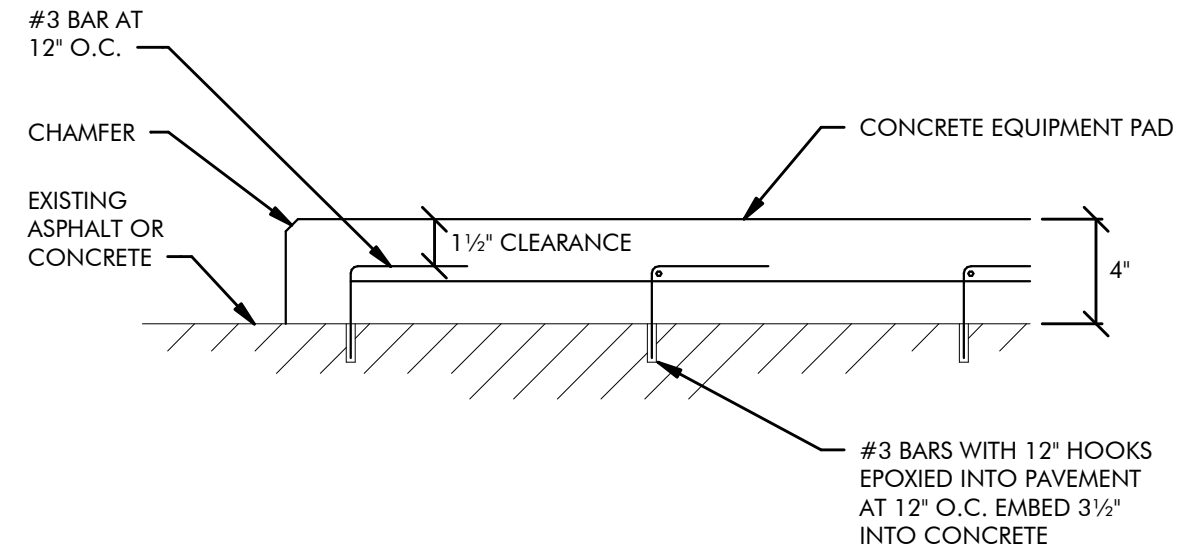
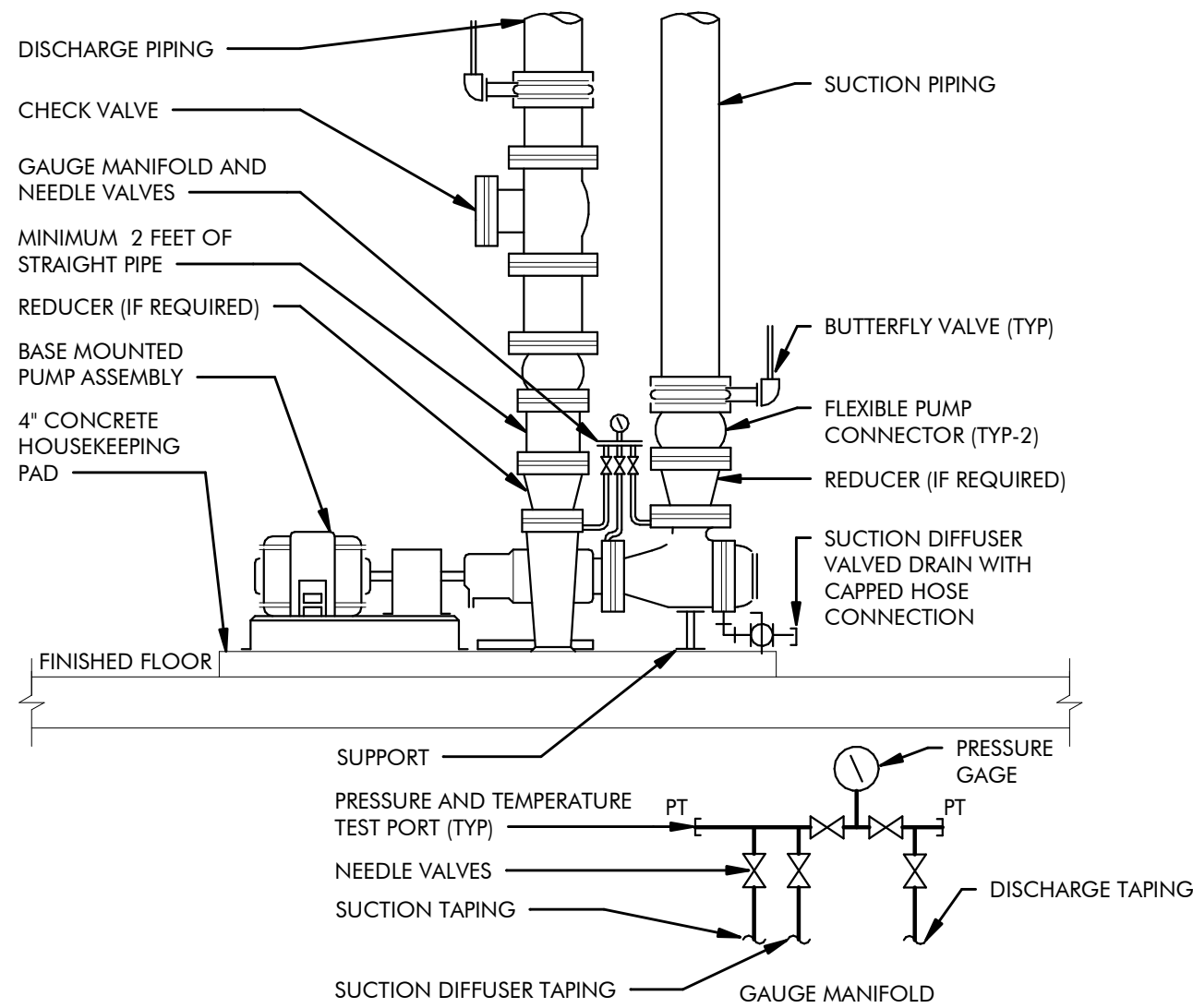
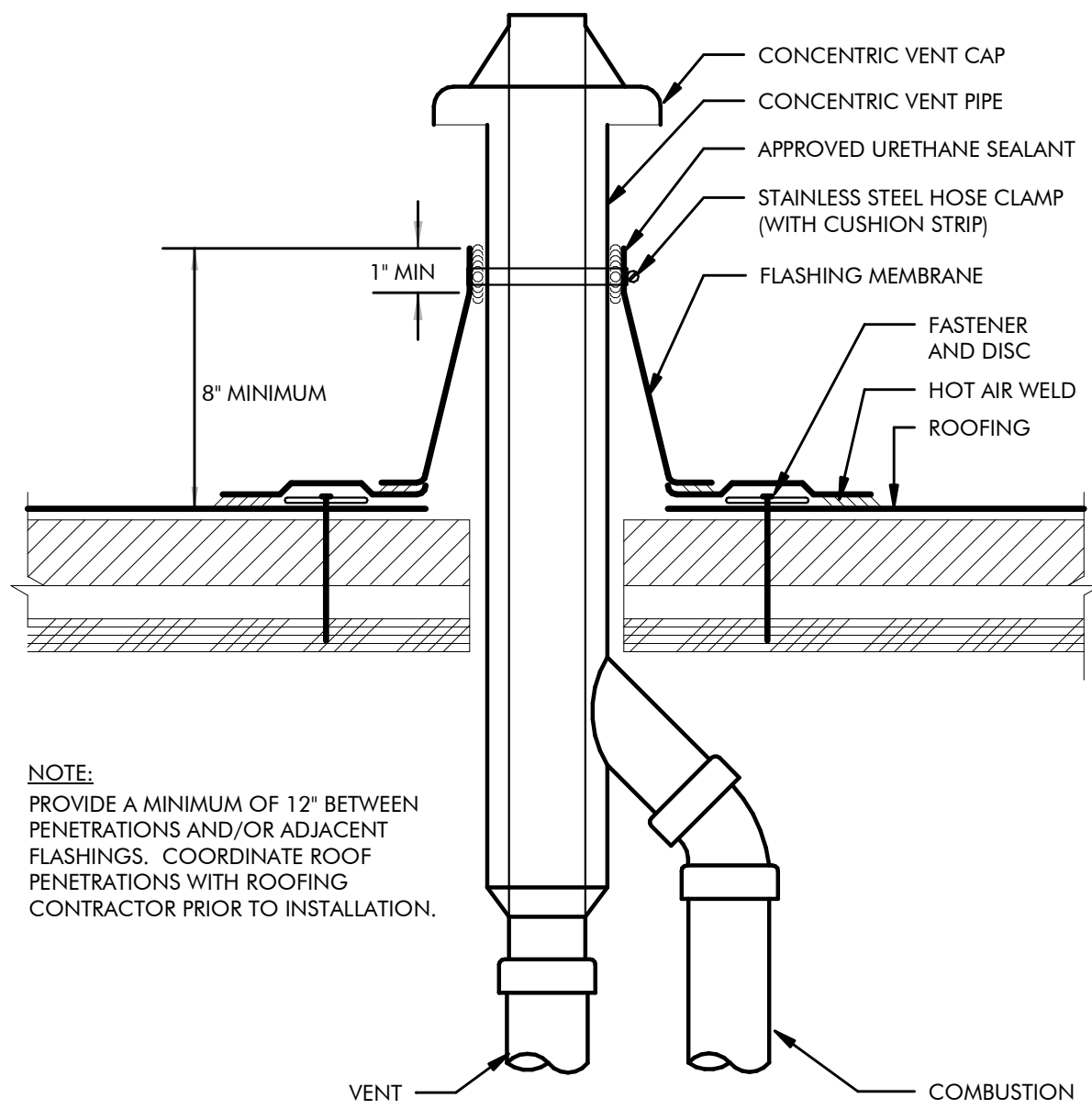
ANCHORAGE INSTALLATION INFORMATION					
ANCHOR	SIZE	SUPPORT	MINIMUM DIMENSIONS		
			EDGE (IN.)	DEPTH (IN.)	DEPTH (IN.)
DEWALT	3/8"Ø x 2.5"	SLAB	6	6	6
HILTI	3/8"Ø x 2.375"	SLAB	6	6	4-1/8



NOTE:

1. BOLT HOLES TO BE 1/16" LARGER THAN BOLT DIAMETER. FOR OVER-SIZED HOLES, CONTRACTOR TO USE WELDED WASHER AS SHOWN IN DETAIL B OR FILL OR FILL HOLE WITH EPOXY, GROUT, OR NEOPRENE GROMMET.

2. SEE CONDITION 4 TABLE FOR ANCHORAGE OPTIONS INTO SLAB AND FILLED DECK.

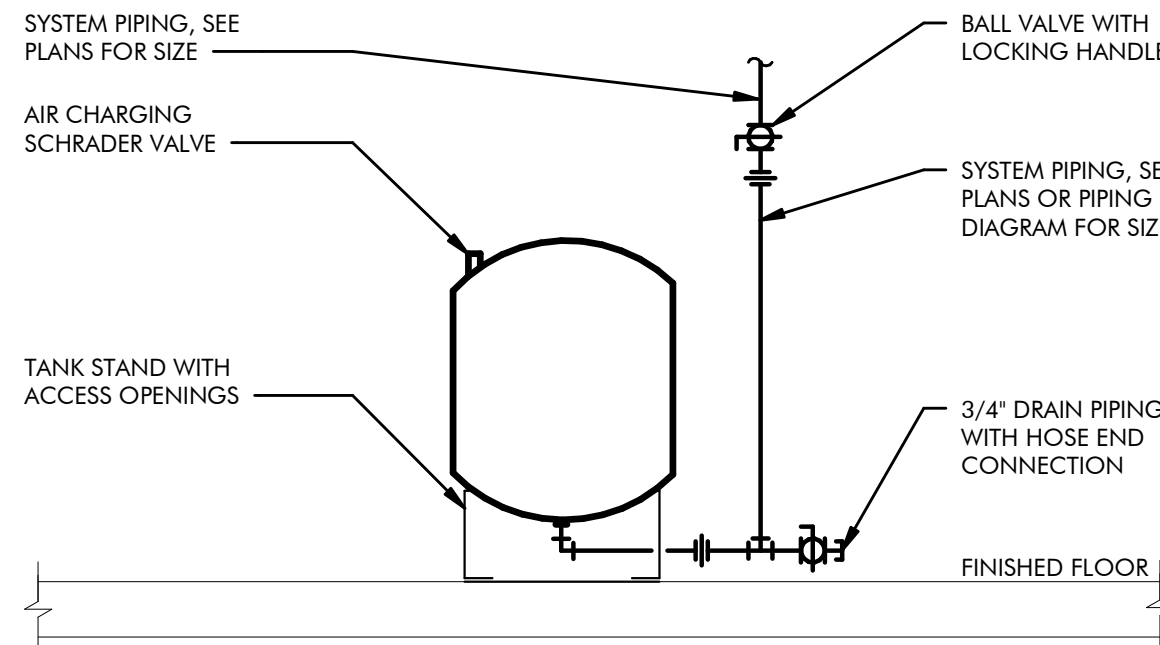
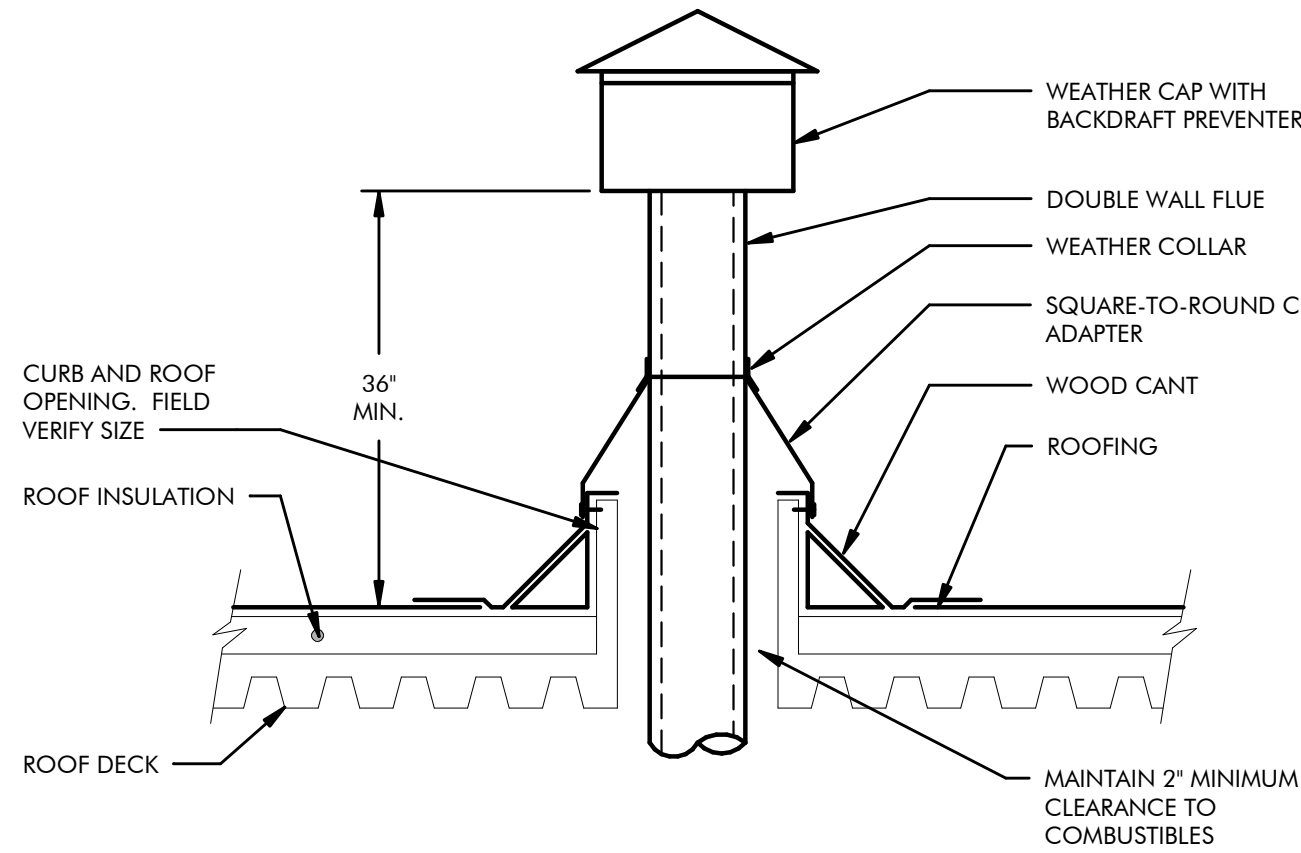
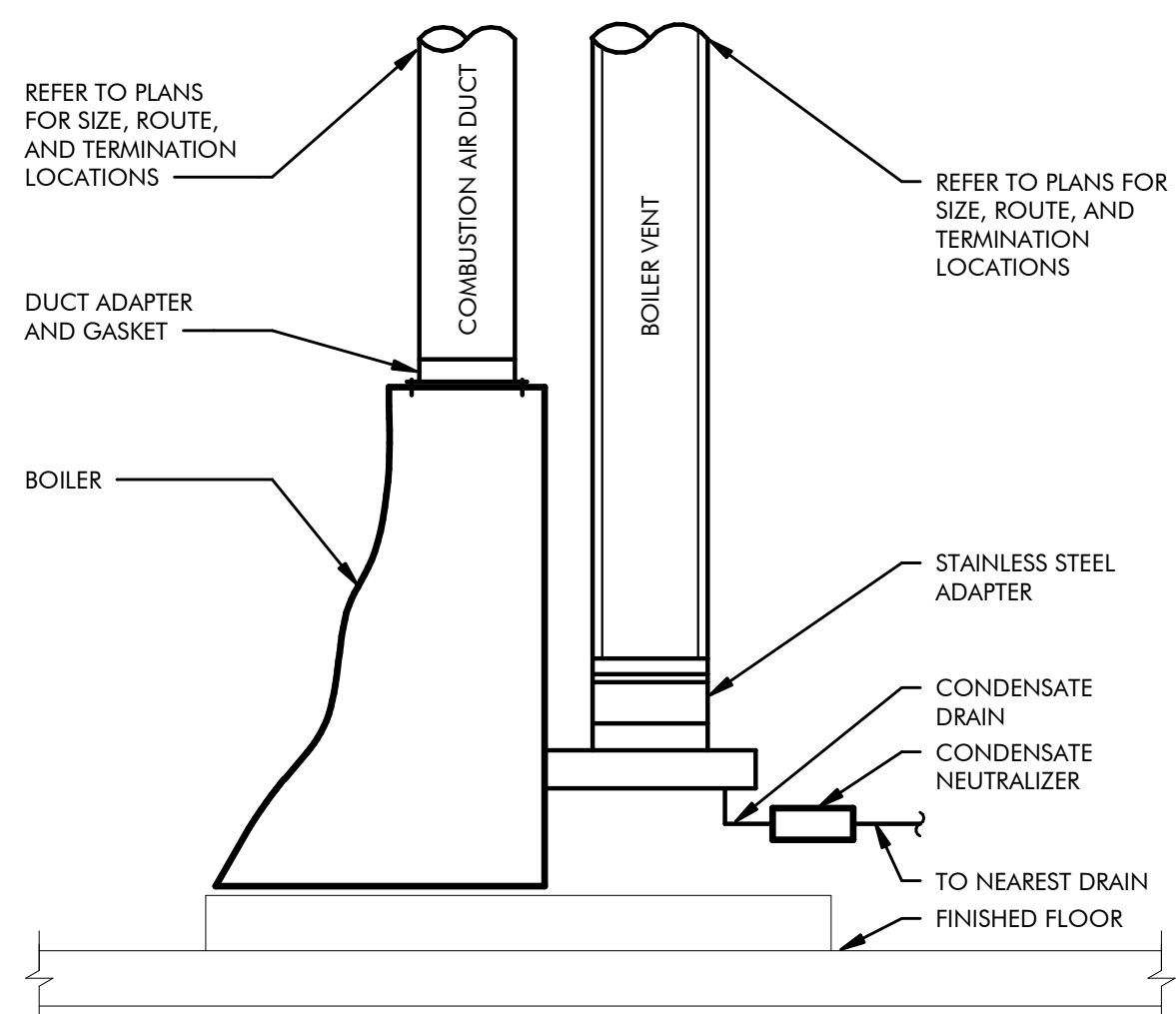
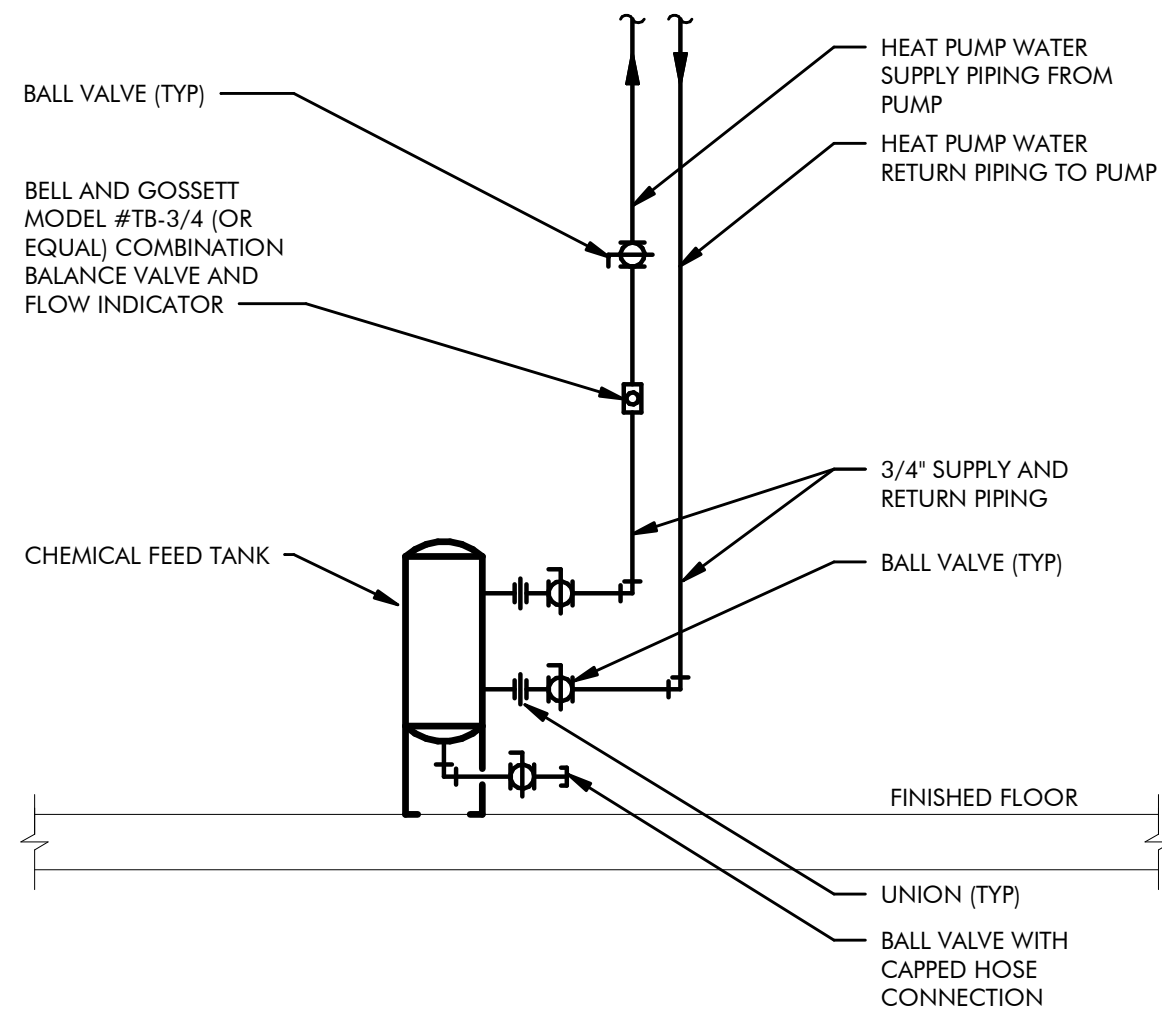


1 BOILER ANCHORAGE DETAIL
M6.1 SCALE : NONE

2 CONCENTRIC VENT DETAIL
M6.1 SCALE : NONE

3 BASE-MOUNTED PUMP DETAIL
M6.1 SCALE : NONE

4 CONCRETE EQUIPMENT PAD
M6.1 SCALE : NONE

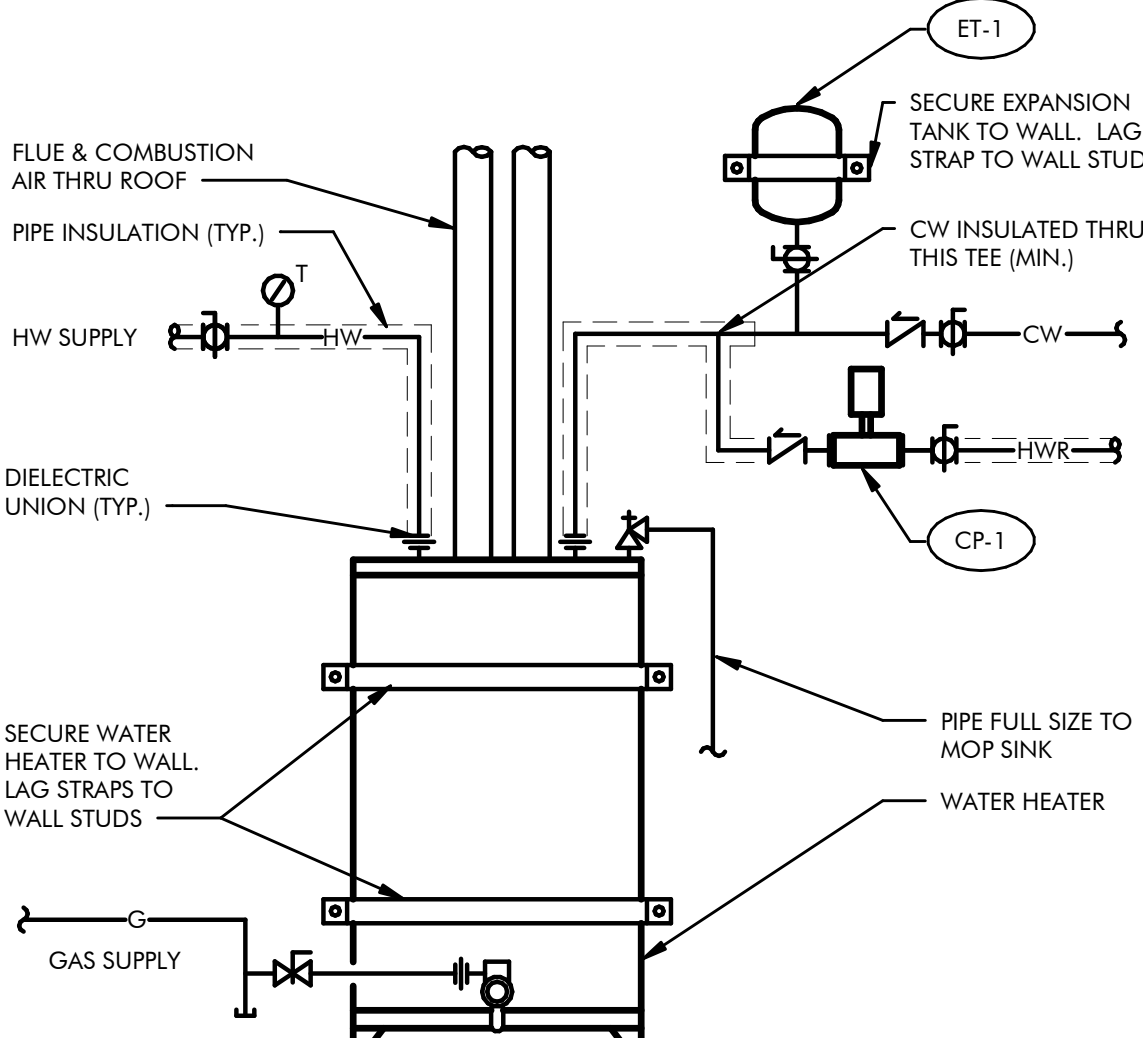
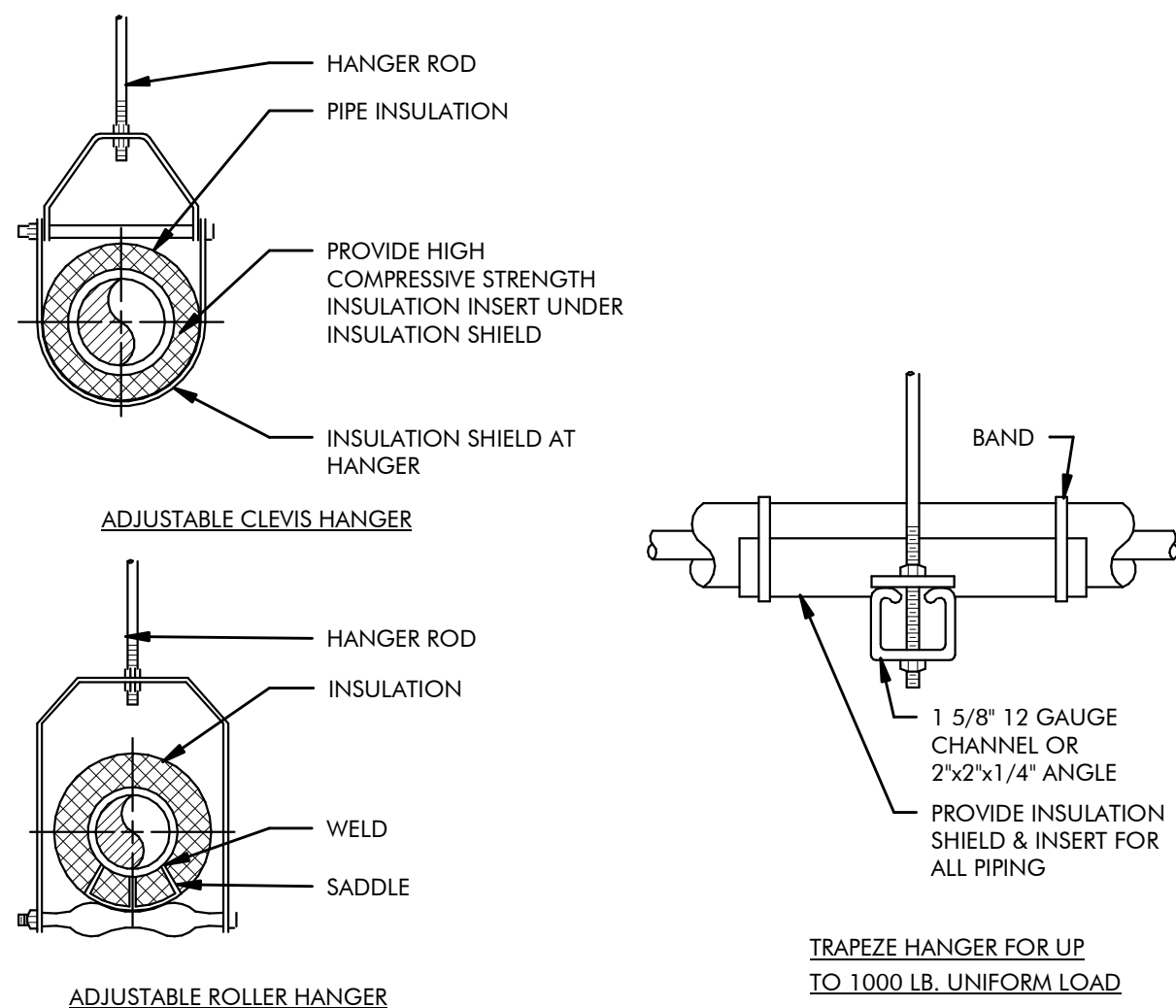
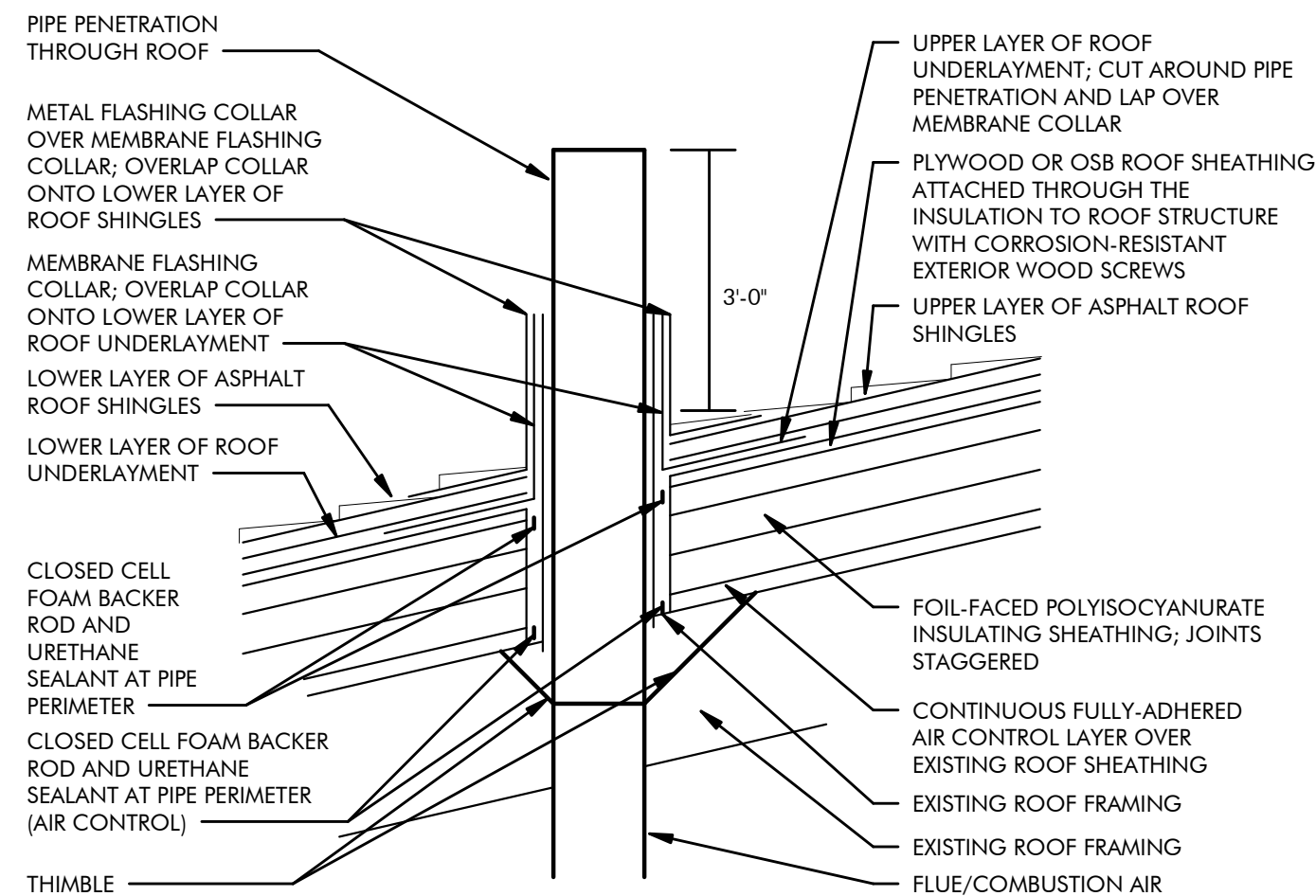
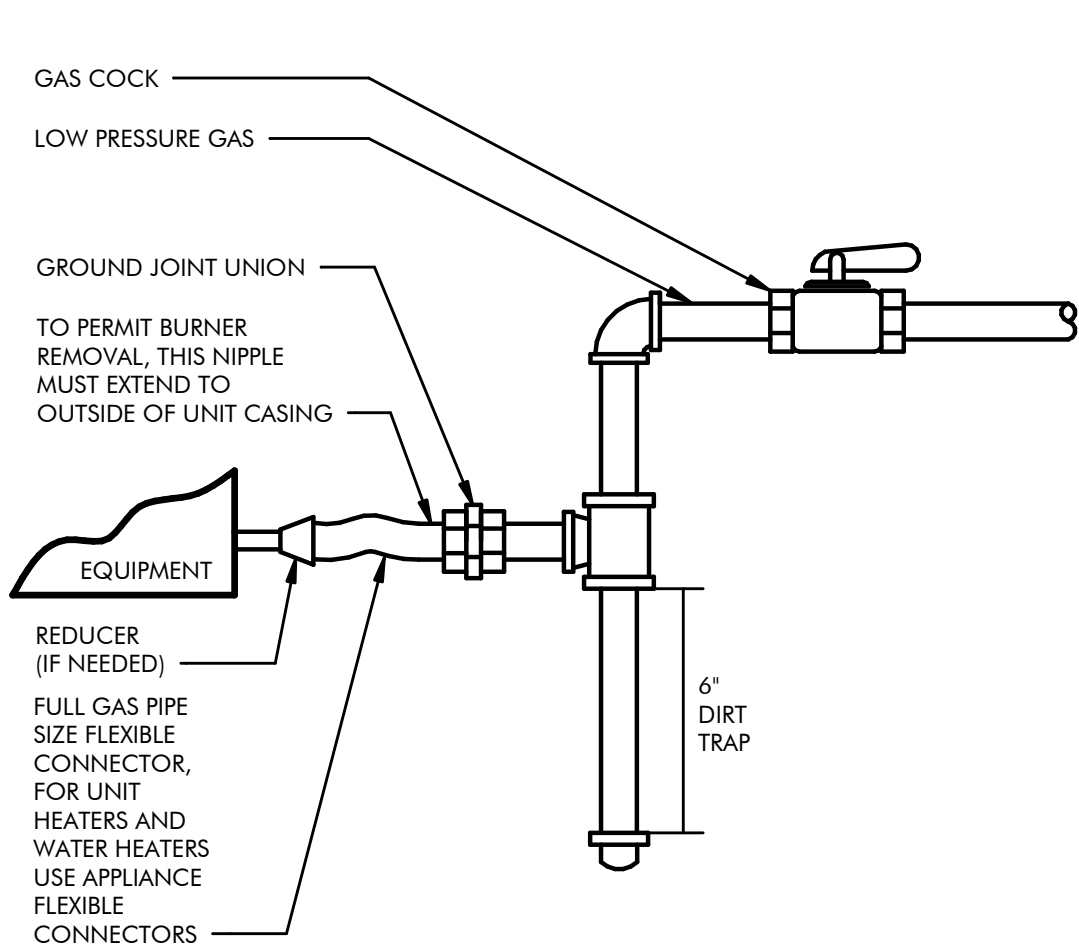


5 CHEMICAL FEED TANK DETAIL
M6.1 SCALE : NONE

6 CONDENSING BOILER FLUE CONNECTION DETAIL
M6.1 SCALE : NONE

7 FLUE THROUGH ROOF DETAIL
M6.1 SCALE : NONE

8 EXPANSION TANK DETAIL
M6.1 SCALE : NONE



9 GAS CONNECTION DETAIL
M6.1 SCALE : NONE

10 FLUE ROOF FLASHING DETAIL
M6.1 SCALE : NONE

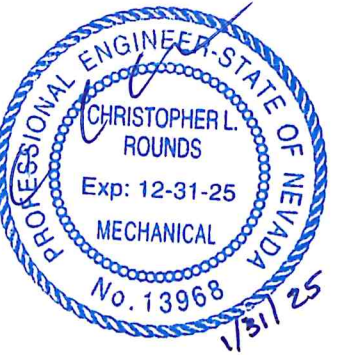
11 TYPICAL PIPE HANGER DETAIL
M6.1 SCALE : NONE

12 WATER HEATER - GAS
M6.1 SCALE : NONE

PLOT DATE:

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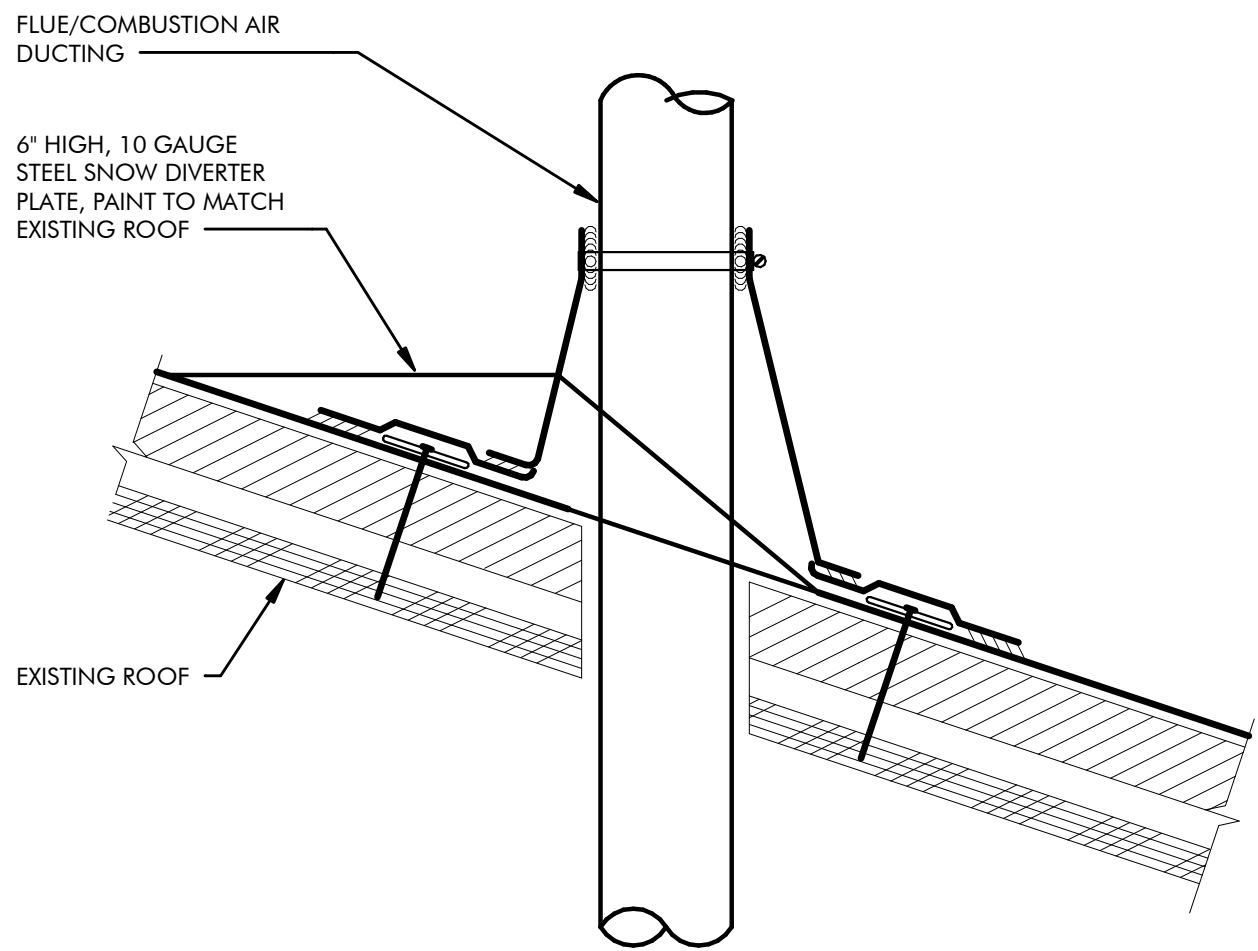
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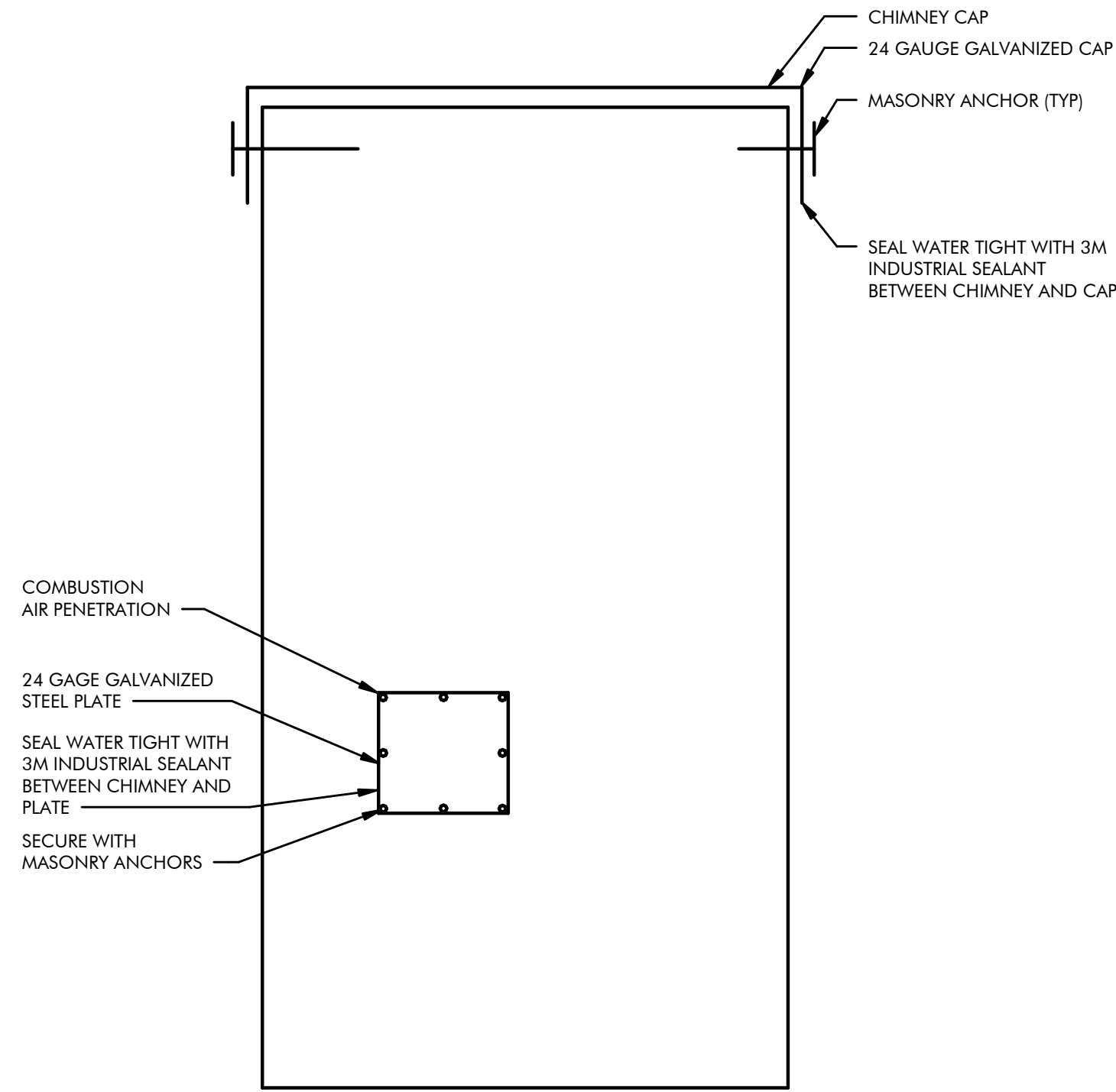
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MECHANICAL DETAILS

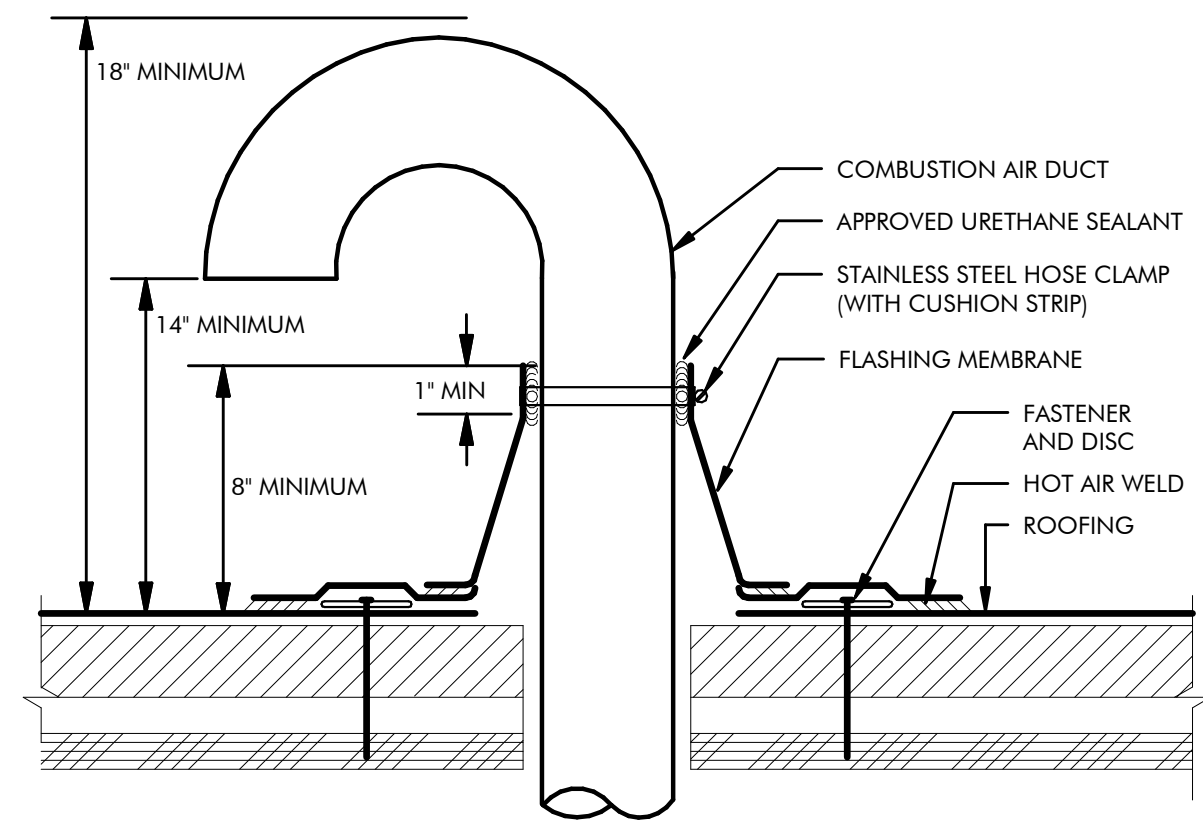
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1 SNOW DIVERTER DETAIL
M6.2 SCALE: 12" = 1'-0"

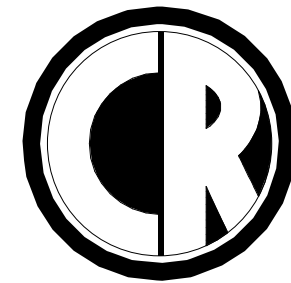


2 CHIMNEY CAP AND PLATE DETAIL
M6.2 SCALE: NONE



3 COMBUSTION AIR GOOSENECK DETAIL
M6.2 SCALE : NONE

PLOT DATE:



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MECHANICAL DETAILS

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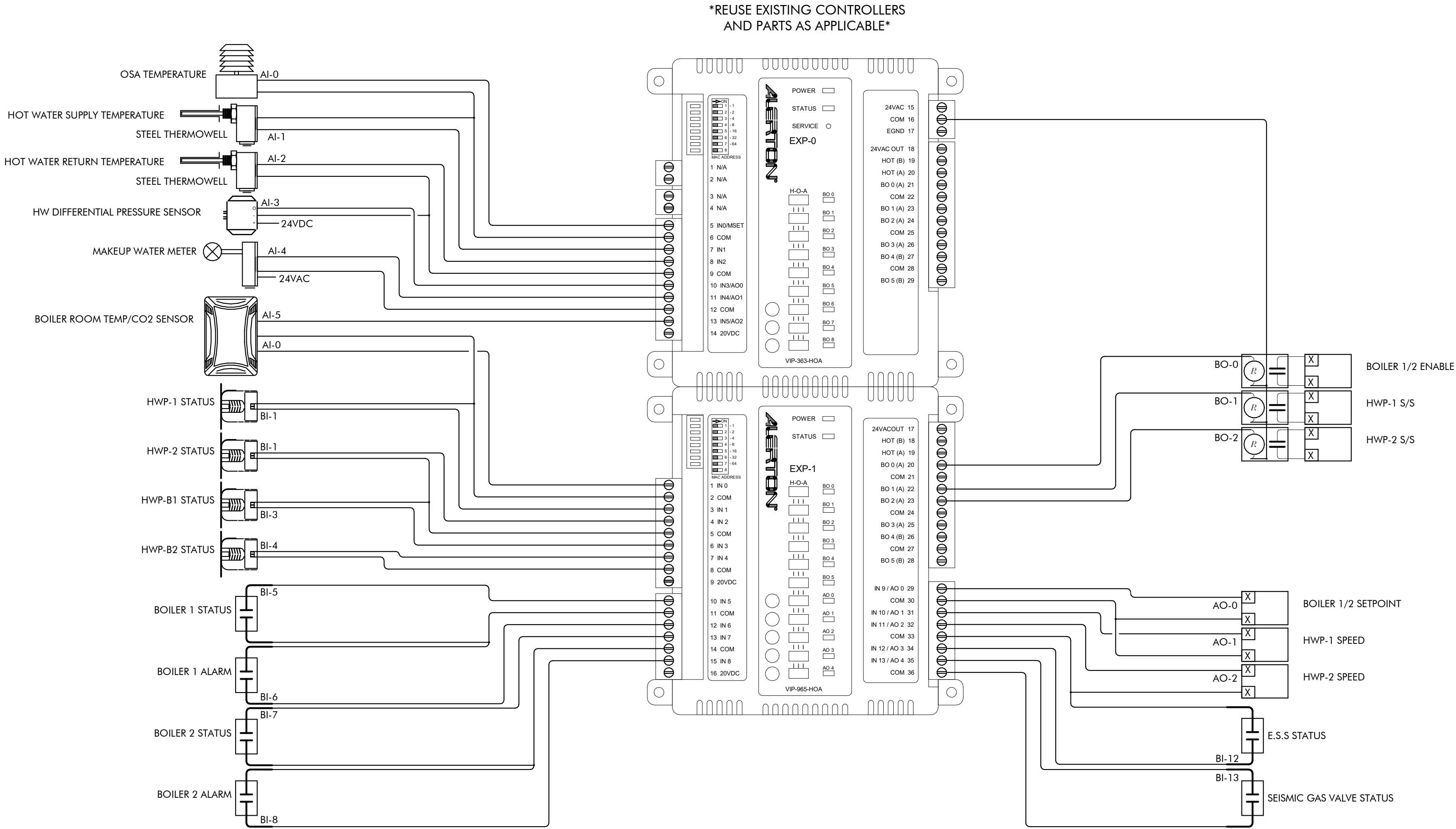
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DATE: 1/31/2025
PROJECT NO: 158324

SHEET NUMBER:

M6.2

PLOT DATE:

1 BOILER PLANT CONTROL DIAGRAM
M7.1 SCALE : NONE



CONTROLS SYMBOL LEGEND

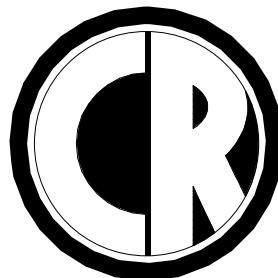
SYMBOL	ABBR.	DESCRIPTION
AS	AS	AVERAGING SENSOR
BSP	BSP	BUILDING STATIC PRESSURE SENSOR (WITH PROBES)
CO	CO ₂	CARBON DIOXIDE SENSOR
CS	CS	CURRENT SENSOR/SWITCH
DP	DP	DIFFERENTIAL PRESSURE SENSOR
DSP	DSP	DUCT STATIC PRESSURE SENSOR
DS	DS	DISCONNECT SWITCH (FUSED)
ESD	ESD	EMERGENCY SHUT-DOWN SWITCH (BREAK-GLASS TYPE)
FSD	FSD	COMBINATION FIRE/SMOKE DAMPER
FMS	FMS	FLOW MEASURING STATION
FS	FS	FLOW SWITCH
HDS	HDS	HIGH STATIC PRESSURE SENSOR
M	M	MOTORIZED ACTUATOR
MS	MS	MOTOR STARTER
OA	OA	OUTSIDE AIR TEMPERATURE/HUMIDITY SENSOR
OS	OS	OCCUPANCY SENSOR
OSP	OSP	OUTDOOR STATIC PRESSURE SENSOR
R	R	RELAY (POLES AND VOLTAGE AS REQUIRED)
RTS	RTS	ROOM TEMPERATURE SENSOR
SD	SD	SMOKE DAMPER
S	SD	SMOKE DETECTOR (PRODUCTS OF COMBUSTION DETECTOR)
T	TS	TEMPERATURE SENSOR (PENCIL TYPE)
T	TSTAT	THERMOSTAT OR TEMPERATURE SENSOR @ 48" AFF
TX	TX	TRANSFORMER (SIZE & VOLTAGE AS REQUIRED)
E		BY ELECTRICAL CONTRACTOR
P		BY PLUMBING CONTRACTOR
M		BY MECHANICAL CONTRACTOR
OB	OB	OPPOSED BLADE DAMPER
PB	PB	PARALLEL BLADE DAMPER
TCV	TCV	TEMPERATURE CONTROL VALVE (2-WAY OR 3-WAY)
P		PRESSURE SENSOR, TEMPERATURE SENSOR WITH WELL
P		PRESSURE GAUGE, TEMPERATURE GAUGE
P	P	PUMP
		POWER WIRING BY ELECTRICAL CONTRACTOR
		CONTROL WIRING

CONTROLS ABBREVIATIONS

AFF/AFG	ABOVE FINISHED FLOOR/GRADE
BSP	BUILDING STATIC PRESSURE SENSOR (WITH PROBES) CO CARBON MONOXIDE
DDC	DIRECT DIGITAL CONTROL SYSTEM
EA	EXHAUST AIR
HPS/HPR	HEAT PUMP WATER SUPPLY/RETURN PIPING
MAX	MAXIMUM
MOD	MODULATING ACTUATOR (SPRING RETURN - U.N.O.)
MIN	MINIMUM
NC	NORMALLY CLOSED
NO	NORMALLY OPEN
OA	OUTSIDE AIR
RA	RETURN AIR
SA	SUPPLY AIR
TCP	TEMPERATURE CONTROL PANEL
TYP	TYPICAL
UNO	UNLESS NOTED OTHERWISE
VFD	VARIABLE FREQUENCY DRIVE
2-POS	TWO-POSITION ACTUATOR (SPRING RETURN - U.N.O.)

CONTROL NOTES

- ALL WIRING TO BE IN CONDUIT. PLENUM RATED CABLE WITH J-HOOKS IS ALLOWED FOR ABOVE CEILING INSTALLATION.
- CONTROL SYSTEM CONTRACTOR SHALL PROVIDE A COMPLETE DIRECT DIGITAL CONTROL SYSTEM. PROVIDE AND INSTALL ALL NECESSARY WIRING TO MAKE SYSTEM OPERATIONAL. ALL WIRING SHALL BE IN CONDUIT WITH ANY SPLICES MADE IN JUNCTION BOXES. CONTROL DIAGRAMS AND SEQUENCE OF OPERATION ON REFER TO DRAWINGS.
- CONTROLS CONTRACTOR SHALL CONNECT NEW CONTROLLERS TO THE CONTROL NETWORK AND ADD NEW GRAPHICS. COORDINATE ALL WORK WITH LCSD MAINTENANCE PRIOR TO BID.
- THE THERMOGRAPHIC FLOOR PLAN SHALL BE UPDATED WITH THE NEW FLOOR PLAN AND ZONING, INCLUDING THE ROOM TEMPERATURE SENSORS.
- CONTROLS CONTRACTOR TO COORDINATE UNIT LABELING ON GRAPHICS, THERMOSTAT, AND CONTROLLER WITH LCSD MAINTENANCE PRIOR TO INSTALLATION.
- CONTROLS CONTRACTOR:
CERRIS SYSTEMS
4750 LONGLEY LANE #106
RENO, NV 89502



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MECHANICAL CONTROL DIAGRAMS AND
SEQUENCE OF OPERATION

REVISIONS:

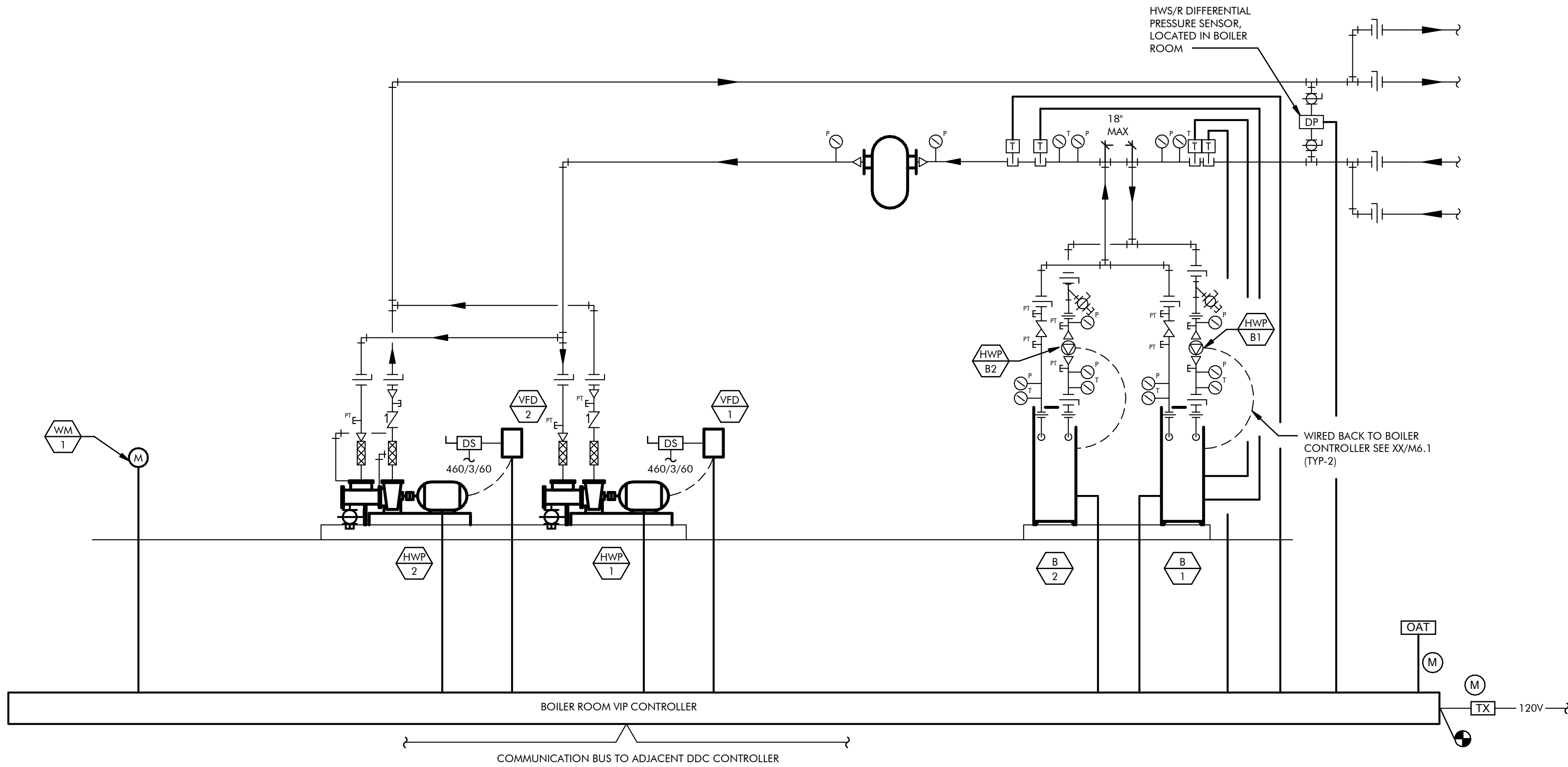
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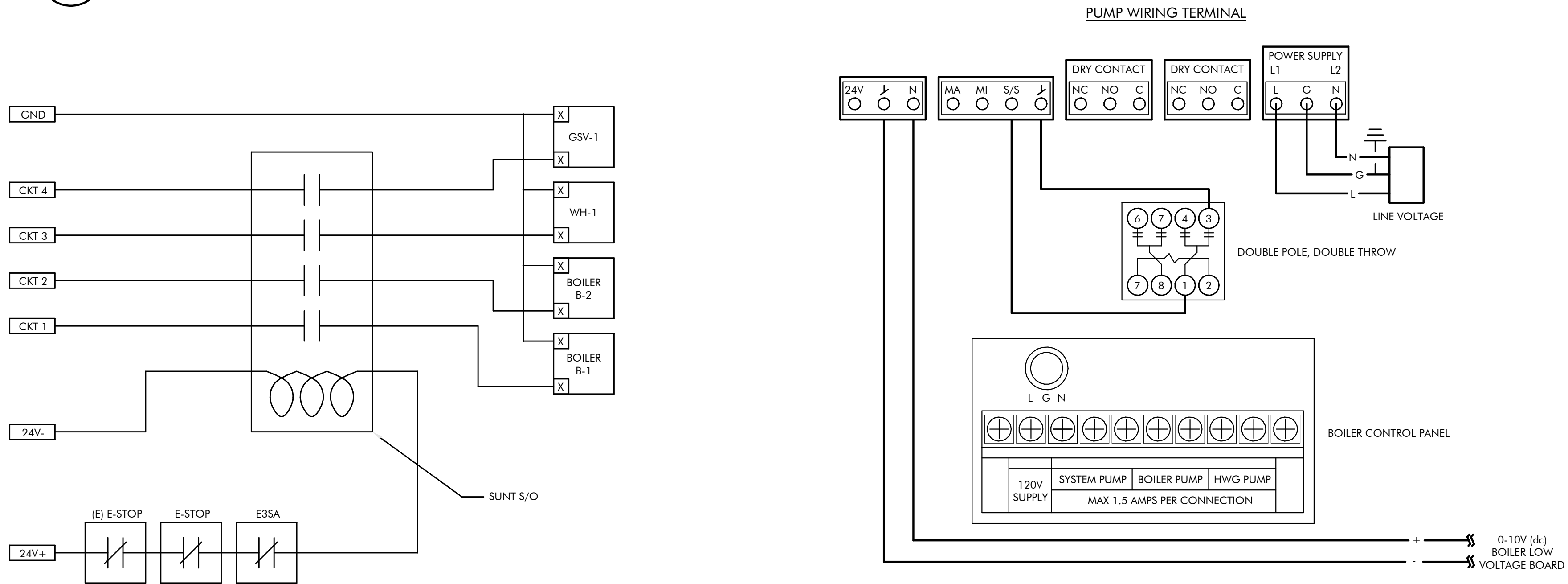
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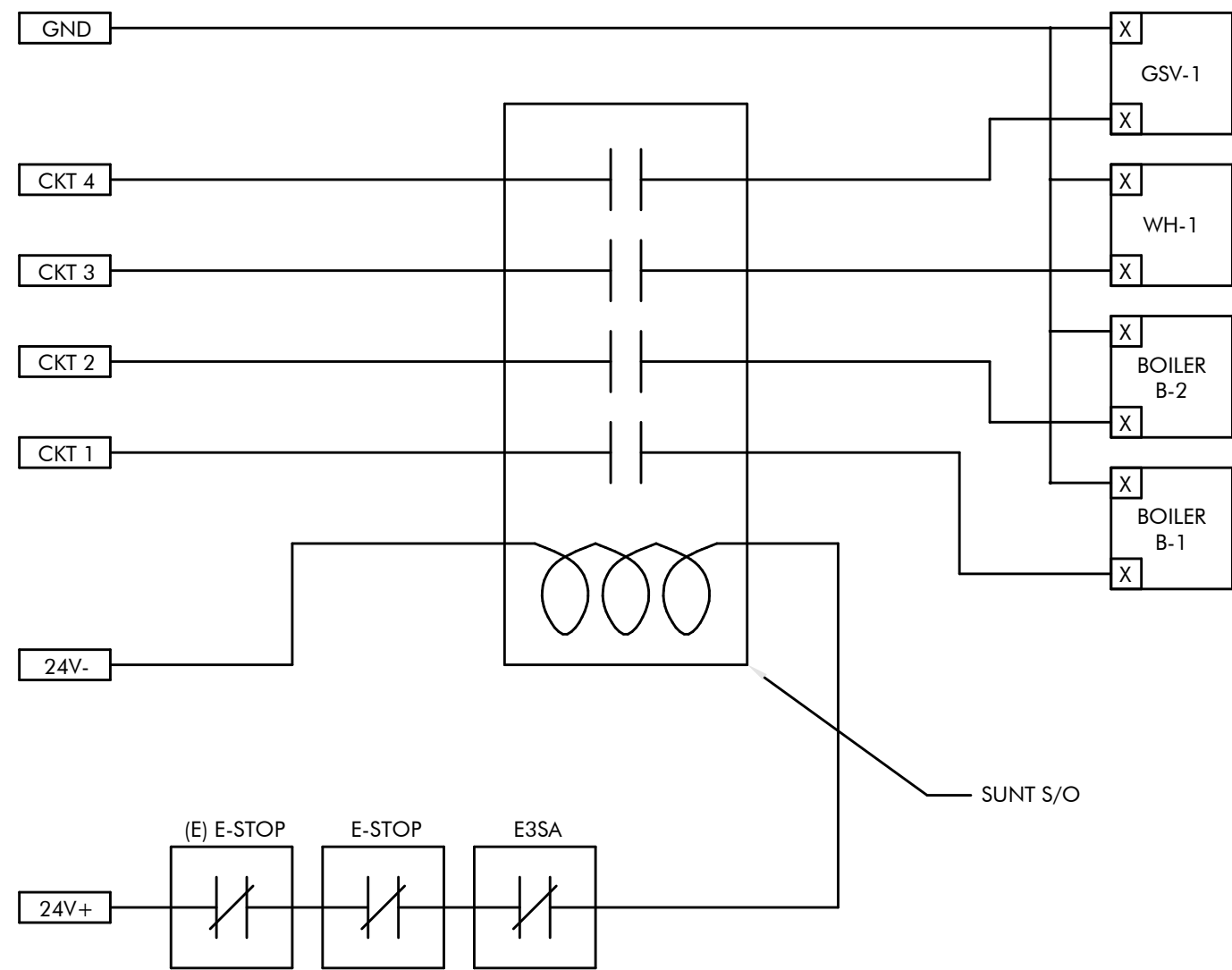
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1 HEATING HOT WATER CONTROL DIAGRAM
M7.2 SCALE : NONE



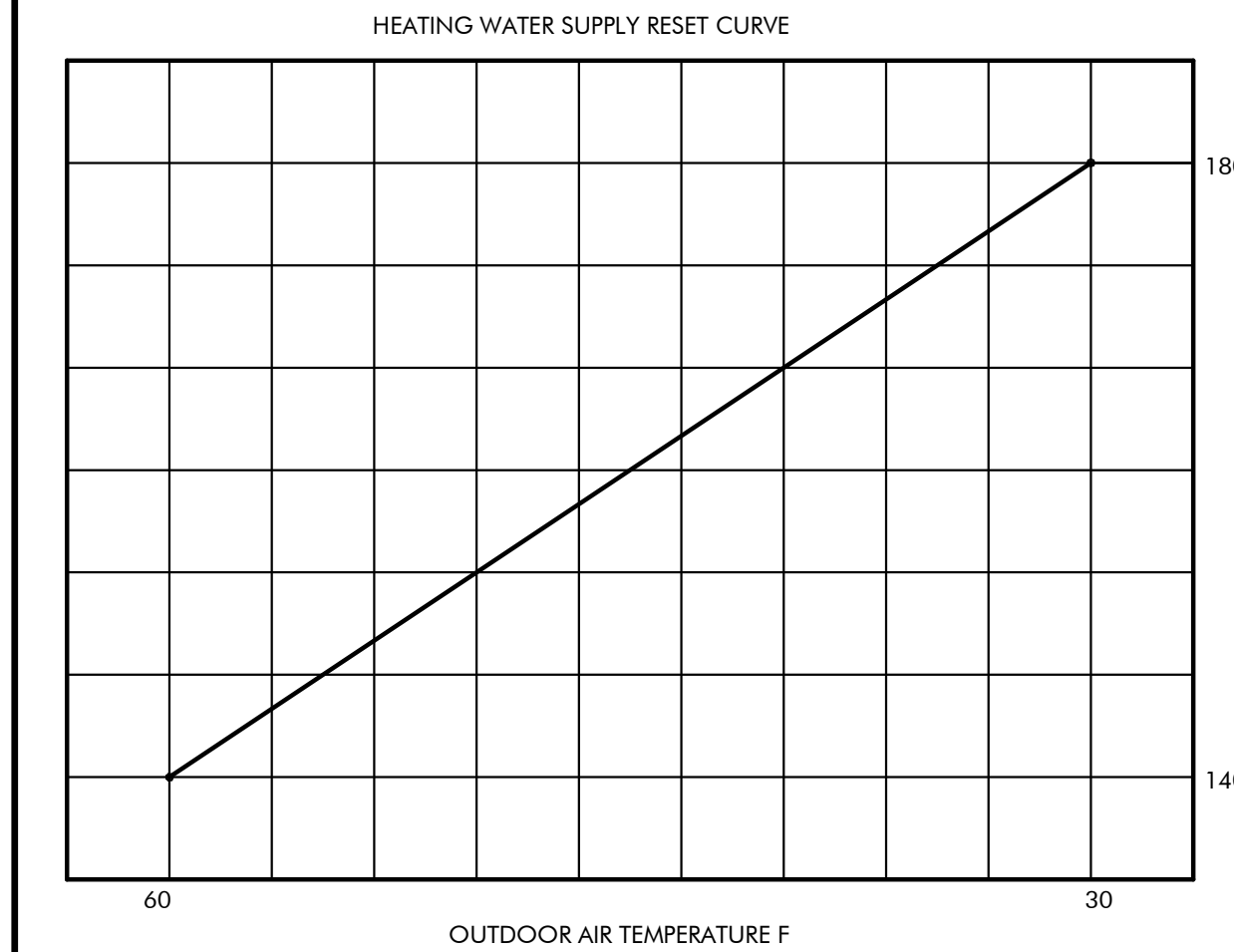
3 BOILER PUMP (HWP-B1, & HWP-B2) WIRING DIAGRAM
M7.2 SCALE : NONE



2 BOILER E-STOP CONTROL DIAGRAM
M7.2 SCALE : NONE

HEATING HOT WATER SYSTEM SEQUENCE OF OPERATION

- A. SETPOINTS
- HEATING SYSTEM SHALL BE ENABLED AT 60°F AND DISABLED AT 70°F (10°F DEADBAND) OR AS DIRECTED BY THE OWNER. ALL SETTINGS SHALL BE ADJUSTABLE.
 - THE HEATING WATER SUPPLY TEMPERATURE SHALL BE RE-SET BY THE BUILDING MANAGEMENT SYSTEM IN ACCORDANCE WITH THE FOLLOWING CURVE (INITIALLY 1:1 RATIO):

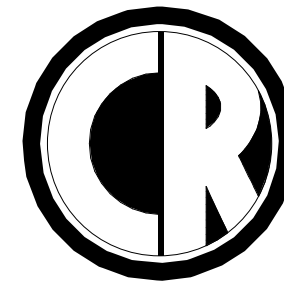


- B. BUILDING HEATING PUMPS (HWP-1, & HWP-2)
- WHEN HEATING SYSTEM IS ENABLED, THE BUILDING MANAGEMENT SYSTEM SHALL START LEAD BUILDING SUPPLY PUMP (HWP-1, & HWP-2)
 - UPON FAILURE OF THE LEAD PUMP, THE BUILDING MANAGEMENT SYSTEM SHALL ENERGIZE THE LAG (STANDBY) PUMP.
 - THE BUILDING MANAGEMENT SYSTEM SHALL ALTERNATE LEAD/LAG OF PUMPS WEEKLY.
- C. BOILERS (B-1 & B-2) AND ASSOCIATED BOILER PUMP (HWP-B1, & HWP-B2)
- THE BUILDING MANAGEMENT SYSTEM SHALL SEND SIGNAL TO MASTER BOILER CONTROLLER. THE BOILER CONTROLLER SHALL ENERGIZE LEAD BOILER (B-1 / B-2) AND START ASSOCIATED PUMP (HWP-B1 / HWP-B2) UTILIZING THE BOILERS INTERNAL LEAD/LAG CONTROL.
 - THE ASSOCIATED BOILER PUMP SHALL RUN CONTINUOUSLY WHEN BOILER IS IN OPERATION. THE BOILER CONTROLLER SHALL SHUT OFF THE PUMP 15 MINUTES AFTER BOILER SHUTDOWN TO PREVENT RESIDUAL HEAT FROM EXCEEDING BOILER HIGH LIMIT TEMPERATURE.
 - FLOW SWITCH AT BOILER DISCHARGE ALLOWS BOILERS TO ENERGIZE. BOILER INTEGRAL CONTROLS TO MODULATE BURNER TO MAINTAIN SYSTEM HEADER WATER TEMPERATURE SETPOINT.
 - THE BOILER CONTROLLER SHALL INDICATE ALARM CONDITION WHENEVER THE BOILER INDICATES FAILURE (THROUGH ALARM CONTACTS).
 - THE MANUAL RESET HIGH LIMIT CONTROL ON EACH BOILER SHALL BE SET INITIALLY AT APPROXIMATELY 210°F (ADJUSTABLE).
 - IF ANY SPACE TEMPERATURE SENSOR FALLS BELOW 50°F, THEN THE HEATING SYSTEM SHALL BE PLACED IN THE ENABLED MODE.
 - SAFETIES:
 - FLOW SWITCH SHALL DISABLE BOILER AND SET ALARM.
 - EMERGENCY SHUTDOWN SWITCH AT EACH BOILER ROOM EXIT SHALL DISCONNECT THE POWER TO ALL FUEL BURNING EQUIPMENT IN BOILER ROOM.
 - THE BUILDING MANAGEMENT SHALL SEND SIGNAL TO MASTER BOILER CONTROLLER, WHEN THE CONTROLLER ENERGIZES EITHER BOILERS, THE SUPPLY FAN (SF-1) SHALL ENERGIZE.
- D. OPERATOR'S TERMINAL
- SEE 'TEMPERATURE CONTROL AND EMCS GENERAL NOTES'.
 - HEATING WATER SUPPLY TEMPERATURE (°F).
 - HEATING WATER RETURN TEMPERATURE (°F).
 - BOILER SUPPLY TEMPERATURE (°F).
 - BOILER COMMAND (ENABLE/DISABLE).
 - BOILER STATUS (ON/OFF).
 - BOILER ALARM (ALARM/NORMAL).
 - HW PUMP COMMAND (START/STOP).
 - HW PUMP STATUS (ON/OFF).
 - HEATING WATER RESET TEMPERATURE (°F).

- E. SAFETIES
- EMERGENCY BOILER ROOM SHUT DOWN, SEE SEQUENCE BELOW
 - ROOM CARBON MONOXIDE (CO) DETECTOR SHALL ALARM IN ROOM AND ALSO BMS WHEN LEVELS ARE ABOVE 50 PPM (ADJUSTABLE THROUGH BMS)

BOILER ROOM EMERGENCY SHUTDOWN SEQUENCE OF OPERATION

- WHEN THE EMERGENCY SHUTDOWN BUTTON IS ENGAGED, BOTH BOILERS (B-1 AND B-2) WILL SHUT DOWN AND LOCKED OUT VIA THE AUXILIARY CONTACT LOCKOUT ON THE BOILERS. WATER HEATER (WH-1) SHALL ALSO SHUT DOWN BY A NORMALLY CLOSED RELAY BETWEEN THE OUTLET AND POWER PLUG. IN ADDITION, THE GAS SHUT OFF VALVE (GSV-1) SHALL BE TRIPPED AND VALVE SHALL BE CLOSED.

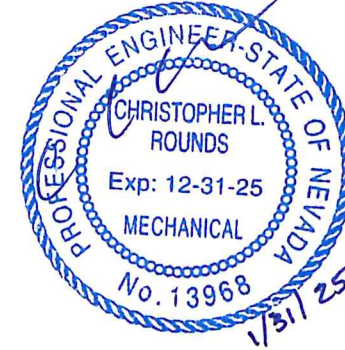


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MECHANICAL CONTROL DIAGRAMS AND
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DRAWN BY: RLT
DESIGNED BY: CL
CHECKED BY: CL
APPROVED BY: CLR
DATE: 1/31/2025
PROJECT NO: 158324

SHEET NUMBER:

M7.2

ELECTRICAL SYMBOLS AND NOMENCLATURE

	SINGLE-OUTLET RECEPTACLE		SINGLE-PHASE, 1-POLE CIRCUIT PATH (1/2" CONDUIT, (2) - #10 CU, UNLESS OTHERWISE NOTED) ABOVE FLOOR
	DOUBLE-OUTLET 'DUPLEX' RECEPTACLE		SINGLE-PHASE, 2-POLE CIRCUIT PATH (1/2" CONDUIT, (3) - #10 CU, UNLESS OTHERWISE NOTED) ABOVE FLOOR
	THREE-PHASE (3W) RECEPTACLE (CONFIGURATION AS NOTED)		THREE-PHASE, 1-POLE CIRCUIT PATH (1/2" CONDUIT, (4) - #10 CU, UNLESS OTHERWISE NOTED) ABOVE FLOOR
	QUADRUPLE-OUTLET 'QUAD' RECEPTACLE		RETURN CIRCUIT TO PANEL 'HOMERUN' (CIRCUIT AS NOTED) ABOVE FLOOR
	SPECIAL RECEPTACLE (VOLTAGE/CONFIGURATION AS NOTED)		CIRCUIT BREAKER (AMPS/POLES AS NOTED)
	JUNCTION BOX		FUSE (AMPS/POLES AS NOTED)
	FLOOR MOUNT RECEPTACLE		SHEET NOTE INDICATOR
	THERMOSTAT		SHEET/EQUIPMENT NOTE INDICATOR
	SAFETY DISCONNECT SWITCH (SIZE/VOLTAGE/CONFIGURATION AS NOTED)		EQUIPMENT NOTE INDICATOR
	COMBINATION SAFETY SWITCH/MAGNETIC STARTER		REVISION 'DELTA' NOTE INDICATOR
	TELEPHONE/DATA JUNCTION BACKBOX		FEEDER NOTE INDICATOR
	SINGLE-POLE TOGGLE SWITCH (VOLTAGE AS REQUIRED)	48"	48" MOUNTING HEIGHT AFF. (ACTUAL HEIGHT AS NOTED)
	MULTI-STATION 'THREE-WAY' TOGGLE SWITCH (VOLTAGE AS REQUIRED)	AFF.	ABOVE FINISHED FLOOR
	SOLID STATE DIMMING SWITCH (VOLTAGE AS REQUIRED)	AFG.	ABOVE FINISHED GRADE
	MOTOR-RATED TOGGLE SWITCH (VOLTAGE AS REQUIRED)	ATS.	AUTOMATIC TRANSFER SWITCH
	KEYED TOGGLE SWITCH (VOLTAGE AS REQUIRED)	C	CONDUIT
	CABLE TELEVISION OUTLET	CB	CIRCUIT BREAKER
	PANELBOARD (NAME/AMP/PHASE/VOLTAGE/CONFIGURATION AS NOTED)	CC	CONTROLS CONTRACTOR
	TRANSFORMER (NAME/KVA RATING/PHASE/VOLTAGE AS NOTED)	CLG	CEILING
	INDICATES MECHANICAL EQUIPMENT	(E)	EXISTING
	PHOTO ELECTRIC CELL	EC	ELECTRICAL CONTRACTOR
	TIME CLOCK	FACP	FIRE ALARM CONTROL PANEL
	CONTACTOR (CONFIGURATION AS NOTED)	F.B.O.	FURNISHED BY OTHERS
	DUCT DETECTOR FIRE ALARM SYSTEM COMPONENT	GFI	GROUND FAULT INTERRUPTING TYPE
	SMOKE DETECTOR FIRE ALARM SYSTEM COMPONENT	HID	HIGH INTENSITY DISCHARGE
	HEAT DETECTOR FIRE ALARM SYSTEM COMPONENT	LTG	LIGHTING
	FLOW SWITCH FIRE ALARM SYSTEM COMPONENT	NTS	NOT TO SCALE
	TAMPER SWITCH FIRE ALARM SYSTEM COMPONENT	MC	MECHANICAL CONTRACTOR
	HORN/STROBE COMBINATION FIRE ALARM SYSTEM COMPONENT	MCB	MAIN CIRCUIT BREAKER
	MANUAL PULL STATION	MSB'	MAIN SWITCH BOARD
	SINGLE-PHASE, 1-POLE CIRCUIT PATH (1/2" CONDUIT, (2) - #10 CU, UNLESS OTHERWISE NOTED) ABOVE FLOOR	(N)	NEW
	SINGLE-PHASE, 2-POLE CIRCUIT PATH (1/2" CONDUIT, (3) - #10 CU, UNLESS OTHERWISE NOTED) ABOVE FLOOR	NL	NIGHT LIGHT
	THREE-PHASE, 1-POLE CIRCUIT PATH (1/2" CONDUIT, (4) - #10 CU, UNLESS OTHERWISE NOTED) ABOVE FLOOR	TYP	TYPICAL
	RETURN CIRCUIT TO PANEL 'HOMERUN' (CIRCUIT AS NOTED) ABOVE FLOOR	UG	UNDER GROUND
	MOTOR (HORSEPOWER AS NOTED)	UN	UNLESS OTHERWISE NOTED
	SHUNT TRIP STATION	WP	WEATHER PROOF
		XFR	TRANSFORMER

MECHANICAL EQUIPMENT CONNECTION SCHEDULE:

MEQ #	DISCONNECTING MEANS	VOLTS / # / FLA	(E) CKT	LOAD KVA	(N) CKT	CONDUIT & WIRE	NOTE #3 & #4	NOTES
	30A/5F/3P 250V, NI DISC. SAFETY SWITCH	208 / 3 / 4.5	M2'-8, 10, 12	0.54	M2'-8, 10, 12	1/2" C., (3) - #12 Cu & (1) - #12 Cu GND		LOCKABLE
	30A/5F/3P 250V, NI DISC. SAFETY SWITCH	208 / 3 / 4.5	M2'-14, 16, 18	0.54	M2'-14, 16, 18	1/2" C., (3) - #12 Cu & (1) - #12 Cu GND		LOCKABLE
	PROVIDED BY M.C. & INSTALLED BY E.C.	208 / 3	--	--	M2'-19, 21, 23	3/4" C., (3) - #8 Cu & (1) - #10 Cu GND		10 HP
	PROVIDED BY M.C. & INSTALLED BY E.C.	208 / 3	--	--	M2'-25, 27, 29	3/4" C., (3) - #8 Cu & (1) - #10 Cu GND		10 HP
	VFD-1	208 / 3 / 30.8	M2'-19, 21, 23	11.09	VIA VFD-1	3/4" C., (3) - #8 Cu & (1) - #10 Cu GND		10 HP
	VFD-2	208 / 3 / 30.8	M2'-25, 27, 29	11.09	VIA VFD-2	3/4" C., (3) - #8 Cu & (1) - #10 Cu GND		10 HP
	30A/NF/2P 250V, NI DISC. SAFETY SWITCH	208 / 1 / 8.8	M2'-7, 9, 11	1.83	M2'-7, 9	1/2" C., (2) - #12 Cu & (1) - #12 Cu GND		1 HP, LOCKABLE
	30A/NF/2P 250V, NI DISC. SAFETY SWITCH	208 / 1 / 8.8	M2'-13, 15, 17	1.83	M2'-15, 17	1/2" C., (2) - #12 Cu & (1) - #12 Cu GND		1 HP, LOCKABLE
	NEMA 5-20R RECEPTACLE & MATCHING CORD SET	120 / 1 / 0.52	--	0.06	F1'-18	1/2" C., (2) - #12 Cu & (1) - #12 Cu GND		--
	JUNCTION BOX & HARDWIRE	120 / 1 / 1	--	0.12	F1'-18	1/2" C., (2) - #12 Cu & (1) - #12 Cu GND		--
	NEMA 5-20R RECEPTACLE & MATCHING CORD SET	120 / 1 / 6.2	F1'-18	0.14	F1'-18	1/2" C., (2) - #12 Cu & (1) - #12 Cu GND		--

MECHANICAL EQUIPMENT CONNECTION SCHEDULE NOTES:

- CONTRACTOR SHALL DISCOVER AND FIELD VERIFY THE SERVING PANEL & BRANCH CIRCUIT AND UPDATE PANEL DIRECTORIES.
- SEE MECHANICAL PLANS FOR EXACT LOCATIONS OF MECHANICAL EQUIPMENT.
- CONTRACTOR'S BID SHALL INCLUDE NEW (OVERHEAD) CONDUITS AND PATHWAYS AS REQUIRED FOR ALL EQUIPMENT CONNECTIONS. NEVERTHELESS, CONTRACTOR MAY REUSE ANY EXISTING CONDUITS, BACK BOXES, AND PATHWAYS THAT ARE MADE AVAILABLE DURING THE DEMOLITION PHASE OF WORK.
- ALL BRANCH CIRCUIT WIRING SHALL BE & PROVIDED WITH PRINTED PERMANENT WIRE MARKERS WHICH CLEARLY IDENTIFY THE SERVING PANEL & CIRCUIT BREAKER.

ENGINEERING
MECHANICAL ENGINEERING CONSULTANT

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01/31/2025

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CONSULTANT:

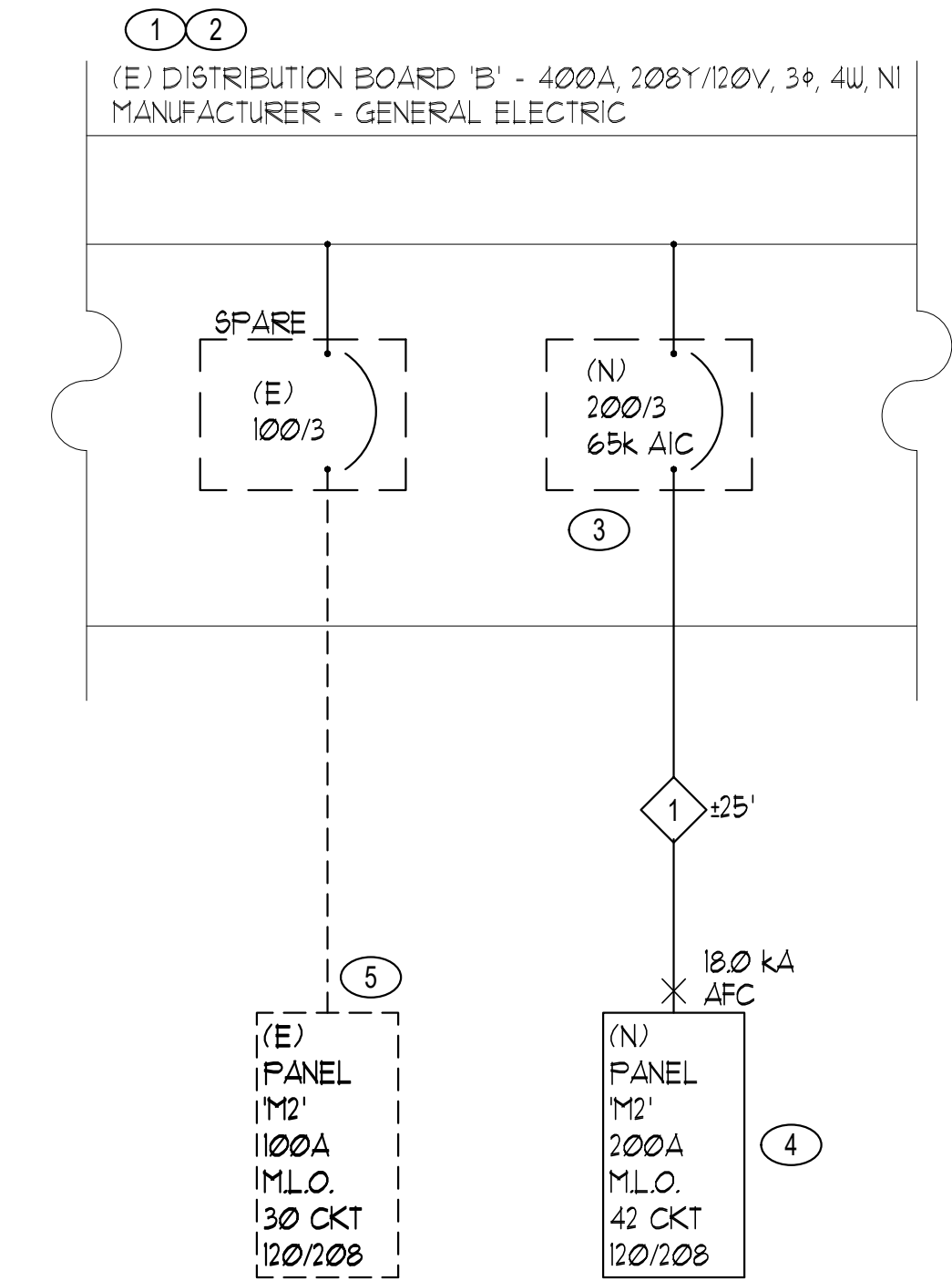
Electrical Engineers

9655 Gateway Drive
Reno, Nevada 89521-2968
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kyle.jensen@jeneng.com
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DOUGLAS COUNTY SCHOOL DISTRICT
GEORGE WHITTELL HIGH SCHOOL
BOILER REPLACEMENT
240 WARRIOR WAY, ZEPHYR, NV 89448
ELECTRICAL SYMBOLS & MECHANICAL
EQUIPMENT CONNECTION SCHEDULE

REVISIONS:		
REV.	DESCRIPTION	DATE
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DRAWN BY: KPJ		
DESIGNED BY: KPJ		
CHECKED BY: GGJ		
APPROVED BY: GGJ		
DATE: 01/31/2025		
PROJECT NO: N224JK		
SHEET NUMBER:		

Electrical Feeder Schedule by Jensen Engineering, Inc.																	
Feeder No.	Source	Destination	Length	OCPD Rating	Connected Current	Voltage & Phase	Conduit			Conductors per Conduit				Zc (Ω)	Voltage Drop		Notes
							Qty.	Size	Material	Type	Qty.	Size (AWG)	Material		V _{Drop}	%	
1	(E) DIST. BOARD 'B'	(N) PANEL 'M2'	25	200	161	208Y/120 V, 3φ	1	2"	Steel		Phase:	3	3/0	0.094	0.66	0.32	
											Neutral:	1	3/0				
											Ground:	1	6				
Notes: 1. Voltage Drop calculated using Neher-McGrath Method. 2. Impedance taken from NEC/CEC Table 9; assumes power factor of 0.85. 3. Length estimated in feet for voltage drop only and shall not be used for pricing/bidding. 4. Conductors selected from NEC/CEC Table 310.15(b)(16), 75 degree columns. 5. Conduit Size is Trade Size, representing nominal Inside Diameter.																	



PARTIAL
SINGLE-LINE DIAGRAM

NOT TO SCALE

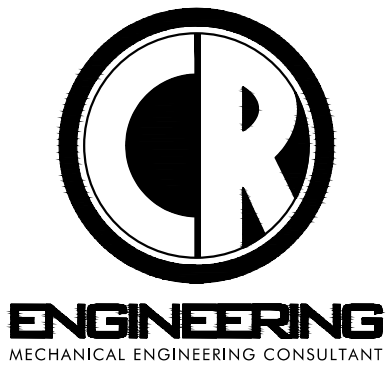
A
E03

3-Phase, 4-Wire, Y-Connected Electrical Panelboard Schedule by Jensen Engineering, Inc.																																				
Project Name:		WHITTELL HS BOILER REPLACEMENT		Line to Neutral Voltage:		120				Bus Material:		COPPER		Short Circuit Rating:		NEW																				
Panel Name:		M2		Line to Line Voltage:		208				Bus Rating:		225 AMP		New or Existing:		EXISTING																				
Panel Location:		AS SHOWN ON SHEET E1.0		Main Breaker or Lug Only:		LUG ONLY				Lug/Breaker Rating:		200 AMP		Mounting:		SURFACE																				
Ckt. No.	Load (VA)	Description		Load Power Factor	One-Way Ckt Length (ft)	Wire Size (AWG)	Corrected z ¹ (D-to-Neutral)	VOLTRIP (%)	Poles	Tripp	Phase	Breaker	VOLTRIP (%)	Corrected z ¹ (D-to-Neutral)	Wire Size (AWG)	One-Way Ckt Length (ft)	Load Power Factor	Description	Load (VA)	Ckt. No.																
1	5000	5000	(E) DOMESTIC WATER PUMP						3	60	A	20	1					(E) AHU-1/HWP TCP	500	2																
3																																		180	4	
5																																			180	6
7	915	915	(N) HWP-B1						2	15	B	20	1					(E) RECEPTACLE BELOW PANEL	540	8																
9																																		540	10	
11																																			540	12
13		915	(N) HWP-B2						2	15	C	15	3					(N) B-2	540	14																
15																																		540	16	
17																																			540	18
19	3698	3698	(N) HWP-1 VIA VFD-1						3	40	A	50	3					(E) AHU-1	4200	20																
21																																		4200	22	
23																																			4200	24
25	3698	3698	(N) HWP-2 VIA VFD-2						3	40	B	20	1					(E) BOILER TCP	500	26																
27																																				28
29																																				
31		3698									C	20	1					(E) SPARE		32																
33																																				34
35																																				
37											A	20	1					(E) SPARE		38																
39																																				40
41																																				
13311	14226	13311	Total Load (VA)	Notes:	1. Corrected impedance calculated using Neher-McGrath method for determining resistance in AC circuits. 2. Circuit length used for calculating voltage drop; not to be used for estimating or pricing. 3. Wire size used for calculating voltage drop; not to be used for estimating or pricing. See electrical drawing												Total Load (VA):			6280	5460	5460														
															+25% of Lighting Load (VA):			0	0	0																
															+25% of Largest Motor Load (VA):			0	0	0																
															Combined Total Load (VA):			19591	19686	18771																
															Average Line Current (Amps):			163.26	164.05	156.43																
															Average Total Current (Amps):			161.32																		
															Total Connected Load (kVA):			58.05																		

3-Phase, 4-Wire, Y-Connected Electrical Panelboard Schedule by Jensen Engineering, Inc.																				
Project Name:		WHITTILL HS BOILER REPLACEMENT		Line to Neutral Voltage:		120		Bus Material:		COPPER		Short Circuit Rating:								
Panel Name:		P1		Line to Line Voltage:		208		Bus Rating:		225 AMP		New or Existing:		EXISTING						
Panel Location:		AS SHOWN ON SHEET E1.0		Main Breaker or Lug Only:		EXISTING		Lug/Breaker Rating:		225 AMP		Mounting:		EXISTING						
Ckt. No.	Load (VA)	Description		Load Power Factor	One-Way Ckt Length (ft)	Wire Size (AWG)	Corrected Z ¹ (D-to-Neutral)	VOLTRIP (%)	Poles	Tripp	Phase	Breaker	VOLTRIP (%)	Corrected Z ¹ (D-to-Neutral)	Wire Size (AWG)	One-Way Ckt Length (ft)	Load Power Factor	Description	Load (VA)	Ckt. No.
1	0		(E) SPARE						1	20	A	20	1					(E) SPARE	0	2
3	1080		(E) LOAD						1	20	B	20	1					(E) LOAD	1080	4
5			(E) LOAD						1	20	C	20	1					(E) LOAD		6
7	1080		(E) LOAD						1	20		20	1					(E) LOAD	1080	8
9			(E) LOAD						1	20		20	1					(E) LOAD		10
11	1080		(E) LOAD						1	20		30	1					(E) LOAD	1080	12
13			(E) LOAD						1	20		20	1					(E) LOAD		14
15	1080		(E) SPARE						1	20		20	1					(E) SPARE	0	16
17	0		(E) SPARE						1	20		20	1					(E) SPARE	1080	18
19			(E) SPARE						1	20		20	1					(N) CP-1, GSV-1 & WH-1		20
21	1080		(E) LOAD						1	20		20	1					(E) LOAD	1080	22
23	0		(E) SPARE						1	30		30	1					(E) SPARE	0	24
25			(E) SPARE						1	30		30	1					(E) SPARE	0	26
27	500		(E) LOAD						1	20		30	1					(E) SPARE	0	28
29			(E) LOAD						2	50		20	1					(E) LOAD	1000	30
31	3640		(E) SPARE						1	20		30	1					(E) SPARE	0	32
33	1080		(E) LOAD						1	20		20	1					(E) LOAD	1080	34
35			(E) LOAD						1	20		20	1					(E) LOAD	500	36
37	1080		(E) LOAD						1	20		20	1					(E) LOAD		38
39	1248		(E) LOAD						2	20								(E) LOAD	500	40
41	1248		(E) LOAD									20	1					(E) LOAD	1080	42
43	250		(E) LOAD						1	20										42
6068 8128 7130 Total Load (VA)				Notes: 1. Corrected impedance calculated using Neher-McGrath method for determining resistance in AC circuits. 2. Circuit length used for calculating voltage drop; not to be used for estimating or pricing. 3. Wire size used for calculating voltage drop; not to be used for estimating or pricing. See electrical drawing												Total Load (VA): 3240 5820 3586 +25% of Lighting Load (VA): 0 0 0 +25% of Largest Motor Load (VA): 0 0 0 Combined Total Load (VA): 9308 13948 10716 Average Line Current (Amps): 77.57 116.23 89.30 Average Total Current (Amps): 94.41 Total Connected Load (kVA): 33.97				

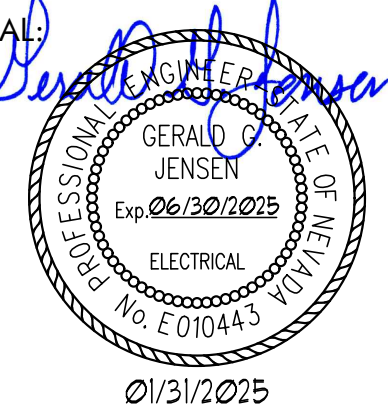
SHEET NOTES:(THIS SHEET ONLY)

- 1 (E) DEAD-FRONT IS TO BE REMOVED AND REPLACED WITH PROVISIONS TO ACCOMMODATE (N) CIRCUIT BREAKER.
- 2 CONTRACTOR SHALL FIELD VERIFY EXACT MEASUREMENTS FOR MODIFICATIONS TO (E) DEAD-FRONT COVER.
- 3 CONTRACTOR SHALL INCLUDE ALL REQUIRED MOUNTING HARDWARE AND MODIFICATIONS TO ACCOMMODATE (N) 200A, 3-POLE BREAKER FOR (N) PANEL 'M2'.
- 4 ALL (E) CIRCUIT BREAKERS AND (E) CONNECTED LOADS ARE TO BE REINSTALLED IN (N) 200A PANELBOARD 'M2'. EXTEND AND MODIFY (E) BRANCH CIRCUIT WIRING TO ACCOMMODATE REINSTALLATION OF (E) BREAKERS AND (E) CONNECTED LOADS.
- 5 REMOVE AND RETIRE (E) CONDUIT, CONDUCTORS AND (E) PANEL 'M2' COMPLETE.
- 6 THE (E) 100A BREAKER SHALL BE LABELED 'SPARE' AND SET IN THE 'OFF' POSITION.

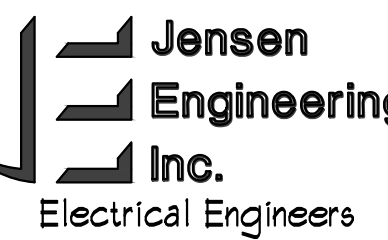


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DOUGLAS COUNTY SCHOOL DISTRICT
GEORGE WHITTELL HIGH SCHOOL
BOILER REPLACEMENT
240 WARRIOR WAY, ZEPHYR, NV 89448

DETAILS

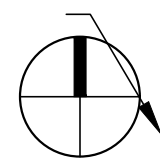
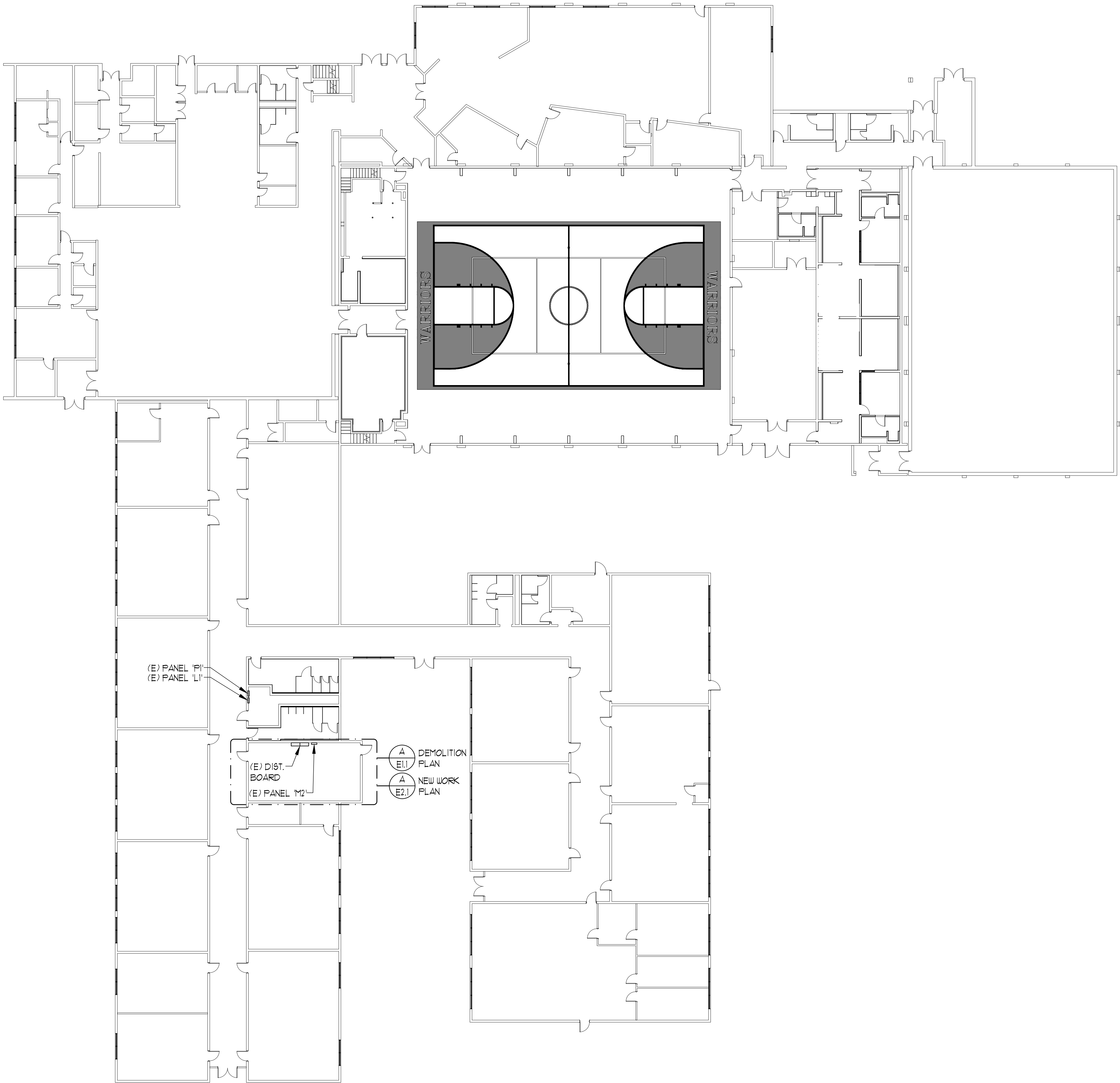
REVISIONS:

REV.	DESCRIPTION	DATE
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DRAWN BY: KPJ
DESIGNED BY: KPJ
CHECKED BY: GGJ
APPROVED BY: GGJ
DATE: 01/31/2025
PROJECT NO: N224JK

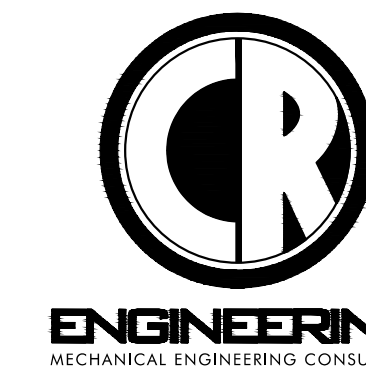
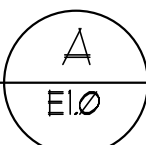
SHEET NUMBER:

E0.3



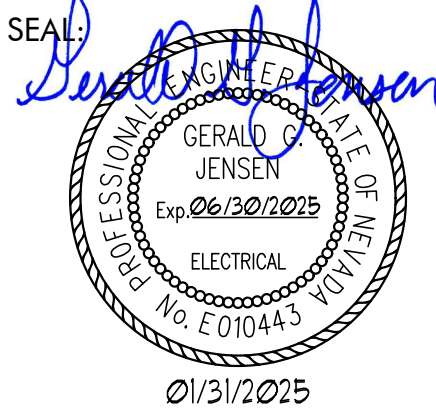
OVERALL ELECTRICAL FLOOR PLAN

SCALE: 1/16" = 1'-0"



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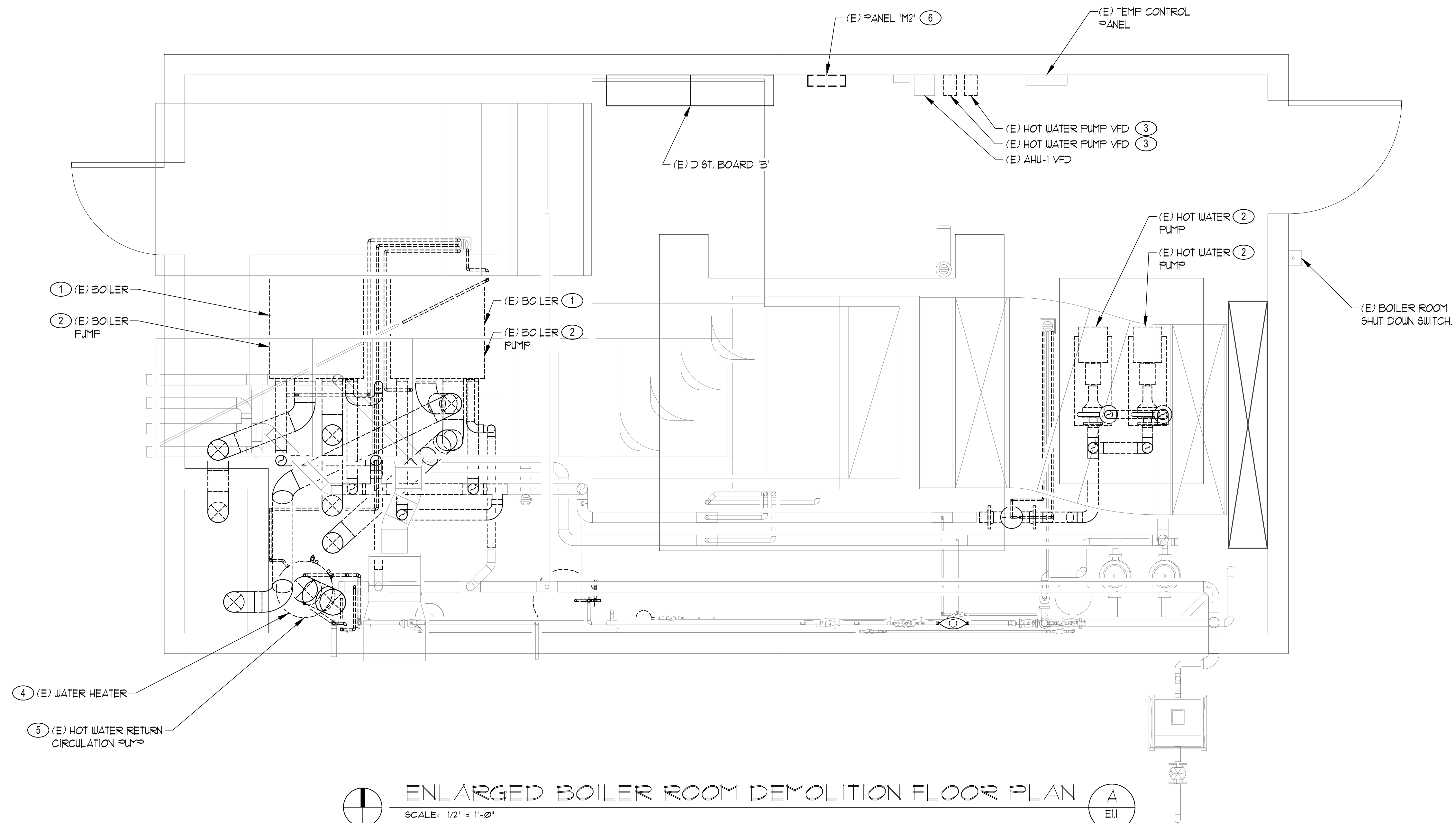
DOUGLAS COUNTY SCHOOL DISTRICT
GEORGE WHITTELL HIGH SCHOOL
BOILER REPLACEMENT
240 WARRIOR WAY, ZEPHYR, NV 89448
OVERALL ELECTRICAL FLOOR PLAN

REVISIONS:		
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DRAWN BY: KPJ
DESIGNED BY: KPJ
CHECKED BY: GGJ
APPROVED BY: GGJ
DATE: 01/31/2025
PROJECT NO: N224JK

SHEET NUMBER:

E1.0



ENLARGED BOILER ROOM DEMOLITION FLOOR PLAN
SCALE: 1/2" = 1'-0"

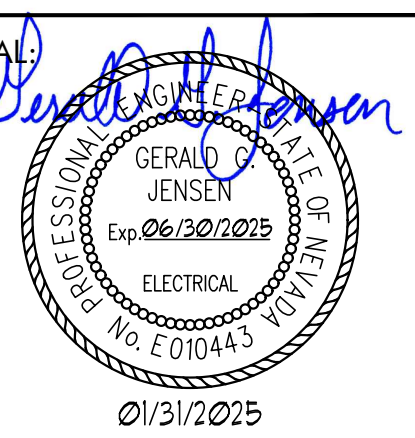
SHEET NOTES: (THIS SHEET ONLY)

- 1 REMOVE AND RETIRE (E) CONDUIT AND CONDUCTORS TO (E) BOILER.
- 2 REMOVE AND RETIRE (E) CONDUIT AND CONDUCTORS TO (E) PUMP.
- 3 REMOVE AND RETIRE (E) CONDUIT AND CONDUCTORS TO (E) VFD.
- 4 REMOVE AND RETIRE (E) CONDUIT AND CONDUCTORS TO (E) WATER HEATER.
- 5 REMOVE AND RETIRE (E) CONDUIT AND CONDUCTORS TO (E) HOT WATER RETURN CIRCULATION PUMP.
- 6 (E) 100A PANELBOARD 'M2' IS TO BE REMOVED AND REPLACED WITH (N) 200A PANELBOARD 'M2'.

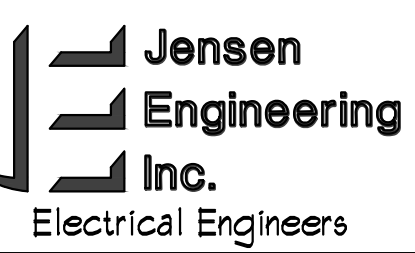


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DOUGLAS COUNTY SCHOOL DISTRICT
GEORGE WHITTELL HIGH SCHOOL
BOILER REPLACEMENT
240 WARRIOR WAY, ZEPHYR, NV 89448
ENLARGED BOILER ROOM ELECTRICAL
DEMOLITION PLAN

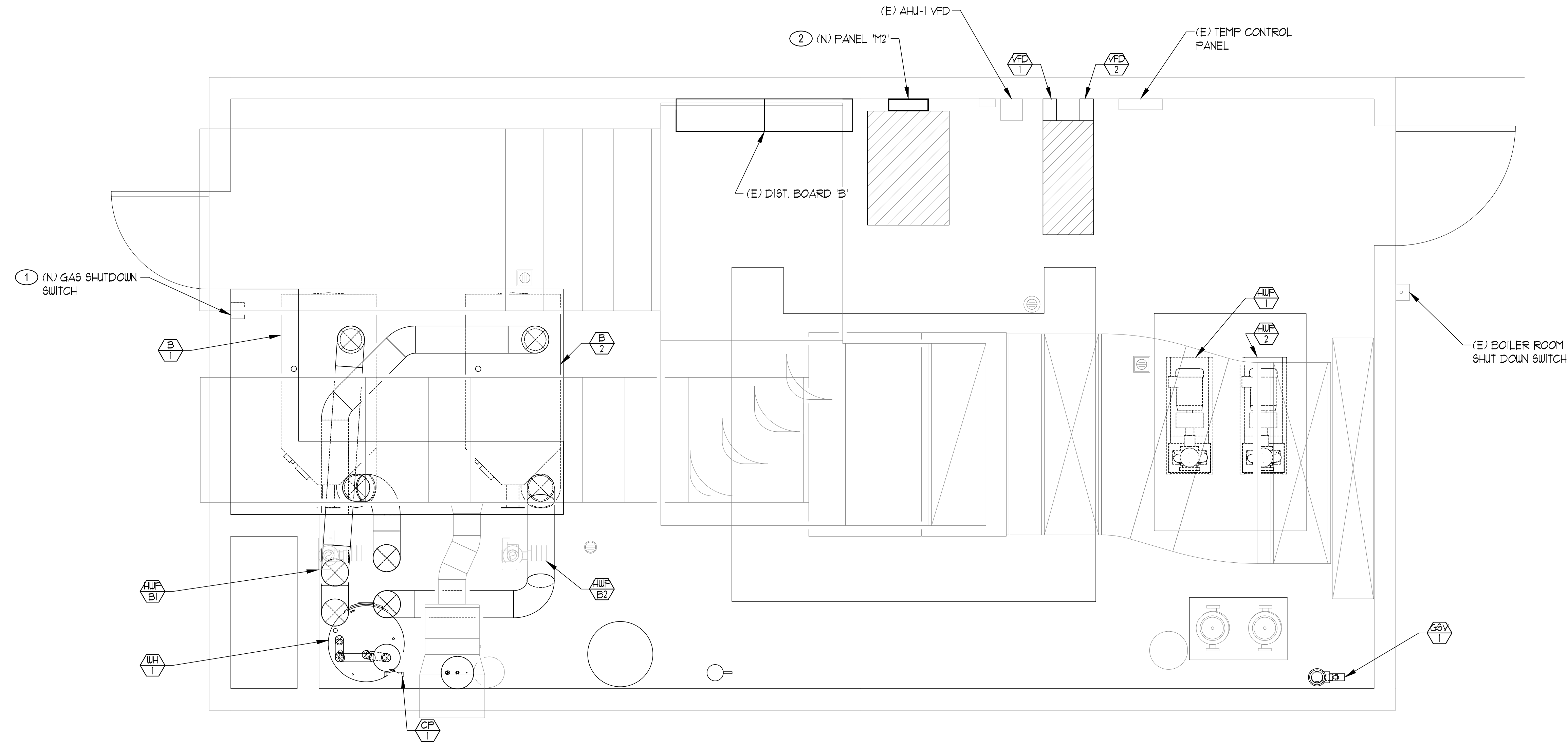
REVISIONS:

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PROJECT NO: N224JK

SHEET NUMBER:

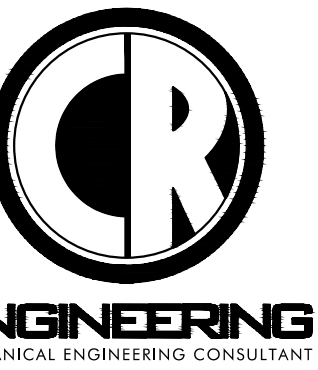
E1.1



ENLARGED BOILER ROOM ELECTRICAL FLOOR PLAN
SCALE: 1/2" = 1'-0"

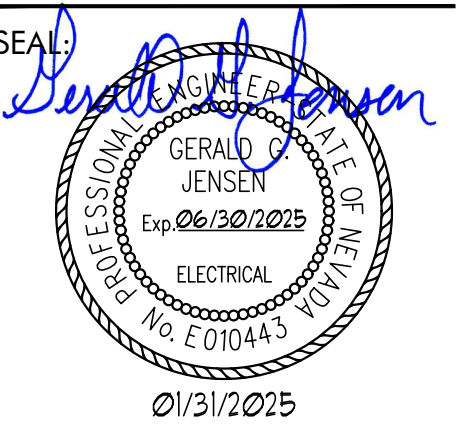
SHEET NOTES: (THIS SHEET ONLY)

- COORDINATE WITH MECHANICAL AND CONTROL DRAWINGS FOR REQUIREMENTS WITH (N) SHUTDOWN SWITCHES.
- REFER TO SHEET E03 FOR DETAILS.

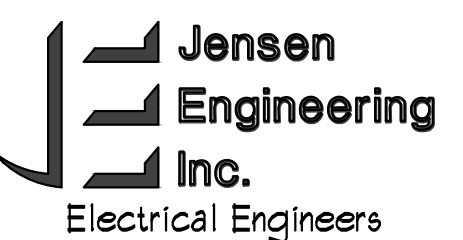


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DOUGLAS COUNTY SCHOOL DISTRICT
GEORGE WHITTELL HIGH SCHOOL
BOILER REPLACEMENT
240 WARRIOR WAY, ZEPHYR, NV 89448
ENLARGED BOILER ROOM ELECTRICAL
NEW WORK PLAN

REVISIONS:

REV.	DESCRIPTION	DATE
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-

DRAWN BY: KPJ
DESIGNED BY: KPJ
CHECKED BY: GGJ
APPROVED BY: GGJ
DATE: 01/31/2025
PROJECT NO: N224JK

SHEET NUMBER:

E2.1