TECHNICAL SPECIFICATIONS

SECTION 011000 - SUMMARY

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes the following:

1. Work covered by the Contract Documents.
2. Type of the Contract.
3. Use of premises.
4. Owner's occupancy requirements.
5. Work restrictions.

B. Related Sections include the following:

1. Division 01 Section "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

1.03 WORK COVERED BY CONTRACT DOCUMENTS

A. Project Identification: Bid Documents for Washwater Reclaim Pump Station #2 HVAC Upgrades, Jordan Valley Water Treatment Plant

1. Project Location: 15305 S 3200 W Herriman, UT 84065
2. JVWCD – Project number #4387

B. Owner: Jordan Valley Water Conservancy District

C. Consultants:

1. Prime Consultant/Mechanical Engineer: Heath Engineering Company, 377 West 800 North, Salt Lake City, Utah 84103.

1.04 TYPE OF CONTRACT

A. Project will be constructed under a single prime contract.

1.05 USE OF PREMISES

A. General: Contractor shall have limited use of premises for construction operations as indicated on Drawings by the Contract limits.

B. Use of Site: Limit use of premises to areas within the Contract limits indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.

1. Owner Occupancy: Keep drives, parking areas and dock open throughout the project for general use. Brief interruption of access allowed for work of the Project to take place. Allow for Owner and its assigns occupancy of Project site during and throughout construction. Do not disrupt normal operations in the building. Operations not to be disrupted include, but are not limited to, the following:

a. Emergency vehicle access.

b. Public transportation access.

c. Access for building waste removal.

d. Access for building deliveries.

e. Access to exits and entrances for building employees.

f. Utilities and other services to the building.

2. Driveways and Entrances: Keep driveways loading areas, and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.

a. Schedule deliveries to minimize use of driveways and entrances.

b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

C. Use of Existing Building: Maintain existing building in a weathertight condition throughout construction period. Repair damage caused by construction operations. Protect building and its occupants during construction period.

1. Maintain function of existing building during construction period. Conduct construction work in a manner that does not interfere with the safety of the employees, public.

1.06 OWNER'S OCCUPANCY REQUIREMENTS

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

1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and approval of authorities having jurisdiction.

2. Notify Owner not less than 72 hours in advance of activities that will affect Owner's operations.

1.07 WORK RESTRICTIONS

A. During construction period, Contractor will have use of premises for construction operations. Contractor will ensure that Contractor, its employees, subcontractors, and employees:

1. Confine operations to areas within Contract limits shown on Drawings. Do not disturb portions beyond Contract limits.

2. Refrain from using profanity or being discourteous or uncivil to others on the Project Site and/or while performing the Work.

3. Do not build fires on Project Site.

4. Reasonably accommodate use of existing facilities by Facility operating staff.
5. Do not bring or allow weapons on the Project Site.
6. Display on their persons at all times while on the Property visible identification of their association with Contractor or Subcontractor (i.e., via uniform and/or identification card or badge).

B. Nonsmoking Building: Smoking is not permitted within the building or openly on property.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 014200 - DEFINITIONS AND STANDARDS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes procedural and administrative requirements for compliance with governing regulations and codes and standards imposed upon the Work. These requirements include obtaining permits, licenses, inspections, releases and similar documentation, as well as payments, statements and similar requirements associated with regulations, codes and standards.

1.03 DESCRIPTION OF REQUIREMENTS

A. The term, "Regulations" is defined to include laws, statutes, ordinances and lawful orders issued by governing authorities, as well as those rules, conventions and agreements within the construction industry which effectively control the performance of the work regardless of whether they are lawfully imposed by governing authority or not.

B. Governing Regulations: Refer to General and Supplementary Conditions for requirements related to compliance with governing regulations.

1.04 DEFINITIONS:

A. General Explanation: A substantial amount of specification language constitutes definitions of terms found in other contract documents, including the drawings. (Drawings are recognized as being diagrammatic in nature and not completely descriptive of the requirements indicated thereon.) Certain terms used in contract documents are defined in this article. Definitions and explanations contained in this section are not necessarily either complete or exclusive but are general for the Work to extent that they are not stated more explicitly in another element of contract documents.

B. General Requirements: The provisions or requirements of other Division sections apply to entire work of the Contract and, where so indicated, to other elements which are included in the project.

C. Indicated: The term "Indicated" is a cross-reference to graphic representations, notes or schedules on the drawings, to other paragraphs or schedules in the specifications, and to similar means of recording requirements in contract documents. Where terms such as "shown," "noted," "scheduled," and "specified" are used in lieu of "indicated," it is for the purpose of helping the reader locate the cross-reference, and no limitation of location is intended except as specifically noted.

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

E. Approve: Where used in conjunction with the Engineer's response to submittals, requests, applications, inquiries, reports and claims by the Contractor, the meaning of term "approved" will be held to limitations of the Engineer's responsibilities and duties as specified in General and Supplementary Conditions. In no case will an Engineer's approval be interpreted as a release of the Contractor from responsibilities to fulfill requirements of contract documents. In general, the Engineer will "Review" Contractors submittals and work offering and make comment.

F. Downtime: Related to shutdown of the mechanical or electrical system.

1.05 SPECIFICATION AND DRAWING CONVENTIONS

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

1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.

2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.

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

C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:

1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.

2. Abbreviations: Materials and products are identified by abbreviations scheduled on Drawings.

D. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.

1.06 INDUSTRY STANDARDS:

A. Applicability of Standards: Except where more explicit or stringent requirements are written into the contract documents, applicable construction industry standards have the same force and effect as if bound into or copied directly into contract documents. Such industry standards are made a part of the contract documents by reference. Individual specification sections indicate which codes and standards the Contractor must keep available at the project site for reference.

B. Referenced standards (standards referenced directly in the contract documents) take precedence over non-referenced standards that are recognized in the industry for applicability to the Work.

C. Non-referenced Standards: Except as otherwise limited by the contract documents, non-referenced standards recognized in the construction industry are defined as having direct applicability to the Work and will be enforced for the performance of the Work. The decision as to whether an industry code or standard is applicable to the Work, or as to which of several standards are applicable, is the sole responsibility of the Engineer and related sub-consultants.

D. Publication Dates: Except as otherwise indicated, where compliance with an industry standard is required, comply with standard in effect as of date of contract documents.

E. Updated Standards: Where an applicable industry code or standard is revised and reissued after the date of the contract documents and before the performance of the work affected, request clarification of how to proceed. The Engineer with sub-consultant counsel will decide whether or not to issue a request for proposed cost adjustment in response to the updated standard.

F. Conflicting Requirements: Where compliance with two or more standards is specified, and where these standards establish different or conflicting requirements for minimum quantities or quality levels, the most stringent requirement will be enforced, unless the contract documents specifically indicate a less stringent requirement. Identify and refer requirements that are different, but apparently equal, and uncertainties as to which quality level is more stringent, to the Engineer for resolution before proceeding.

G. Contractor/subcontractor/worker Experience: The contract documents require that each entity performing work be experienced in that part of the work being performed. Each entity is also required to be familiar with industry standards applicable to that part of the work.

H. Abbreviations and Names: Trade association names and titles of general standards are frequently abbreviated. Where acronyms or abbreviations are used in the specifications or other contract documents they are defined to mean the recognized name of the trade association, standards generating organization, governing authority or other entity applicable to the context of the text provision. Refer to the "Encyclopedia of Associations," published by Gale Research Co., available in most libraries.

1.07 GOVERNING REGULATIONS/AUTHORITIES:

A. General: The procedure followed by the Engineer has been to contact governing authorities where necessary to obtain information needed for the purpose of preparing contract documents; recognizing that such information may or may not be of significance in relation to the Contractor's responsibilities for performing the Work. Contact governing authorities directly for necessary information and decisions having a bearing on performance of the Work.

B. Unless specifically noted to contrary, conform with and test in accordance with applicable sections and parts of codes and standards, and most recent revisions and supplements thereto, of the following:

1. Manual of Accident Prevention in Construction by the Associated General Contractors of America (AGC).

2. American Society of Mechanical Engineers (ASME).

3. American National Standards Institute (ANSI).

4. National Electrical Code (NEC). (NFPA-70).
5. National Electrical Manufacturers Association (NEMA).
6. National Fire Protection Association (NFPA).
7. Institute of Electrical and Electronics Engineers (IEEE).
8. International Building Code
9. International Mechanical Code
10. International Plumbing Code

C. Miscellaneous applicable codes and standards not listed above.

1.08 LAWS AND ORDINANCES

A. Comply with applicable laws, orders, ordinances, practices and requirements of any governmental and private agency under whose jurisdiction work is performed in connection with the contract documents, including the following:

1. Jordan Valley Water Conservancy District
2. State of Utah
3. City of Herriman
4. Other as have legal/lawful or Owner authority standing.

1.09 INSURANCE STANDARDS:

A. To be in accordance with standards, practices and requirements of the State of Utah.

1.010 INTERPRETATION OF THIS SECTION:

A. In event of discrepancies between various codes, ordinances, practices, standards, laws, etc., Engineer's interpretations will be followed.

1.011 PERMITS, LICENSES AND CERTIFICATES

A. For the Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, and similar documents, correspondence and records established in conjunction with compliance with standards and regulations bearing upon performance of the work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 017300 - EXECUTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes general procedural requirements governing the “Execution of the Work” in all of its trades and forms including, but not limited to, the following:

1. General installation of products.
2. Progress cleaning.
3. Starting and adjusting.
4. Protection of installed construction.
5. Correction of the Work.

B. Related Sections include the following:

1. Division 01 Section "Cutting and Patching" for procedural requirements for cutting and patching necessary for the installation or performance of other components of the Work.

1.03 SUBMITTALS

A. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.01 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/Architect.

2. Allow for building movement, including thermal expansion and contraction.

3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

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.

3.02 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.

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.

3.03 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."

3.04 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.

3.05 CORRECTION OF THE WORK

A. Repair or remove and replace defective construction. Restore damaged substrates and finishes. Comply with requirements in Division 01 Section "Cutting and Patching."

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

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

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

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

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

END OF SECTION

SECTION 017700 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

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

1. Inspection procedures.
2. Project record document submittal.
3. Warranties.
4. Final cleaning.

B. Submit all guarantees, warranties, record documents, operation maintenance instruction manuals, and Shop Drawings to design professional for the Owner in both print and electronic form.

C. Related Sections include the following:

1. Division 01 Section "Execution" for progress cleaning of Project site.
2. Divisions 02 through 49 Sections for specific closeout and special cleaning requirements for the Work in those Sections.

1.03 SUBSTANTIAL COMPLETION

A. Preliminary Procedures: Before requesting inspection for determining date of Substantial Completion, complete the following in compliance with requirements listed in General Conditions. List items below that are incomplete in request.

1. In the Application for Payment that coincides with, or first follows, the date Substantial Completion is claimed, show 100 percent completion for the portion of the Work claimed as substantially complete. Include supporting documentation for completion as indicated in these Contract Documents and a statement showing an accounting of changes to the Contract Sum.
2. If 100 percent completion cannot be shown, 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.
    a. Owner and Engineer/Consultants will conduct pre-substantial completion inspections on Contractor’s request upon contractor’s compliance with requirements indicated in General Conditions.
3. Advise Owner of pending insurance changeover requirements.
4. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.

5. 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.
6. Prepare and submit Project Record Documents, operation and maintenance manuals, Final Completion construction photographs, damage or settlement surveys, property surveys, and similar final record information.
7. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.
8. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
9. Complete startup testing of systems.
10. Submit test/adjust/balance records.
11. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
12. Complete final cleaning requirements, including touchup painting.
13. 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 and consultants, 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.

1.04 FINAL COMPLETION

A. Preliminary Procedures: Before requesting final inspection for determining date of Final Completion, complete the following:

1. Submit a final Application for Payment according to Division 01 Section "Payment Procedures."
2. Submit certified copy of Engineer's/Consultant’s Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect/Engineer. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
3. Submit evidence of final, continuing insurance coverage complying with insurance requirements.

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.

1.05 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Preparation: Submit a punch list in PDF format via email. 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.

3. Include the following information at the top of each page:

a. Project name.

b. Date.

c. Name of Engineer.

d. Name of responsible sub-consultant (Engineer)

e. Name of Contractor.

f. Name of responsible subcontractor (Where a focus is on a specific trade.)

g. Page number.

1.06 OPERATION AND MAINTENANCE MANUALS

A. Assemble a complete set of operation and maintenance data, as required in General Conditions, indicating the operation and maintenance of each system, subsystem, and piece of equipment not part of a system. Include operation and maintenance data required in individual Specification Sections and as follows:

1. Operation Data:

a. Emergency instructions and procedures.

b. System, subsystem, and equipment descriptions, including operating standards.

c. Operating procedures, including startup, shutdown, seasonal, and weekend operations. (Interpret as meaning complete, tailored, project specific information for operation of this particular heating and power generating plant, as an overall plant and in each and all of its subsystems.

d. Description of controls and sequence of operations.

e. Piping and wiring diagrams.

f. MSDS sheets.

2. Maintenance Data:

a. Manufacturer's information, including list of spare parts.

b. Name, address, and telephone number of Installer or supplier.

c. Maintenance procedures.

d. Maintenance and service schedules for preventive and routine maintenance.

e. Maintenance record forms.

f. Sources of spare parts and maintenance materials.

g. Copies of maintenance service agreements.

h. Copies of warranties and bonds.

B. Organize operation and maintenance manuals into suitable sets of manageable size binders. Bind and index data in heavy-duty, 3-ring, swing hinge, buckram-covered, loose-leaf binders, in thickness necessary (3” max.) to accommodate contents, with pocket inside the covers to receive folded oversized sheets. Identify each binder on front and spine with the printed title "OPERATION AND MAINTENANCE MANUAL," Project name, and subject matter of contents.

1.07 WARRANTIES

A. Submittal Time: Submit digital copies of the warranties on request of Architect/Engineer for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated.

B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.

C. Organize digital copy of warranty documents into an orderly sequence based on the table of contents of the Project Manual. Project manual shall be a bookmarked PDF document.

PART 2 - PRODUCTS

2.01 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

3.01 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:

a. Clean Project site, and in areas disturbed by construction activities, including dock and drive-parking 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. Sweep concrete floors broom clean in unoccupied spaces.

f. Remove labels that are not permanent.

g. 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.

h. Wipe surfaces of mechanical and electrical equipment, elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.

i. Replace parts subject to unusual operating conditions.

j. 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.

3.02 DEMONSTRATION AND TRAINING

A. Instruction: Instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.

1. Provide instructors experienced in operation and maintenance procedures.
2. Provide instruction at mutually agreed-on times. For equipment that requires seasonal operation, provide similar instruction at the start of each season.
3. Schedule training with Owner through Owner’s Project Coordinator with at least seven days' advance notice.
4. Coordinate instructors, including providing notification of dates, times, length of instruction, and course content.
5. Contractor shall provide up to 4 hours of training to JVWCD Staff from a qualified instructor.

B. 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. For each training module, develop a learning objective and teaching outline. Include instruction for the following:

1. System design and operational philosophy.
2. Review of documentation.
3. Operations.
4. Adjustments.
5. Troubleshooting.
6. Maintenance.
7. Repair.

END OF SECTION

SECTION 017839 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 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. Related Sections include the following:

1. Division 01 Section "Closeout Procedures" for general closeout procedures.
2. Divisions 02 through 49 Sections for specific requirements for Project Record Documents of the Work in those Sections.

1.03 SUBMITTALS

A. Record Drawings: Comply with the following:

1. Number of Copies: Submit a bookmarked PDF copy.

B. Record Specifications: Submit one bookmarked PDF copy of Project's Specifications, including addenda and contract modifications.

C. Record Product Data: Submit one bookmarked PDF copy of each Product Data submittal.

1. Where Record Product Data is required as part of operation and maintenance manuals, submit marked-up Product Data as an insert in manual instead of submittal as Record Product Data.

PART 2 - PRODUCTS

2.01 RECORD DRAWINGS

A. Record Prints: Maintain one set of 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. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to prepare the marked-up Record Prints.

a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.

b. Accurately record information in an understandable drawing technique.

c. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.

2. Content: Types of items requiring marking include, but are not limited to, the following:

a. Dimensional changes to Drawings.

b. Revisions to details shown on Drawings.

c. Revisions to routing of piping and conduits.

d. Revisions to electrical circuitry.

e. Actual equipment locations.

f. Duct size and routing.

g. Locations of concealed internal utilities.

h. Changes made by Change Order or Construction Change Directive.

i. Changes made following Engineer's/Sub-Consultant’s written orders.

j. Details not on the original Contract Drawings.

k. Field records for variable and concealed conditions.

l. Record information on the Work that is shown only schematically.

3. 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.

4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.

5. Mark important additional information that was either shown schematically or omitted from original Drawings.

6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

2.02 RECORD SPECIFICATIONS

A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.

2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.

3. Note related Change Orders, Record Product Data, and Record Drawings where applicable.

2.03 RECORD PRODUCT DATA

A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.

2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.

3. Note related Change Orders, Record Specifications, and Record Drawings where applicable.

2.04 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.

PART 3 - EXECUTION

3.01 RECORDING AND MAINTENANCE

A. General: Do not use Project Record Documents (referred to as “as-builts” in General Conditions) for construction purposes. Protect Project Record Documents from deterioration and loss. Provide access to Project Record Documents for Engineer's/Sub-Consultant’s reference during normal working hours.

B. 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.

C. 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/Sub-consultant’s reference during normal working hours.

END OF SECTION

SECTION 018119 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes the following:

1. Demolition and removal of existing packaged rooftop unit.
2. Demolition and removal of existing electrical.

1.03 DEFINITIONS

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

B. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

C. Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.

1.04 SUBMITTALS

A. Schedule of Selective Demolition Activities: Indicate the following:

1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's building manager's and other on-site operations are uninterrupted.
2. Locations of proposed dust- and noise-control temporary partitions and means of egress, including for building patrons affected by selective demolition operations.
3. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.
4. Means of protection for items to remain and items in path of waste removal from building.

1.05 QUALITY ASSURANCE

A. Pre-demolition:

1. Inspect and discuss condition of construction to be selectively demolished.
2. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
3. Review areas where existing construction is to remain and requires protection.

1.06 PROJECT CONDITIONS

A. Owner will occupy portions of the building. Conduct selective demolition so Owner's operations will not be disrupted.

1. Comply with requirements specified in Division 01 Section "Summary."

B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

C. Notify Engineer of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

D. Hazardous Materials: A report on the presence of hazardous materials is on file for review and use. Examine report to become aware of locations where hazardous materials are present.

1. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Engineer and Owner. Owner will remove hazardous materials under a separate contract.

E. Storage or sale of removed items or materials on-site is not permitted.

F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

1.07 WARRANTY

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.01 EXAMINATION

A. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.

B. Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged.

C. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Engineer.

D. Engage a professional engineer to survey condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective demolition operations.

E. Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs and templates.

F. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

3.02 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Services/Systems: Maintain services/systems indicated to remain and protect them against damage during selective demolition operations.

B. Service/System Requirements: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving systems to be selectively demolished.

1. Owner will arrange to shut off indicated services/systems when requested by Contractor. Contractor shall work with the Owner to isolate – shutoff systems.

2. If services/systems are required to be removed, relocated, or abandoned, before proceeding with selective demolition provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.

3. Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing.

3.03 PREPARATION

A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.

2. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.

3. Cover and protect furniture, furnishings, and equipment that have not been removed.

C. Pollution Controls:

1. Disposal: Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

2. Cleaning: Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

3.04 SELECTIVE DEMOLITION, GENERAL

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.

2. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.

3. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.

4. Maintain adequate ventilation when using cutting torches.

5. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.

6. Dispose of demolished items and materials promptly.

B. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Engineer, items may be removed to a suitable, protected storage location during selective demolition and reinstalled in their original locations after selective demolition operations are complete.

C. Removed and Reinstalled Items:

1. Clean and repair items to functional condition adequate for intended reuse. Paint equipment to match new equipment.

2. Pack or crate items after cleaning and repairing. Identify contents of containers.

3. Protect items from damage during transport and storage.

4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

3.05 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

A. Electrical Installations: In demolition where electrical installation exists, remove the wiring and conduit back to the respective panel or remaining connection point. Where conduit can continue in service, remove old conductors back to the panel and run new conductors. Keep track of remaining circuits by labeling, coding etc.

3.06 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill.

1. Do not allow demolished materials to accumulate on-site.

2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.

B. Burning: Do not burn demolished materials.

3.07 CLEANING

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

END OF SECTION

SECTION 230000 - GENERAL MECHANICAL REQUIREMENTS

PART I - GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

Sections of other Divisions which relate to mechanical work apply to the work of this section.

B. Related Sections: Refer to “Electrical Requirements for Mechanical Equipment” Section in Division 23 for basic electrical requirements for all mechanical equipment. Special and specific electrical requirements are specified within each respective equipment specification section.

1.2 SUMMARY: This Section specifies the basic requirements for mechanical installations and includes requirements common to more than one section of Division 230000.

This Division does not define, nor is it limited by, trade jurisdictions. All work described herein is a part of the General Contract and is required of the Contractor regardless.

1.3 DESCRIPTION OF PROJECT: The mechanical work described in these mechanical specifications is for the Washwater Reclaim Pump Station #2 HVAC Upgrades project at the Jordan Valley Water Treatment Plant in Herriman, Utah. Design weather conditions are: 98°F db, 62°F wb, and winter 3°F. Altitude readings, unless otherwise noted, are for an elevation of 4,800 feet above sea level. Make adjustment to manufacturer's performance data as needed.

1.4 CODES AND PERMITS, AUTHORITIES HAVING JURISDICTION:

A. Perform the mechanical work in strict accordance with the applicable provisions of the various codes ordinances and adoptions pertaining to the project location in effect on the date of invitation for bids. Provide all materials and labor necessary to comply with rules, regulations and ordinances. Where the drawings and/or specifications indicate materials or construction in excess of code requirements, the drawings and/or specifications govern.

B. Hold and save the Owner and Architect/Engineer free and harmless from liability of any nature or kind arising from failure to comply with codes and ordinances.

C. Secure all permits necessary for the prosecution of the work under this contract. Owner to pay all fees including connection fees related to utility hookups.

D. Reference Standards:
American Welding Society
International Mechanical Code 2021 or latest edition
International Building Code 2021 or latest edition
Locally enforced NFPA Codes
Local Fuel Utility Regulations
Local Power Utility Regulations
American Gas Association
ASME Codes for Pressure Vessels and Piping

ANSI B31.1 Piping

E. Final inspection by the Architect/Engineer will not be made nor Certificate of Substantial Completion issued until certificates of acceptability from the Authorities having jurisdiction are delivered.

1.5 DEFINITION OF PLANS AND SPECIFICATIONS: The mechanical drawings at reduced scale show the general arrangement of piping and equipment, etc., and shall be followed as closely as the actual building construction and the work of other trades will permit. The architectural and structural drawings shall be considered as part of the work insofar as these drawings furnish the Contractor with information relating to design and construction of the building. Architectural drawings shall take precedence over mechanical drawings. Request clarification and participate in resolution in the event of conflict.

Because of the small scale of the mechanical drawings, it is not possible to indicate all offsets, fittings and accessories which may be required. Investigate the structural and finish conditions affecting the work and arrange the work accordingly, providing such extensions, fittings, valves and accessories to meet the conditions as may be required. Some small scale work is not shown such as control conduit and piping, incidental piping, specialties. Provide as directed by note or specification.

Examine the actual construction site prior to bidding and obtain an understanding of the conditions under which the work will be performed. No allowances will be made for failure to make such examination.

During construction, verify the dimensions governing the mechanical work at the building. No extra compensation shall be claimed or allowed because of differences between actual dimensions and those indicated on the drawings. Examine adjoining work on which mechanical work is dependent for perfect efficiency, and report any work of other trades which must be corrected. No waiver of responsibility for defective work shall be claimed nor allowed due to failure to report unfavorable conditions affecting the mechanical work.

1.6 ROUGH-IN:

A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.

B. Refer to equipment specifications in Divisions 2 through 26 for rough-in requirements.

1.7 MECHANICAL INSTALLATIONS:

A. Coordinate mechanical equipment and materials installation with other building components.

B. Verify all dimensions by field measurements.

C. Arrange for chases, slots, and openings in other building components to allow for mechanical installations.

D. Coordinate the installation of required supporting devices and sleeves to be set in poured in place concrete and other structural components, as they are constructed.

E. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing-in the building.

F. Coordinate the cutting and patching of building components to accommodate installation of mechanical equipment and materials.

G. Where mounting heights are not detailed or dimensioned, install mechanical services and overhead equipment to provide the maximum headroom possible.

H. Install mechanical equipment to facilitate maintenance and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.

I. Coordinate the installation of mechanical materials and equipment above ceilings with suspension systems, light fixtures, existing structures and other installations.

J. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.

K. Where mechanical work penetrates other trade work such as gypboard walls, etc., penetration shall be neatly cut and walls shall be filled and patched.

1.8 ACCESSIBILITY:

A. Install equipment and materials to provide required access for servicing and maintenance. Coordinate the final location of concealed equipment and devices requiring access with final location of required access panels and doors. Allow ample space for removal of all parts that require replacement or servicing.

B. Extend all grease fittings to an accessible location.

C. Establish required clearance to all installation features involving operation and maintenance. Respect manufacturer’s recommendations for access and clearance.

D. Access Doors - General: All items of mechanical equipment which may require adjustment, maintenance, replacement or which control a system function shall be made readily accessible to personnel operating the building.

1. Provide access doors in floors, walls, ceiling and partitions to valves, cleanouts, chases, etc. Access doors shall be all-steel construction equivalent to "Milcor" by Inland Ryerson in a style approved by the Owner's Representative. Doors shall be 24" x 24" minimum, or larger as needed, with screwdriver latches.

1.9 CHANGE ORDERS: See General Conditions.

1.10 ALTERNATIVE CONSTRUCTION/SUBSTITUTION: These documents outline a way in which the Owner may be delivered a functional and reliable facility. Drawings and specifications describe reasonable engineering practice for the Contractor to follow.

Coordination between trades may result in periodic needs to adjust the installation from that indicated, but in no case shall the intended function be compromised.

The Contractor may perceive some work methods which differ from those specified which could save time and effort. These may be presented to the Architect with a breakdown of possible cost savings for review. Implement only with authorization.

Materials substitutions will generally be covered in a review process prior to bidding. After bidding, substitutions shall be proposed only on the basis of definitive cost accounting and implemented only with authorization.

1.11 CUTTING AND PATCHING:

A. Lay out the project where new work is involved ahead of time, providing sleeves and blockouts, and have work specifically formed, poured and framed to accommodate mechanical installations. Cut and patch only as needed.

B. Refer to the Division 1 Section: CUTTING AND PATCHING for general requirements for cutting and patching.

C. Refer to Division 26 Section: BASIC ELECTRICAL REQUIREMENTS for requirements for cutting and patching electrical equipment, components, and materials.

D. Do not endanger or damage installed Work through procedures and processes of cutting and patching.

E. Arrange for repairs required to restore other and any work damaged as a result of mechanical installations.

F. No additional compensation will be authorized for cutting and patching Work that is necessitated by ill-timed, defective, or non-conforming installations.

G. Perform cutting, fitting, and patching of mechanical equipment and materials required to:

1. Uncover Work to provide for installation of ill-timed Work;

2. Remove and replace defective Work;

3. Remove and replace Work not conforming to requirements of the Contract Documents;

4. Remove samples of installed Work as specified for testing:

5. Install equipment and materials in existing structures.

H. Upon written instructions from the Architect/Engineer, uncover and restore Work to provide for Architect/Engineer observation of concealed Work.

I. Cut, remove and legally dispose of selected mechanical equipment, components, and materials as indicated, including, but not limited to removal of mechanical piping and other mechanical items made obsolete by the new Work.

J. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.

K. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.

1.12 SUBMITTALS: Submittal of shop drawings, product data, and samples will be accepted only from the Contractor to the Architect. Data submitted from subcontractors and material suppliers directly to the Architect/Engineer will not be processed. Document each transmittal and sign and stamp the submittal indicating that it has been reviewed and is in compliance with the criteria of the project, any exceptions being clearly noted.

A. Shop Drawings: As soon as possible after the contract is awarded, submit to the Engineer, one (1) PDF copy of the descriptive literature covering all equipment and materials to be used in the installation of mechanical systems for this project. Written confirmation of acceptable review by the Owner's Representative shall be obtained before ordering, purchasing, acquiring or installing any such equipment or materials for the project.

Prepare the submittal in an orderly manner after the order of this specification, contained in a single PDF file with bookmarked tabs for each item or group of related items. Submitted literature shall clearly indicate performance, quality, utility requirements, dimensions of size, connection points and other information pertinent to effective review.

Equipment must fit into the available space with allowance for operation, maintenance, etc. The Contractor shall take full responsibility for space and utility requirements for equipment installed.

Factory-wired equipment shall include shop drawings of all internal wiring to be furnished with unit.

Review of the Architect/Engineer is for general conformance of the submitted equipment of the project specification; in no way does such approval relieve Contractor of his obligation to furnish equipment and materials that comply in detail to the specification, nor does it relieve the Contractor of his obligation to determine actual field dimensions and conditions which may affect his work.

B. Record Drawings: During the course of construction, maintain a set of drawings, specifications, change orders, shop drawings, addenda, etc., for reference and upon which all deviations from the original layout are recorded. Turn these marked-up documents over to the Architect/Engineer at the conclusion of the work so that the original tracings can be revised. If the Contractor fails to mark up the prints, reimburse the Architect/Engineer for time required to do so.

1.13 OPERATION AND MAINTENANCE TRAINING:

A. Instruction of Owner's Personnel: At a time prior to Owner making use of a device or system, and in general after testing and balance work for a building or major system is complete, prepare, schedule and conduct a series of training sessions for Owner's operating and supervisory personnel. Instructions shall cover each device and system with emphasis on understanding of the purpose and function, the maintenance requirements and the proper adjustment and operating technique.

B. Instruct building operating staff in operation and maintenance of mechanical systems utilizing Operation and Maintenance Manual when so doing.

C. Minimum instruction periods shall be as follows:

1. Mechanical - four hours, total.

2. Temperature Control – one hour, total. Programming help as needed.

D. Initial instruction periods shall occur after pre-final inspection when systems are properly working and before final payment is made. Schedule subsequent visits with the Owner’s Building Operation Personnel throughout the first year.

E. None of these instructional periods shall overlap another.

F. Vendors for each piece of equipment controls, etc., shall participate along with the Contractor(s).

1.14 GUARANTEE/WARRANTY: The following guarantee is a part of this specification and is binding on the part of the Contractor and his assigns:

"Contractor guarantees that this installation is in accordance with the terms of the Contract and is free from mechanical defects. He agrees to replace or repair, to the satisfaction of the Owner's Representative, any part of this installation which may fail or be determined unacceptable within a period of one (1) year after final acceptance. See also the General Conditions of these specifications. Failed equipment in the repair or replacement shall be guaranteed for one full year from the date of recommission."

Compile and assemble the warranties required by Division 23 into a separated set of vinyl covered, insert sheets, tabulated and indexed for each reference, included in the O & M Manual.

Provide complete warranty information for each item to include product or equipment to include date of beginning of warranty or bond; duration of warranty or bond; and names, addresses, and telephone numbers and procedures for filing a claim and obtaining warranty services.

Mechanical systems and equipment shall not be considered for substantial completion and initiation of warranty until they have performed in service continuously without malfunction for at least thirty (30) working days.

1.15 TESTS AND CERTIFICATIONS: Make all tests required by code or specification in the presence of a representative of the Owner, with tests recorded and certified by the Contractor and Representative. Involve local authorities where required.

1.16 PERMITS, FEES, LICENSES: Refer to General Conditions.

1.17 MECHANICAL COORDINATION DRAWINGS: For the mechanical room prepare and submit a set of coordination drawings showing major elements, components and systems of mechanical equipment and materials in relationship with other building components (structure, fire sprinkler, electrical, etc.). Prepare drawings to an accurate scale of 1/4" - 1-0" or larger. Indicate the locations of all equipment and materials, including clearances for installing and maintaining equipment, servicing and maintaining equipment, valve stem movement, and similar requirements. Indicate movement and positioning of large equipment into the building during construction.
Prepare floor plans, reflected ceiling plans, elevations, sections and details to conclusively coordinate and integrate all installations. Indicate locations where space is limited, and where sequencing and coordination of installations are of importance to the efficient flow of the work, including (but not necessarily limited to) the following:

A. Mechanical room:
   1. Heating water pumps.
   2. Boilers.
   3. Piping.
   4. Specialty systems.
   5. Electrical installations.
   6. Related structure.

B. Work in pipe spaces and hallways.

C. Exterior wall penetrations.

D. Ceiling and floor plenums which contain piping, or equipment in congested arrangement. To include structure, piping, fire protection, large electrical conduit, recessed lights, etc.

E. Installations in mechanical riser shafts, at typical sections and crucial offsets and junctures.

F. Pipe expansion loops.

G. Numbered valve location diagrams.

H. Manifold piping for multiple equipment units.

I. General floor plan layouts with piping, lighting, structure, etc.

J. Use drawings to coordinate all affected trades. Do not work without coordinated drawings.

1.18 SCHEDULING/METHODS OF PROCEDURE: Where interruptions of service are needed to effect work of this contract, outline the work, coordinate with other trades, determine the Owners acceptable downtime and prepare a time based schedule to accomplish the work. Give notice of a necessary utility interruption (or shutdown) to any existing system to the owner’s construction coordinator not less than 72 hours prior to the proposed shutdown. This will then be coordinated with Jordan Valley Water Conservancy District as necessary for approval to go ahead with the shutdown or re-schedule. Set up for evening, nighttime or weekend hours as necessary to accomplish the work with minimum disruption.

PART II - GENERAL MECHANICAL MATERIALS AND METHODS

2.1 QUALITY OF MATERIALS AND EQUIPMENT:

A. All equipment and materials shall be new, and shall be the standard products of manufacturers regularly engaged in the production of plumbing, heating, ventilating and air conditioning equipment, and shall be the manufacturer's latest design. Specific equipment shown in schedules on drawings and specified herein is to be the basis for the Contractor's bid. Provisions for substitute equipment are outlined in the General Conditions. All materials shall be produced by manufacturing plants located in the United States of America.

B. Furnish and install all major items of equipment specified in the equipment schedules on the drawings complete with all accessories normally supplied with catalog items listed, and all other accessories necessary for a complete and satisfactory installation.

2.2 PROTECTION OF MATERIALS AND EQUIPMENT:

A. Close pipe and duct openings with caps or plugs to prevent lodgement of dirt or trash during the course of installation. Cover equipment tightly and protect against dirt, water and chemical or mechanical injury. Plumbing fixtures intended for the final installation shall not be used by the construction forces. At the completion of the work, clean fixtures, equipment and materials and polish thoroughly and deliver in a factory dock condition for the Owner's acceptance. Make damage and defects developing before acceptance of the work good at Contractor's expense.

B. Do not make temporary use of project equipment, new or existing, during construction without the written consent of the owner. Systems shall not be used for temporary heat.

2.3 QUALIFICATIONS OF WORKMEN:

A. All mechanics shall be capable journeymen, skilled in the work assigned to them. Apprentices may be used with appropriate direction.

B. Employ no unskilled persons in the work which he is given to do; execute all work in a skillful and workmanlike manner. All persons employed upon this work shall be competent, faithful, orderly and satisfactory to the Owner. Should the Owner's Representative deem anyone employed on the work incompetent or unfit for his duties, and so certify, Contractor shall dismiss him and he shall not be again employed upon the work without permission of the Owner's Representative.

C. All welders involved in welding of pressure piping systems shall be certified in accordance with Section IX of the ASME Boiler and Pressure Vessel Code. Written verification of successful test completion shall be submitted to Architect prior to initiating work.

2.4 FOREMAN: Dedicate and designate a full-time general mechanical foreman to the Owner's Representative to be consistently available on site during the life of the project for consultation. Do not replace this individual without prior approval from the Owner's Representative.

2.5 USE OF COMMON VENDORS: Regardless of subcontract delegations, coordinate purchasing between trades so that equipment and materials of similar nature come from a single vendor, i.e., all package HVAC terminal units shall be common source. Valves, terminal boxes, speed drives, etc., the same. Do not burden the Owner with multiple brands of similar equipment unless so directed.

2.6 WALL/FLOOR PENETRATIONS - FLASHINGS:

A. Install sleeves through the floor into “dry rooms” flush with the floor, caulked and sealed. Into wet rooms, extend piping to create 1" dam. Use Schedule 40 galvanized steel pipe for all pipe sleeves.

B. Let pipe sleeves allow for movement of the pipe due to expansion and contraction, yet to include seismic restraint.

C. Seal all wall openings weathertight.

2.7 HANGERS AND SUPPORTS (GENERAL):

A. Provide hangers and/or supports for all equipment, piping and ductwork. Primary information is contained in these specifications and on the drawings.

B. Provide hangers and supports to correlate with seismic restraint and vibration isolation.

2.8 MANUFACTURER'S DIRECTIONS: Install all equipment in strict accordance with directions and recommendations furnished by the manufacturer. Where such directions are in conflict with the plans and specifications, report such conflicts to the Architect who shall direct adjustments as deemed necessary and desirable.

2.9 LUBRICATION: Lubricate equipment at startup. Then, provide all lubricants for the operation of all equipment until acceptance by the Owner. The Contractor is held responsible for all damage to equipment and bearings while the equipment is being operated by him consequent to preacceptance operation.

2.10 ELECTRICAL WIRING AND CONTROL:

A. In general, motor starters, related motor starter equipment and power wiring indicated on the electrical drawings and control diagrams are to be furnished and installed under Division 26 of this Specification. Items of electrical control equipment specifically mentioned to be furnished by the Division 23 either in these specifications or on the electrical or mechanical drawings, shall be furnished and mounted by this Contractor and shall be connected under and as required by this Division 23 and Division 26 of these specifications.

B. Refer to the control equipment and wiring shown on the diagrams. Any changes or additions required by specific equipment furnished shall be the complete responsibility of the contractor.

C. Division must be fully coordinated with Division 26 to insure that all required components of the work are included and fully understood. No additional cost shall accrue to the Owner as a result of lack of coordination.

D. Where the detailed electrical work is not shown on the electrical drawings, the Mechanical Contractor shall furnish, install and wire or have prewired all specified and necessary controls for air handling equipment specified for this project. The objective of this paragraph is to make sure a complete operating system is obtained at no additional cost to the Owner for field wiring required related to the equipment.

2.11 FLUSHING AND DRAINING OF SYSTEMS/CLEANING OF PIPING: Fill, clean and flush and sterilize where appropriate, all water piping systems with water and drain these systems before they are placed in operation. Flushings shall consist of not less than six (6) short, intermittent flushes of five (5) to ten (10) minutes duration. Sample and test each flush for cleanliness. Blow out all other piping systems with compressed air or nitrogen to remove foreign materials that may have been left or deposited in the piping system during its erection.

2.12 JOBSITE CLEANUP:

A. Keep site clean during progress of work.

B. At the conclusion of work, clean all installation thoroughly.

1. Leave equipment in a factory dock condition. Correct any damage and touch up or repaint if necessary.

2. Remove all debris from site.

2.13 ARCHITECTURAL ACCESS DOORS:

A. Extent of Work: Provide architectural grade access doors at each point of required access to duct features, piping valves, and specialties, concealed equipment, etc. Coordinate this work with other sections for ceilings, walls, etc.

B. Material: Steel framed doors with heavy duty hinges and latch type locking mechanisms with surface finish configuration to accept, match or correlate with adjacent surface.

1. Product equivalent to Inland-Ryerson “Milcor”, Cesco

2. Size adequate to access point of maintenance, to work on and remove concealed devices and equipment.

C. Installation: Complete, blended into adjacent work.

END OF SECTION 230000

SECTION 230100 - OPERATION AND MAINTENANCE MANUALS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specifications sections, apply to work of this section.

B. Division-23 General Mechanical Requirements sections apply to work of this section.

1.2 SUMMARY:

A. Organize digital bookmarked PDF versions of operation and maintenance manuals. Manuals shall contain descriptive drawings and data which identify equipment installed at the project and detail the procedures and parts required to maintain and repair the equipment. Copies of approved submittals shall be included for all equipment.

1.3 OPERATION AND MAINTENANCE MANUAL FOR MECHANICAL SYSTEMS:

A. General:

1. The "Operating and Maintenance Manual" is a bound compilation of drawings and data that the owner requires for each building or project. These manuals, complete with drawings and data, shall be furnished to the Owner.

2. The mechanical contractor has overall responsibility to obtain the necessary data and compile the data as set forth in this specification, including items or equipment purchased by the Owner and delivered to the contractor for installation.

3. The number of binders (or "volumes") required will depend on the amount of information to be catalogued. Total "sets" see paragraph 1.2A.

4. Make all information legible and sufficiently marked to indicate the exact size, model, type, etc., of equipment furnished and installed.

B. Purpose: The Operating and Maintenance Manual is prepared to provide a ready reference to all important pieces of mechanical and electrical equipment installed on the project. It is also to provide the necessary operating and maintenance data for use by service personnel. It is also to provide information required for checking equipment performance or for planning of plant expansion or redesign.

PART II - MATERIALS AND METHODS

2.1 PAGE SIZE: All pages shall be standard 8-1/2 x 11 inches size or approximate multiples (preferably 16 x 11 inches) folded to 8-1/2 x 11 inch.

2.2 DRAWINGS: All drawings larger than 8-1/2" x 11" shall be folded and inserted in individual 8-1/2" x 11" manilla pockets, which shall have standard three-ring side punching for insertion in the binders. The equipment name, drawing description and number shall be written on the face of each manilla pocket.

2.3 BINDERS: Binders shall be 8-1/2 x 11 inch, 3 ring ridged type “D” with clear plastic cover and backbone for slip in title information 2" to 3" rings as required for the project. The number of binders, however, shall be based on not filling them beyond 2-1/2" thickness.

A. The Operation and Maintenance Manual will be provided digitally. The organization of the manual shall meet the requirements as described for the digital PDF manual and shall be searchable and bookmarked.

B. Place the following information on the front cover and backbone:

1. "Operation and Maintenance Manual".

2. Project Name (and volume number if more than one volume).

3. Project Number (where applicable).

4. Building name and number.

5. Architect's name.

6. Engineer's name.

7. General Contractor's name.

8. Mechanical Contractor's name.

9. Items 6 through 8 need not be printed on the backbone.

2.4 CONTENTS AND INDEXING:

A. Manuals shall contain descriptions of the building systems in sufficient detail to adequately indicate the type of systems installed and the basic details of their operation.

B. All purchased equipment data shall be used to designate the sections. Within each section additional indexing of component parts may be required.

C. Operation and Maintenance Manuals shall contain to the fullest extent all possible information pertinent to the equipment. The arrangement and type of information to be filed shall be as follows:

1. Copy of purchase order change (if any).

2. Outline drawings, special construction details, “as built” electrical wiring and control diagrams for all major and supplementary systems.

3. Manufacturer’s test or calculated performance data and certified test curves.

4. Installation, operating, and maintenance instructions, including a complete parts list and sectional drawing with parts identification numbers. Mark with model, size and plan number.

5. Manufacturer’s brochure marked to indicate exact equipment purchased. Brochures on component parts supplied by a manufacturer with his equipment, but not manufactured directly by him, shall also be included.

6. The serial numbers of each item of equipment installed are to be listed with the model numbers and plan symbols.

7. Include a Table of Contents. The contents shall be divided with tabbed index dividers into the following suggested parts:

   a. Part I Building and System Descriptions
   b. Part II Purchased Equipment Data
   c. Part III Test Reports and Valve Charts
   d. Part IV Start-Up and Operation
   e. Part V Preventative Maintenance Recommendations

8. A copy of the approved submittals for each piece of equipment.

9. A copy of all testing, adjusting and balancing reports.

10. Wiring diagrams, marked with model and size and plan symbol.

11. The index shall contain the name and address of the manufacturer and, if different, where replacement and repair parts may be obtained.

END OF SECTION 230100

SECTION 230513 - MOTORS, DRIVES & ELECTRICAL REQUIREMENTS FOR MECHANICAL WORK

PART I - GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

B. Related Sections: Separate electrical components and materials required for field installation and electrical connections are specified in Division 16.

1.2 SUMMARY:

A. This section specifies the basic requirements for motors and drives furnished by this Division and for electrical components which are an integral part of packaged mechanical equipment. Package components include, but are not limited to factory installed motors, starters, and disconnect switches, etc.

B. Specific electrical requirements (i.e. horsepower and electrical characteristics) for mechanical equipment are noted within these documents.

1.3 QUALITY ASSURANCE:

A. Provide electrical components and materials which are UL labeled.

B. Provide variable speed drives which conform to the latest standard of the following:

1. IEEE - Institute of Electrical and Electronic Engineers.

2. NEC - National Electrical Code.

3. NEMA - National Electrical Manufacturers Association.

4. Provide complete packaged unit(s) which are listed and carry the label of at least one of the following:

a. UL - Underwriters Laboratory
b. ETL - ETL Testing Laboratories, Inc.
c. CSA - Canadian Standards Association

1.4 SUBMITTALS:

A. Submit complete product and application information for variable speed drives as follows:

1. Provide multiple sets of drawings of system (VFD) being supplied, in strict compliance with the specifications. Include, as a minimum:

a. General arrangement of each unit showing size and incoming and outgoing conduit locations.

b. Schematic.

c. Connection diagram, sufficient to install drive system.

2. Provide each unit with four owner/maintenance manuals which shall include:

a. Vendor information of equipment being supplied.

b. Connection information.

c. Start up procedure.

d. Fault reset instruction.

e. Wiring diagrams (power and control).

f. Parts list.

g. Test results.

h. Harmonic voltage distortion on line with unit off.

i. Harmonic voltage distortion with unit on line.

B. Submit product data for motors, belts, drives, starters, and other electrical components with submittal data required for the equipment for which it serves, as required by the individual equipment specification sections. Verify project electrical characteristics with submittal. Confirm suitability for altitude, maintaining full nameplate rating plus service factor. Include this data in maintenance manual in accordance with Section "Operation and Maintenance Manuals".

1.5 REFERENCES:

A. NEMA Standards MG 1: Motors and Generators.

B. NEMA Standards ICS 2: Industrial Control Devices, Controllers, and Assemblies.

C. NEMA Standards 250: Enclosures for Electrical Equipment.

D. NEMA Standards KS 1: Enclosed Switches.

E. Comply with National Electrical Code (NFPA 70).

1.6 WARRANTY:

A. General: For variable frequency drives. Furnish a written warranty consisting of the following:

1. Warranty parts and labor for five years after substantial completion.

PART II - PRODUCTS

2.1 MOTORS:

A. The following are basic requirements for simple or common motors. For special motors, more detailed and specific requirements are specified in the individual equipment specifications.

1. Torque characteristics shall be sufficient to satisfactorily accelerate the driven loads.

2. Motor sizes large enough so that the driven load will not require the motor to operate in the service factor range.

3. Two-speed motors with 2 separate windings for poly-phase motors. Confirm 2-speed starter requirements with Division 26.

4. Single speed motors of the permanent split capacitor type. (PSC)

5. Temperature Rating: Minimum rate for 40°C environment with maximum 90°C temperature rise for continuous duty at full load (Class H Insulation for altitude, Class B leads allowed).

6. Starting Capability: Frequency of starts as indicated by automatic control system, and not less than 5 evenly timed spaced starts per hour for manually controlled motors.

7. Service Factor: 1.15 for poly-phase motors and 1.35 for single phase motors, 1.0 for TEFC motors.

8. Pump motors with an end shield with ventilation openings beneath the motor.

9. Motor Construction: NEMA Standard MG 1, general Purpose, continuous duty, design "B", except "C" where required for high starting torque.

10. Frames: NEMA Standard No. 48 or 54; T-frame, use driven equipment manufacturer's standards to suit specific application.

11. Bearings:

a. Ball or roller bearings with inner and outer shaft seals;

b. Re-greasable, except permanently sealed where motor is normally inaccessible for regular maintenance;

c. Designed to resist thrust loading where belt drives or other drives produce lateral or axial thrust in motor;

d. For fractional horsepower, light duty motors, sleeve type bearings are permitted;

e. All Motors supplied for VFD applications shall include insulated bearings.

12. Enclosure Type:

    a. Open drip-proof motors for indoor use where satisfactorily housed or remotely located during operation;
    b. Guarded drip-proof motors where exposed to contact by employees or building occupants;

    c. Weather protected type I for outdoor use, Type II where not housed;

13. Overload Protection: built-in thermal overload protection and, where indicated, internal sensing device suitable for signaling and stopping motor at starter.

14. Noise Rating: "Quiet"

15. Efficiency: "Premium Energy Efficient" motors shall have a minimum efficiency as scheduled in accordance with IEEE Standard 112, test method B. If efficiency not specified, motors shall have a higher efficiency than "average standard industry motors", in accordance with IEEE Standard 112. Motors used with Variable Frequency Drives shall be compatible and designed for use with Variable Frequency Drives. Any “explosion proof” motor for classified areas, scheduled for use with VFD’s, shall be listed for invertor duty applications.

16. Nameplate: indicate the full identification of manufacturer. ratings, characteristics, construction, special features and similar information.

17. Acceptable Manufacturers: Allis-Chalmers, Baldor, Century, General Electric, Gould, Lincoln, Louis-Allis, Marathon, Reliance, U.S. Motors, Westinghouse.

2.2 VARIABLE FREQUENCY DRIVES:

A. General: Furnish and install Variable Frequency Drives (motor speed controllers) with associated control signal components, harmonic filtering, power factor compensation and related cabinets, devices, ventilation, etc. Sizes and capacity as schedule on the drawings. Rate drives for constant torque application with variable torque application capability. Drive shall be warrantied for parts and labor for 5 years after substantial completion. Drives shall be wired for full VFD rating.

    1. Verify compatibility of each VFD System being supplied with the related equipment motor. If a new motor is being supplied supply the VFD to match the new motor(s) and warranty the Drive to be compatible with that motor.

    2. Furnish each system in a NEMA 1 enclosure either wall-mounted or free standing, with fan forced, filtered ventilation.

    3. Furnish each system with silk screened or engraved labels on all door operator and pilot devices, attached with screws, rivets or adhesive.

    4. Provide an electrical shock warning label on each system to warn personnel that a potential of electric shock exists.

    5. Supply each system complete, wired with all components assembled in a single enclosure including, but not limited to the VFD units, contactors, door interlocked circuit breaker. Units requiring mounting and interwiring of separate bypass enclosure are not under this specification.

6. Supply a complete set of engineering drawings consisting of, as a minimum, general arrangement, power wiring diagram, control wiring diagram and schematic of VFD System components, options, and equipment and tests included to meet power quality requirements of the specification.

7. Furnish an owner's manual consisting of catalog sheets showing actual components and parts numbers. Manual shall also show test certificates, warranty and service personnel responsible for warranty.

8. Furnish factory trained VFD System installation and start-up and warranty service. Mount unit and connect to power supply, mount and wire remote devices.

B. Construction: Assemble the Variable Frequency Drive units and components in a NEMA 1 enclosure.

1. The Variable Frequency Drive inverter shall be altitude compensated and sized for the elevation at which the unit will be installed. The inverter shall operate in an ambient temperature of -10°C to 50°C and a humidity of 0 to 90 percent non-condensing.

2. Mount the Variable Frequency Drive inverter unit on a removable panel along with all other components such that, if required, the panel can be removed from the enclosure for maintenance or part replacement.

3. Mount the door with a minimum of two hinges with removable pins. Door shall be rigid and large doors shall have additional hinges and stiffening steel.

4. Paint enclosure, two coats over primer, with high grade enamel, a minimum of 50-70 microns thick.

5. The enclosure shall be force ventilated and the exhaust ports covered with louvers. All components of the system, except sensors, shall be contained in this single enclosure as an integrated package.

6. Door mounted operator devices shall be industrial, oil tight, equivalent to control center devices.

7. Control power for operator devices and customer connections shall be 120 volts. The control power transformer shall be a "Machine Tool" type and have both primary and secondary fusing.

C. Standard Features: Provide the following features as standard on all VFD units furnished.

1. The VFD unit shall be a solid state AC to DC converter sinusoidal pulse-width modulation (PWM) type, with an altitude adjusted horsepower rating equal to or greater than the motor HP that the unit is supplying or not less than the scheduled rating, whichever is greater.
2. Electrical characteristics:

    a. Input Voltage 460 VAC +/- 10% (Nominal 480 Volts)
    b. Input Frequency 60 Hz +/- 5%

3. Motor braking torque available by means of regenerative braking.

4. An output frequency clamp such that minimum or maximum output frequency can be set at desired limits.

5. Rated overload current shall be 150% for one minute.

6. Adjustable acceleration/deceleration time setting from one second to 120 seconds.

7. A 95 percent or better displacement power factor over the entire speed range.

8. A 95 percent or better output/input efficiency over the entire speed range.

9. A door interlocked input disconnect motor circuit protector. The MCP shall allow trip adjustment sufficient to start the motor across the line in the bypass mode and normally be set at a minimum setting for maximum protection in the VFD mode. The door mounted handle shall be lockable in the off position.

10. The following door mounted operator controls as a minimum:

    a. Hand/Off/Auto Switch - keyed switch required.
    b. Local/Remote Switch - keyed switch required.
    c. Frequency Setting - through programmable controller pad.
    d. Frequency Indication Meter Calibrated in % Speed - through programmable controller pad.
    e. Power on Light
    f. VFD Enable Light
    g. VFD Fault Light
    h. External Fault Light (safeties interlock)

11. A minimum of the following protective features with an alarm display indication:

    a. Overcurrent Shut-off
    b. Regenerative Overvoltage
    c. Electronic Thermal Protector
    d. Heatsink Overheat
    e. Instantaneous Power Failure
    f. Ground Fault

12. The following termination points on terminal strip for field connections:

    a. Safeties Interlock
    b. Remote Start/Stop Contact
    c. Remote VFD Fault Contacts (N.C.)
    d. Remote VFD/Bypass Enable Contacts (N.O.)
    e. Remote Electronic Signal Input

13. Auto restart initiation by means of an automatic time delayed restart after recovering from undervoltage or loss of power. The inverter shall have auto restart compatibility with power provided by standby engine generator system provide all required components to insure compatibility to operate on standby engine power. The invertor shall not automatically restart after overcurrent, overvoltage, overtemperature, or any other damaging conditions but shall require a manual restart.

14. Remote input signal connection terminals (0-5 VDC or 0-10 VDC = 0-100% speed or 4-20 mA = 20-100% Speed).

D. Additional Configuration Features:

1. Bypass Option: Equip the inverter with a manual bypass contactor arrangement for transfer to the feeder line to operate at constant speed. The contactors shall be electrically and mechanically interlocked and supplied with an adjustable motor overload.

2. Provide a VFD isolation switch to allow maintenance on the VFD while in the bypass mode. Furnish prewired in the same enclosure, including contactors, VFD isolation switch, motor overload VFD/Bypass selector switch and Bypass ON light.

3. Digital or Analog Ammeter, through programmable key pad.

4. Digital or Analog Voltmeter, through programmable key pad.

5. Frequency Jump: Furnish a frequency jump control to avoid operating at a point of resonance with the natural frequency of the machine.

6. Provide series line reactors for harmonic distortion control as standard equipment.

7. Drive Speed Control, I/E or I/I or E/E or E/I transducers as needed.

8. Synchronous transfer to allow transfer from VFD to utility line and back to VFD unit while motor is running.

9. Provide Bac Net interface card for interface to the building automation system through the Ethernet network.

10. Remote Digital/Analog Speed Meter with 4-20 ma signal. Locate at central control console.

11. Each VFD shall have a built-in disconnect.

E. Acceptable Manufacturers: Acceptable manufacturers of VFD equipment shall meet the following requirements.

1. Suppliers of VFD Systems must be in the primary business of supplying Variable Frequency Drives and have a minimum of five (5) years of service in that business.

2. Vendor must have local service center with factory spare parts inventory and factory authorized service technician on call 24 hours/day.

3. VFD units supplied in response to this specification shall be labeled by UL, CSA or ETL. Note the entire unit shall carry the label not just a component.

4. The following VFD suppliers are acceptable providing that all points of this specification are adhered to:

a. ABB.
b. Energy Management Corporation using Mitsubishi drives.
c. Yaskawa.

5. VFD vendors must have prior approval from Owner before quoting equipment specified. If not listed above, vendor must apply to Owner for approval 10 days prior to bid date showing point by point compliance with this specification including sample of typical harmonic voltage distortion test report. In compliance with general requirements of the specification.

F. Testing: Prior to shipping, test each unit and submit certified test report with each unit. Standard tests to include:

1. Visual inspection, consisting of checking unit enclosure, wiring, connections, fasteners, covers and locking mechanism.

2. High pot test; two (2)X rated voltage plus 1000 volts AC for 60 seconds shall be applied per UL 508 on all perifial drive system power components (circuit breakers, contactors, motor overloads, line reactors, disconnect switches, etc.) as a complete package. A copy of test results shall be included in operation manuals.

3. Motor run test.

4. Control panel devices, test all devices and lights.

5. Optional equipment, test optional equipment specified with VFD system.

6. Special tests, as required and specified.

G. Installation: Field mounting pad and power connections shall be provided by contractor.

1. Vendor shall supply field start-up service by an authorized factory service representative consisting of system check-out, start-up and system run. The vendor shall provide warranty and authorized factory service including operator training. A written certificate of same shall be provided at start-up. Provide written certified start-up report. VFD service technicians shall be full time employees of the vendor or manufacturer, primarily engaged in VFD service work during normal business hours but on call 24 hours. Start-up by sales representative is not acceptable.

2. Startup/adjustment effort shall have at least two segments.

    a. Prior to Test and Balance work to place equipment in operation.

    b. At conclusion of Test and Balance work to adjust units to actual operating conditions.

3. The following adjustments and tests shall be performed as a minimum with certified copies included in the maintenance and operation manual.

    a. Verify that the input voltage is within the manufacturer's specification tolerances.

    b. Verify that the motor rotation is correct in all modes of operation.

    c. Verify all operator devices, programming and monitoring functions to be fully operational.

    d. Verify operation of all field signal control connections.

    e. Measure and record system output voltage and current at 50% and 100% speed. Tune the output voltage to correspond to motor nameplate rating at full speed. Check full load current measurements against nameplate data.

    f. Make all parameter adjustments to tune and optimize the VFD system to the application. Record all configuration values as part of this report.

    g. Conduct harmonic tests as identified in the specification. Measurements shall be recorded for each unit with the VFD system off, running at 50% speed, and running at full speed and load.

END OF SECTION 230513

SECTION 230548 - MECHANICAL SOUND, VIBRATION AND SEISMIC CONTROL

PART I - GENERAL:

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

B. This section is Division-23 Mechanical Sound, Vibration and Seismic Control section, and is part of each Division-23 section making reference to mechanical sound, vibration and seismic control specified herein.

C. Division-23 General Mechanical Requirements apply to work of this section.

1.2 SUMMARY: Furnish and install complete seismic restraint and vibration control systems for all work installed under Division 23. Work to be responsive to the intent of the International Building Code, latest adopted edition, for the respective seismic zone. Zone 3, importance factor of 1.

1.3 QUALITY ASSURANCE:

A. Manufacturer's Qualifications: Engage the services of an independent seismic and vibration control subcontractor who has the technology, experience, computer capabilities and manufactured products to prepare the required computations, shop drawings and special devices to meet the minimum requirements described herein. Select from the following:

1. Amber Booth
2. Kinetics
3. Mason
4. Vibro-Acoustics
5. SRS

B. The seismic and vibration control subcontractor shall visit the site during construction at a minimum of two specific periods.

1. When equipment is set in place, prior to placement of seismic restraint devices for the purposes of directing the contractor in properly locating and installing the approved devices.

2. At the completion of the project, prior to final mechanical inspection, for the purpose of verifying the correctness of the seismic restraint and vibration isolation device installation and preparing certification of the seismic vibration-isolation work.

C. The seismic subcontractor shall exercise the quality control for this work and shall include, but not be limited to instructions direct to the Mechanical (Division 23) Contractor concerning:

1. Anchoring of all mechanical equipment including owner furnished and contractor installed.
2. Vibration mounting of equipment.
3. Equipment base coordination with restraint requirements.

4. Snubbing of equipment.
5. Bracing and anchoring of piping and conduit.
6. Provision for expansion and vibration of piping.

D. The subcontractor shall be responsible for identifying the need for the size and location of steel sole plates and their attachment to structural steel or concrete.

E. The subcontractor shall certify in writing that he has inspected the installation and that all isolation, anchors and seismic restraint materials are installed correctly and functioning properly. Certification shall be provided after all corrective work has been completed.

1.4 SUBMITTALS:

A. Submittal data is required and shall consist of computations, vibration isolation selection, equipment anchors, anchor bolt sizes, supports, seismic restraints, sole plate data, restraint locations and type of restraints.

B. Submittal data shall identify dimensions, load deflection data, center of gravity, standard connections, manufacturer's recommendations, behavior problems including vibrations, thermal expansion, building expansion joints, etc., associated with equipment, ductwork, piping and conduit.

C. Calculations need not be submitted when restraint devices for piping, conduit and ductwork are proposed in accordance with the SMACNA Guidelines for Seismic Restraints.

D. Selection of isolator anchors and restraints shall be clearly made known along with the basis for selection so that proposed systems can be reviewed.

E. Calculations furnished for anchors, anchor bolts, sole plates and other support steel for restraining devices shall be signed and stamped by an engineer licensed in one of the United States.

1.5 REFERENCES:

A. Codes and Standards: (Latest adopted edition)

1. International Building Code 2021 with Utah State Amendments
2. NFPA bulletin 90A,
3. UL Standard 181
4. Guidelines for seismic restraint of Mechanical Systems and Plumbing Piping Systems. Published by the Sheet Metal Industry Fund of Los Angeles, California, and the Plumbing and Piping Industry Council, Inc., Los Angeles, California.

PART II - PRODUCTS:

2.1 MATERIALS - PRODUCTS: Restraint devices shall be especially designed to resist seismic forces in all directions.

A. Snubbers: Restraint surfaces which engage under seismic motion shall be cushioned with a resilient elastomer neoprene (bridge bearing neoprene) to protect equipment. Restraints shall allow a maximum of 1/4" before engaging and shall not interfere in normal starting or stopping operation. Housing shall allow for visual inspection to determine clearances during system operation. Restraints shall be field adjustable and be positioned for up to 1/4" clearance both horizontally and vertically. Mountings and snubbers are to be manufactured under a Quality Assurance (QA) Program.

B. Snubbers and Isolator Combination Devices: Combination unitized devices may be used where equipment isolation is required. They shall include the requirements listed for snubbers. Isolation portion shall be stable spring type with combination leveling bolt and equipment fastening device. Base plate shall have adequate means for bolting to structure. The spring assembly shall be removable and shall fit within a welded steel enclosure.

C. Piping and Conduit Restraints: Restraint materials for exposed installation shall be standard fabricated flat steel, angle rod and channel members.

PART III - EXECUTION

3.1 SEISMIC RESTRAINT GUIDELINE:

A. Guidelines for SMACNA seismic restraints for conduit, piping and ductwork are to serve as the basis for restraint methods.

3.2 SEISMIC RESTRAINT-PIPING AND CONDUIT:

A. General: All piping and conduit shall be protected in all planes by restraints, designed to accommodate thermal movement while at the same time restraining seismic motion. Tanks and vessels connected to piping shall be restrained in the same manner as the piping.

B. Locations of the restraints shall include, but not be limited to:

1. At all drops or risers to equipment connections.
2. At all changes in direction of piping and conduit.
3. At all horizontal runs of pipe and conduit to keep it in alignment and prevent sagging with restraints not to exceed the following:
   a. Transverse bracing at 40'-0" O.C. maximum.
   b. Longitudinal bracing at 80'-0" O.C. maximum.

4. Provide flexibility in joints where pipes pass through building seismic or expansion joints.
5. On both sides of flexible connectors.

C. Exceptions:

1. Conduit under 2-1/2" size and piping under 1-1/2" size need not be additionally seismically restrained except as follows:
   a. Brace all piping and conduit 1-1/4" and larger in boiler rooms.
   b. Brace all fuel gas piping 1" and larger.
2. Seismic bracing may be omitted:
   a. When the top of the pipe is suspended 12" or less from the supporting structure member and the pipe or conduit is suspended by an individual hanger.
   b. On all piping 3/4" and smaller.

3.3 SEISMIC RESTRAINT INSULATED PIPING: Where piping is designated to be insulated, the points of support shall be protected by a 360° sheet metal shield. Insert insulation shall be of the same thickness as the adjoining pipe insulation. (Pipe Shields, Inc.)

The sheet metal shield wrapped around the insert shall be of the following lengths and gauge thickness.

PIPE SIZE	SHIELD LENGTH	MINIMUM GAUGE
1/2 - 1-1/2"	4"	20
2 - 6"	6"	20

3.4 SEISMIC RESTRAINT - PIPING AT FIRE-WALL AND FLOOR PENETRATION WHERE WALL IS USED AS A RESTRAINT:

A. Bare Pipe: Encase pipe in minimum 24 gauge sheet metal can sized for one inch spacing between pipe and outer diameter of can. Spacing shall be packed in accordance with fire resistant/retardant materials in accordance with Section: FIRE STOPPING.

B. Insulated Pipe: Encase in adjustable or fixed length cans, minimum 24 gauge, sized for maximum one inch spacing between insulation and outer diameter of can. Insulation shall consist of 360° insert sized to extend a minimum of 1" beyond wall or floor penetration and of the same thickness as the adjoining insulation. Spacing between shield and can shall be packed in accordance with Section: FIRE STOPPING.

3.5 VIBRATION ISOLATION:

A. General: Furnish and install devices to isolate moving equipment from the structure. Review isolation furnished with factory package equipment, require conformance with project criteria.

B. Basic Criteria: Vibration isolation devices which have natural frequencies approximately 1/10 that of the related driving frequency.

C. Equipment to Include:

1. In-Line Mounted Heating Water Pumps: Vibration isolated and seismic restrained.

D. Field Verify: All required devices and installation.

3.6 VIBRATION ISOLATION - PIPING:

A. Furnish and install devices to isolate all piping from other moving equipment. Provide flex connections, spring hangers for pipe, etc., as required.

END OF SECTION 230548

SECTION 230553 - MECHANICAL IDENTIFICATION

PART I - GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

B. Division-23 Basic Mechanical Materials and Methods section apply to work of this section.

1.2 SUMMARY:

A. Label all heating, automatic temperature control equipment (excluding thermostats and relays), and distribution systems. Also label all electrical switches and starters for all mechanical equipment.

PART II - GENERAL MECHANICAL MATERIALS AND METHODS

2.1 EQUIPMENT AND PIPE IDENTIFICATION:

A. Equipment:

1. Use the same identification number and name as that shown on the drawings or in these specifications. Make equipment nameplates of black face formica with white engraved lettering 3/16" high or larger, attached securely.

2. Include the following information on equipment nameplates where applicable:

Identification name.
Identification number.
Capacity specified.
Actual capacity.
Area or zone served.

Note operating conditions, including head or static pressure, RPM, motor horsepower at design conditions, area or zone served, name of lubricant, frequency of lubrication.

B. Valve Identification:

1. For all valves, regardless of size, provide brass tags at least 1-1/4" by 3" in size and 0.051 inches thick. Use engraved lettering at least 1/8" high. Identify each valve on the drawing separately, and with valve tags matching the drawing identification.

2. Provide valve tags which include the following minimum information:

a. Normal Position
b. Duty

3. Identify tag numbers as follows:

Valve Tags	Duty
1-99	HW
200-299	CW

4. Make a schedule of all tagged valves, include in O & M Manuals.

5. Connect valve tags to valve stems with brass chain.

C. Color code all accessible duct and piping and identify with wording and arrows every 50 feet, at each riser, at each junction, at each access door, and where required to easily identify the medium transported.

D. Identify duct and piping systems by:

1. Lettering color, and

2. Flow Direction Arrow.

3. Identifying lettering shall be painted or stenciled on duct or pipe. Self-adhesive or glue-on type labels are acceptable. Letters shall be 2" high for duct and for 3" or larger piping, 1" high for 1-1/4" to 2-1/2" pipe, and 1/2" high for 1" pipe and smaller.

4. Arrows to indicate direction of flow shall be painted or stenciled on the duct or pipe in the same color as the lettering. The arrow shall point away from the lettering. On duct and 3" or larger piping, the “shaft” of the arrow shall be 2" long and 1" wide. Smaller piping, 2-1/2" or less, shall have arrows with a shaft 1/2" wide and 2" long. Use a double-headed arrow if the flow can be in either direction.

5. Piping and duct shall be identified with the following colors:

6. Label existing high temperature water piping, heating water piping, chilled water piping and domestic water piping in existing mechanical room.

Medium in Pipe or Duct	Banding Color	Identifying Lettering	Abbreviation and Lettering Color
Heating Water Supply (Bldg. Heat)	One Yellow Two Orange	Heating Water Supply	BHWS Black
Heating Water Return (Bldg. Heat)	One Yellow One Orange	Heating Water Return	BHWR Black
Domestic Cold Water	One Green	Domestic Cold Water	DWC Black
Drain		Drain	Black

2.2 PANEL IDENTIFICATION:

A. Provide all panel devices on panel faces with engraved black face formica with white engraved lettering labels.

B. Provide all internal panel components with engraved black face formica labels with white engraved lettering. Fasten label beneath each device.

C. Numerically or alphabetically code all panel wiring and tubing.

END OF SECTION 230553

SECTION 230593 - SYSTEM COMMISSIONING, TESTING AND BALANCING

PART I - GENERAL

1.1 GENERAL CONDITIONS:

A. Work of this section shall be subject to the requirements of the General Conditions of this contract, the General Mechanical Requirements, General Electrical Requirements and other sections where this work shares a responsibility.

B. System commissioning and startup of the mechanical systems shall be the responsibility of the Mechanical Contractor and his subcontractors with the participation of the Electrical Contractor related to electrical work and the General Contractor related to general construction items.

C. Testing and Balancing shall be the responsibility of the Mechanical Contractor under the direction of the General Contractor with the full participation of all of the mechanical and electrical trades employed on the project and shall include the participation of an independent testing and balance contractor to coordinate all elements of the work and to perform special technical services outlined herein.

1.2 SYSTEM COMMISSIONING - EXTENT OF WORK:

A. The work required by this section includes but is not necessarily limited to the following:

1. The pre-startup inspection of all systems and subsequent correction of any incorrect items.

2. The initial first run inspections.

3. System operations inspection.

B. The intent of this work is to provide for proper installation, startup, service and operation of the mechanical systems in preparation for system balancing.

C. Repair, replacement or adjustment of each item shall be performed by the installing contractor.

D. Involves all new construction and those elements of existing construction which are affected by this project.

1.3 TESTING AND BALANCING - EXTENT OF WORK:

A. This work incorporates a confirming checkout of construction work, an individual component activation and an overall system activation into one work program which shall serve as the transition period from the Contractor's job to Owner's facility.

B. The TAB Contractor shall be skilled in the operation and manipulation of systems and in the direction of parties involved in the work.

C. Conduct and participate in the startup and shakedown of all mechanical systems installed and modified in this contract; test adjust and balance these systems to obtain optimum performance at a level which minimizes the required energy input, prepare and submit a complete report of work done and the final system condition obtained, participate in the instruction of Owner's personnel in the proper operation of systems and equipment.

D. Involves all new construction and those elements of existing construction which are affected by this project.

1.4 QUALIFICATIONS OF SYSTEM COMMISSIONING AND TAB TEAM:

A. Representatives of the General Contractor, Mechanical Contractor, etc., and Electrical Contractor shall be available on a daily basis through the commissioning and adjustment period. These men shall be experienced journeymen with prior experience in system operation and with specific experience on the construction of this project.

B. Balancing shall be done by an independent firm specializing in this work. A definition of independent shall mean the firm is not associated with any engineering, contracting, or manufacturing firm and derives its income solely from testing, adjusting and balancing mechanical systems. The approved firms to do this work are Barnett, Inc., Payson, UT; Bob’s Test and Balance, Salt Lake City, UT, Certified Testing and Balancing Inc., Salt Lake City, UT.

C. The balancing work including air and hydronic portions shall be performed by the same firm having total responsibility for the final testing, adjusting and balancing of the entire system. A principal of the firm shall be directly involved in the project.

D. The independent testing and balancing firm shall furnish all necessary tools, scaffolding and ladders that are required and shall provide all required instruments, take all readings and make all necessary adjustments.

E. After all tests and adjustments are made a detailed written report shall be prepared and submitted for review, and shall bear the signature of the professional supervising the work. Final acceptance of this project will not be made until a complete and satisfactory report is received. Organize a digital bookmarked PDF copy of the report.

PART II - EXECUTION, SYSTEM COMMISSIONING

2.1 PRE-STARTUP INSPECTION:

A. The pre-startup inspection of all systems shall provide for verifying that each piece of equipment is properly installed and prepared for startup.

B. All pertinent items shall be checked, including but not necessarily limited to the following:

1. Removal of shipping stops.

2. Vibration isolators properly aligned and adjusted.

3. Flexible connections properly aligned.

4. Safety controls, safety valves and high or low limits in operation.

5. All systems properly filled.

6. Pressure and temperature gauges installed.

7. All test stations and measuring devices installed.

8. Initial lubrication of equipment is complete.

9. strainers are clean.

10. Motor rotations are correct.

11. Voltages match nameplate.

12. Control system is in operation.

13. All interlocks are wired and verified.

14. All controls have been connected and verified.

15. All valves and operators are properly installed and operating.

16. All other items necessary to provide for proper startup.

2.2 FIRST RUN INSPECTION:

A. Recheck all items outlined in pre-startup inspection to insure proper operation.

B. Check the following items:

1. Excessive vibration or noise.
2. Loose components.
3. Initial control settings.
4. Motor amperages.
5. Heat buildup in motors, bearings, etc.
6. Control system is properly calibrated and functioning as required.

C. Correct all items which are not operating properly.

2.3 SYSTEM OPERATION INSPECTION:

A. Observe mechanical systems under operating conditions for sufficient time to insure proper operation under varying conditions, such as day-night and heating-cooling.

1. Periodically check the following items:

2. Strainers.

3. Control operation, on-off sequences, system cycling, etc.

4. Visual checks of water flow, seals, packings, safety valves, operation pressures and temperature.

5. Cleaning of excessive oil or grease.

6. Valves close tightly.

7. System leaks.

8. All other items pertaining to the proper operation of the mechanical system whether specifically listed or not.

PART III - EXECUTION - TESTING AND BALANCING

3.1 TOTAL MECHANICAL SYSTEM BALANCE:

A. The mechanical systems balance involves elements of the work of the General Contractor, the Electrical Contractor, the Mechanical Contractor, the Sheet Metal Contractor and the Controls Contractor. Total system balance requires that all elements be not only individually correct, but also correct as a composite system. Therefore, participation of all parties shall be required in the test and balance procedure.

B. Prior to beginning work, a written description of the anticipated sequence of action shall be submitted to the Architect/Owner for review and comment.

C. The testing and balance specialist shall review the contract drawings during the bid period and shall advise the Architect of any modifications to the layout which may be needed to facilitate the balance procedure. Modifications will be incorporated into the contract by Addendum during the bidding period.

D. The test and balance specialist shall visit the project from time to time during the rough installation making a thorough inspection of those items which will affect his subsequent work. He shall advise the Contractor in writing with a copy to the Architect of any work required by the contract which is not being performed adequately. This is in addition to the regular inspection efforts of the Architect and Engineer. Particularly note needed valves, dampers, access doors, thermometers, pressure gauges, belts and drives, diffuser styles, strainers and filters, etc.

3.2 HYDRONIC SYSTEMS:

A. Before any adjustments are made, clean strainers, check temperature control valve operation, check pump rotation, adjust pressure reducing valves, etc.

B. Using system flow meters, pressure gauges, and/or contact pyrometer, adjust the quantity of fluid handled by each pump and supplied to each coil, piece of radiation, heat exchanger, etc., to meet design requirements. Use proportional balance techniques to minimize system pressure requirements.

1. Remove and trim pump impellers where throttling exceeds 10% of adequate flow.

3.3 MAJOR EQUIPMENT: The Testing and Balancing Contractor shall work with the Controls Contractor and Electrician in placing pumps and boilers in operation. The factory representative of the equipment manufacturer shall also participate in a team effort to place the system(s) in operation, adapt to all anticipated operating modes and make adjustments as required to obtain correct operation. The Design Engineer and the Owner's Representative shall witness the final operating sequences.

A. Use proportional balance techniques so that in every case, at least one terminal valve is set for full flow at wide open, and at least one branch valve is wide open at full flow, others equivalent.

3.4 CONTROL SYSTEMS: The Testing and Balancing Contractor shall go through the entire control system with the Controls Contractor verifying proper operation of each and every device and the proper function of each system. Certify such effort in the report.

3.5 MISCELLANEOUS:

A. Observe and note all furnished thermal overload protection in the data sheets. If thermal overload protection is incorrect, the trade which furnished the overload devices shall furnish and install the correct size overload protection devices. It shall be the responsibility of the balancing firm to confirm that proper overload protection has been installed at the completion of the job.

B. All balancing devices, valves, shall be clearly marked as to the final balanced position.

C. Upon request, based on perceived need, make 24-hour space temperature recordings. Any required rebalance of the system shall be performed without additional cost.

D. Upon request, a representative of the balancing firm performing the work shall demonstrate fluid flow quantities shown in the report by reading back outlets or terminals selected specifically or at random by the Design Engineer. It is understood that the operating mode of the system shall be the same for read-back as it was during balancing.

3.6 REPORT:

A. Provide a digital bookmarked PDF copy of report containing a general information sheet listing instruments used, method of balancing, etc.

B. Provide equipment data sheets listing make, size, serial number, rating, etc. of all mechanical equipment including pumps and motors. Operating data shall include rotational speed, inlet and outlet pressures, pressure drop across pumps, pump heads, and measured motor current and voltage.

C. Note any abnormal or notable conditions not covered in the above.

D. Keep a daily log of all work performed, with a list of work scheduled for each day and the workers on the job.

END OF SECTION 230593

SECTION 230900 - MECHANICAL CONTROL SYSTEMS

PART I - GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

B. Division-23 General Mechanical Requirements sections apply to work of this section.

1.2 SUMMARY:

A. Extent of control systems work required by this section is indicated on drawings and schedules, and by requirements of these control related sections.

1. See following sections for types of Control Systems included as a part of this section.
2. Section 230923 - Direct Digital Control Systems
3. Control sequences are specified in this section under: "Sequence of Operation".

B. Refer to other Division-23 sections for installation of instrument wells, valve bodies, and dampers in mechanical systems.

C. Refer to Division-26 sections for the following work.

1. Power supply wiring from power source to power connection on controls and/or unit control panels. Includes starters, disconnects, and required electrical devices, except where specified as furnished, or factory-installed, by manufacturer.

2. Interlock wiring between electrically-operated equipment units; and between equipment and field-installed control devices.

a. Interlock wiring specified as factory-installed is work of this section.

D. Provide the following electrical work as work of this section, complying with requirements of Division-26 sections:

1. Control wiring between field-installed equipment, controls, indicating devices, and unit control panels.

2. 120 volt service required by control systems.

E. Participate in "System Commissioning, Testing and Balancing".

1.3 QUALITY ASSURANCE:

A. MANUFACTURER'S QUALIFICATIONS: Control Components will be purchased and furnished by the Contractor. Approved manufacturers are as follows:

1. Alerton Controls

B. INSTALLER'S QUALIFICATIONS: Firms and workmen specializing and experienced in electric control system installations for not less than 5 years. Approved installers are as follows:

1. ATC Contractors (Brock Jacobson 801-486-9364)

1.4 SUBMITTALS:

A. Product Data: Submit manufacturer's technical product data for each control device furnished, indicating dimensions, capacities, performance characteristics, electrical characteristics, finishes of materials, and including installation instructions and start-up instructions.

B. Shop Drawings: Submit shop drawings for each control system, containing the following information:

1. Schematic flow diagram of system showing fans, pumps, coils, dampers, valves, and control devices, etc.

2. Label each control device with setting or adjustable range of control.

3. Indicate all required pneumatic tubing and/or electrical wiring. Clearly differentiate between portions of work that are factory-installed and portions to be field-installed. Note contract responsibility to provide complete system regardless of delegation. Completely interface with and show existing installation in the existing building.

4. Provide details of faces of control panels, including controls, instruments, and labeling.

5. Include verbal written description of sequence of operation. Confirm correct function of proposed sequences.

C. Samples: Submit sample of each type of proposed thermostat cover.

D. Maintenance Data: Submit maintenance instructions and spare parts lists. Include this data, product data, and shop drawings in maintenance manuals; in accordance with requirements of Division 23.

1.5 REFERENCES:

A. Codes and Standards:

1. Electrical Standards: Provide electrical products which have been tested, listed and labeled by UL and comply with NEMA standards.

2. NEMA Compliance: Comply with NEMA standards pertaining to components and devices for electric control systems.

3. NFPA Compliance: Comply with NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating Systems" where applicable to controls and control sequences.

4. Comply with NEPA 70, "National Electric Code" for all electrical installation.

1.6 DELIVERY, STORAGE, AND HANDLING: Provide factory shipping cartons for each piece of equipment, and control device. Maintain cartons through shipping, storage and handling as required to prevent equipment damage, and to eliminate dirt and moisture from equipment. Store equipment and materials inside and protected from weather.

1.7 INSTRUCTION OF OWNER'S PERSONNEL: (See Section 230000)

A. Purpose is to provide a transition of the systems from the Contractor to the Owner, leaving the Owner's personnel familiar with and well qualified to operate and maintain the systems.

B. Instruction to cover purpose and function of each system and its components, to show proper operating technique, to show proper maintenance technique.

C. Prepare an outline of information to be conveyed, list materials available for reference. Submit to Architect along with a proposed schedule of instruction. Schedule to allow individual time for each trade and each system.

D. Convey information in formal classroom session. Teachers to include qualified contractor personnel and sales representatives for each major piece of equipment. Go from the classroom to the actual location to graphically illustrate concepts discussed.

1.8 WARRANTIES:

A. As part of the overall project warranty, furnish individual manufacturer warranties for each piece of equipment for a period of not less than one year from date of Owner's beneficial use (substantial completion).

B. Warrant the overall assembly of equipment, materials and labor comprising these systems.

1.9 CLEANING AND LUBRICATION: All instruments, control panel and control piping shall be thoroughly cleaned before final acceptance. Provide lubrication for all furnished equipment.

1.10 TESTING AND ADJUSTING OF SYSTEM:

A. During the system commissioning, testing and balancing of the various building systems, have a controls representative(s) present and available to interpret and adjust controls as needed. Demonstrate and report the integrity and accuracy of each function and control point.

B. At the termination of the testing period, the Controls representative shall spend one working day instructing the Owner's operating personnel in the control system operation, and one working day checking each system for day-night and manual override with the Owner's operating personnel on each air system. A complete operating booklet shall be provided and used during the training period. Schedule this training with the Owner and Mechanical Contractor.

1. Since system performance is partly a function of climatic conditions, the Controls contractor shall be available during the changing seasons of the warranty period to make further adjustments and modifications if required. A final complete check of all systems shall be made at the conclusion of the one year warranty period.

PART II – PRODUCTS – NOT USED

PART III - CONTROL SEQUENCES

3.1 GENERAL:

A. Provide control systems to manage and manipulate mechanical equipment in a functional and energy-conserving way.

3.2 CENTRAL CONTROL AND MONITORING SYSTEM:

A. System controllers shall be integrated into the existing Alerton supervisory software.
1. Provide integration of all controllers and equipment interfaces with unique and individualized graphical interfaces with system reporting including:
a. Reported Values
b. Alarms
c. Trending
d. Setpoint Adjustment

B. Connect to building Ethernet/IP network. Coordinate with Owner's IT department for networking details and device integration. Reference Section 230923 for additional detail.

3.3 PACKAGED ROOFTOP A/C UNIT (AC-WW):

A. AC-WW shall be furnished with its own factory-wired controls. The unit controller shall be provided with the required sensors and programming for the rooftop unit. The controller shall be factory-programmed, mounted, and tested. Controller shall have an LCD readout for changing set points and monitoring unit operation. Controller shall be capable of interfacing with the existing Alerton BMS. Report operating status information indicated on the control drawings to the existing BMS.

B. AC-WW is enabled through the BMS but operates through its own internal controls in both heating and cooling modes based upon input from a remote wall-mounted temperature sensor and space temperature setpoints received from the BMS.

C. Economizer sequence: When the application requires cooling, and the outdoor air conditions are suitable for free cooling, the controller will modulate the outdoor air and recirculated air dampers to maintain the space temperature set point. If the space temperature set point cannot be satisfied using outside air, the outside air damper shall close to a minimum, and the unit's compressor is enabled as needed to provide cooling.

D. On call for heating, the unit's electric heater is energized in order to satisfy the heating space temperature set point.

E. Alarms: The controller will display alarms and send all alarms to the BMS. Reference control drawings for required alarms.

END OF SECTION 230900

SECTION 230923 - DIRECT DIGITAL CONTROL SYSTEMS (DDC)

PART I - GENERAL:

1.1 RELATED DOCUMENTS: See Section 230900.

1.2 DESCRIPTION OF WORK:

A. The Building Automation System (BAS) is in place and is to remain. Utilize spare points on existing controller to complete the work as indicated on the plans.

1.3 SUBMITTALS: See Section 230900.

1.4 DELIVERY, STORAGE AND HANDLING: See Section 230900.

1.5 INSTRUCTION OF OWNER'S PERSONNEL: See Section 230900.

1.6 WARRANTIES: See Section 230900.

1.7 CLEANING AND LUBRICATION: See Section 230900.

1.8 TESTING AND ADJUSTING OF SYSTEM: See Section 230900.

PART II - PRODUCTS

2.1 CONTROL CABINETS: Existing cabinet to remain with modifications as noted.

A. CONTROL WIRING:

1. In mechanical rooms, boiler rooms, etc., all control wiring shall be installed in conduit per National Electric Code. Installation shall be square with the walls of the buildings.

2. Number and code all wiring.

PART III - EXECUTION

3.1 COMPLETE SYSTEM:

A. Integrate all controls into the existing control system. Provide all controls and related functions, with all power and communications wiring, actuators, etc.

B. Participate in the checkout and commissioning and shake out of the affected mechanical systems. Provide complete and detailed checkout and testing of all controls and control sequences. Provide thermal rise trend recording and logs during system testing and shake out.

C. Contractor shall coordinate with the owner’s personnel to get Ethernet communications installed from the Alerton main HVAC controller in the high-rise building level 2 electrical room to the SCADA Remote Terminal Unit in Reclaim Pump Station #2. Controls contractor and electrical contractor employed by General Contractor shall provide labor and materials to complete the communications link to the unit-mounted factory controller.

3.2 CONTROL SEQUENCES: See section 230900.

3.3 SYSTEM ACCEPTANCE:

A. GENERAL: The system installation shall be complete and tested for proper operation prior to acceptance testing for the Owner's authorized representative. When the field test procedures have been demonstrated to the Owner's representative, the system will be accepted. The warranty period will start at this time.

B. FIELD EQUIPMENT TEST PROCEDURES: DDC controls panels shall be demonstrated via a functional end to end test. Such that:

1. All output channels shall be commanded (on/off, stop/start, adjust, etc.) and their operations verified.

2. All analog input channels shall be verified for proper operation.

3. All digital input channels shall be verified by changing the state of the field device and observing the appropriate change of displaying value.

4. If a point should fail testing, perform necessary repair action and retest failed point and all interlocked points.

5. Automatic control operation shall be verified by introducing an error into the system and observing the proper corrective system response.

6. Selected time and setpoint schedules shall be verified by changing the schedule and observing the correct response on the controlled outputs.

C. AS-BUILT DOCUMENTATION: After a successful acceptance demonstration, the Contractor shall submit as-built drawings of the completed project for final approval. After receiving final approval, supply "6" complete 11x17 as-built drawing sets, together with PDF File to the Owner.

END OF SECTION 230923

SECTION 236100 - PACKAGED HVAC EQUIPMENT

PART I - GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to work of this section.

B. Division 23 Motors Drives and Electrical Requirements for Mechanical Systems, General Mechanical Requirements, and General Pipes and Fittings sections apply to work of this section.

1.2 SUMMARY:

A. Extent of air-handling unit work is indicated on drawings, schedules, and by requirements of this section.

B. Types of packaged air-handling units specified in this section include the following:

1. Packaged Rooftop A/C Unit

C. Refer to other Division 23 sections for vibration control units used in conjunction with air handling units; not work of this section.

D. Vibration control units required for air handling units is specified in other Division 23 sections, and is included as work of this section.

E. Refer to other Division 23 sections for field-applied insulation to air handling units.

F. Refer to Division 23 sections for the following work.

1. Power supply wiring from power source to power connection on unit. Include starters, disconnects, and required electrical devices, except where specified as furnished, or factory-installed.

2. Interlock wiring between electrically-operated equipment units; and between equipment and field-installed control devices shown on electrical drawings.

a. Interlock wiring specified as factory-installed is work of this section.

G. Provide the following electrical work as work of this section, complying with requirements of Division 26 sections:

1. Control wiring between field-installed controls, indicating devices, and unit control panels.

a. Control wiring specified as work of Division 23 for Automatic Temperature Controls is work of that section.

H. Furnish and install packaged rooftop air handling units designed for outdoor application as described in Contract Documents.

1.3 QUALITY ASSURANCE:

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of packaged air-handling units with characteristics, sizes, and capacities required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Installer's Qualifications: A firm with at least 3 years of successful installation experience on projects with metal ductwork systems, work similar to that required for the project.

1.4 SUBMITTALS:

A. Product Data: Submit manufacturer's technical product data for air handling units showing dimensions, weights, capacities, ratings, fan performance with operating point clearly indicated, motor electrical characteristics, gages and finishes of materials, and installation instructions.

B. Shop Drawings: Submit assembly-type shop drawings showing unit dimensions, weight loadings, required clearances, construction details, and field connection details.

C. Wiring Diagrams: Submit manufacturer's electrical requirements for power supply wiring to air handling units. Submit manufacturer's ladder-type wiring diagrams for interlock and control wiring. Clearly differentiate between portions of wiring that are factory-installed and portions to be field-installed.

D. Maintenance Data: Submit maintenance instructions, including instructions for lubrication, filter replacement, motor and drive replacement, and spare parts lists. Include this data, product data, shop drawings, and wiring diagrams in maintenance manuals; in accordance with requirements of Division 230100.

1.5 REFERENCES:

A. Codes and Standards:

1. AMCA Compliance: Test and rate air handling units in accordance with AMCA standards.

2. ARI Compliance: Test and rate air handling units in accordance with ARI 430 "Standard for Central-Station Air Handling Units", display certification symbol on units of certified models.

3. ASHRAE Compliance: Construct and install refrigerant coils in accordance with ASHRAE 15 "Safety Code for Mechanical Refrigeration".

4. NFPA Compliance: Provide air handling unit internal insulation having flame spread rating not over 25 and smoke developed rating no higher than 50; and complying with NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating Systems".

5. NEC Compliance: Comply with National Electrical Code (NFPA 70) as applicable to installation and electrical connections of ancillary electrical components of air handling units.

6. International Building Code/ International Mechanical Code: Comply with all sections pertaining to mechanical work.

7. AFBMA 9—Load Ratings and Fatigue Life for Ball Bearings.

8. AMCA 99—Standards Handbook

9. AMCA 210—Laboratory Methods of Testing Fans for Rating Purposes

10. AMCA 500—Test Methods for Louver, Dampers, and Shutters.

11. ARI 340/360—Unitary Large Equipment

12. NEMA MG1—Motors and Generators

13. UL 900—Test Performance of Air Filter Units.

1.6 PRODUCT DELIVERY, STORAGE AND HANDLING:

A. Deliver air-handling units with factory-installed shipping skids and lifting lugs; pack components in factory-fabricated protective containers.

B. Handle air-handling units carefully to avoid damage to components, enclosures, and finish. Do not install damaged components; replace and return damaged components to air-handling unit manufacturer.

C. Store air-handling units in clean dry place and protect from weather and construction traffic. Where necessary to store outside, store above grade and enclosed with waterproof wrapping.

D. Comply with Manufacturer's rigging and installation instructions for unloading air handling units, and moving them to final location.

PART II - PRODUCTS

2.1 PACKAGED ROOFTOP A/C UNIT (AC-WW)

A. MANUFACTURERS

1. Available Manufacturers: Subject to compliance with specifications contained within this document, manufacturers offering products that may be incorporated into the work include, but are not limited to:

a. Carrier

b. Greenheck

c. Daikin

d. York

B. GENERAL DESCRIPTION

1. Packaged rooftop unit shall include compressors, evaporator coils, filters, supply fans, dampers, air-cooled condenser coils, condenser fans, electric heaters, and unit controls.
2. Unit shall be factory assembled and tested including leak testing of the DX coils, pressure testing of the refrigeration circuit, and run testing of the completed unit. Run test report shall be supplied with the unit in the service compartment's literature pocket.
3. Unit shall have decals and tags to indicate lifting and rigging, service areas and caution areas for safety and to assist service personnel.
4. Unit components shall be labeled, including refrigeration system components and electrical and controls components.
5. Estimated sound power levels (dB) shall be shown on the unit ratings sheet.
6. Installation, Operation and Maintenance manual shall be supplied within the unit.
7. Laminated color-coded wiring diagram shall match factory installed wiring and shall be affixed to the interior of the control compartment's hinged access door.
8. Unit nameplate shall be provided in two locations on the unit, affixed to the exterior of the unit and affixed to the interior of the control compartment's hinged access door.

C. CABINET

1. Unit cabinet shall be constructed of galvanized steel, and shall be bonderized and coated with a prepainted baked enamel finish on all externally exposed surfaces.
2. Unit cabinet exterior paint shall be: film thickness, (dry) 0.003 in. minimum, gloss (per ASTM D523, 60°F/16°C): 60, Hardness: H-2H Pencil hardness.
3. Evaporator fan compartment interior cabinet insulation shall conform to AHRI Standards 210/240 and or 340/360 minimum exterior sweat criteria. Interior surfaces shall be insulated with a minimum 1/2 in. thick, 1 lb density, flexible fiberglass insulation, neoprene coated on the air side. Aluminum foil-faced fiberglass insulation shall be used in the heat compartment.
4. Base of unit shall have a minimum of 4 locations for thru-the-base electrical connections (factory-installed or field-installed), standard.
5. Base Rail:
    a. Unit shall have base rails on a minimum of 2 sides.
    b. Holes shall be provided in the base rails for rigging shackles to facilitate maneuvering and overhead rigging.
    c. Holes shall be provided in the base rail for moving the rooftop by fork truck.
    d. Base rail shall be a minimum of 16 gauge thickness.
6. Condensate Pan and Connections:
    a. Shall be a sloped condensate drain pan made of a corrosion resistant material.
    b. Shall comply with ASHRAE Standard 62.

c. Shall use a 3/4 in. 14 NPT drain connection, possible either through the bottom or side of the drain pan. Connection shall be made per manufacturer's recommendations.

7. Top Panel: Shall be a single piece top panel.

8. Electrical Connections:

a. All unit power wiring shall enter unit cabinet at a single, factory prepared, knockout location.

b. Thru-the-base capability:

1) Standard unit shall have a thru-the-base electrical location(s) using a raised, embossed portion of the unit basepan.

2) Optional, factory approved, water-tight connection method must be used for thru-the-base electrical connections.

3) No basepan penetration, other than those authorized by the manufacturer, is permitted.

9. Component Access Panels:

a. Cabinet panels shall be easily removable for servicing.

b. Unit shall have one factory installed, tool-less, removable, filter access panel.

c. Panels covering control box, indoor fan, indoor fan motor, and compressors shall have molded composite handles.

d. Handles shall be UV modified, composite. They shall be permanently attached, and recessed into the panel.

e. Screws on the vertical portion of all removable access panel shall engage into heat resistant, molded composite collars.

f. Collars shall be removable and easily replaceable using manufacturer recommended parts.

D. COILS

1. Aluminum Fin-Copper Tube Coils:

a. Standard evaporator and condenser coils shall have aluminum lanced plate fins mechanically bonded to seamless internal helically grooved copper tubes with all joints brazed.

b. Evaporator coils shall be leak tested to 150 psig, pressure tested to 450 psig, and qualified to UL 60335-2-40 burst test at 1775 psig.

c. Condenser coils shall be leak tested to 150 psig, pressure tested to 650 psig, and qualified to UL 60335-2-40 burst test at 1980 psig.

E. REFRIGERANT COMPONENTS

1. Refrigerant circuit shall include the following control, safety, and maintenance features:

a. Fixed orifice metering system on 04-06 models and TXV on 07 size models shall include a multiple feed distribution system that optimizes coil performance.

b. Refrigerant filter drier, solid core design with pre and post-filter service gauge connections for filter diagnostics and maintenance.

c. Service gauge connections on suction and discharge lines.

d. Pressure gauge access through a specially designed access port in the top panel of the unit.

2. There shall be gauge line access port in the skin of the rooftop, covered by a black, removable plug.

a. The plug shall be easy to remove and replace.

b. When the plug is removed, the gauge access port shall enable maintenance personnel to route their pressure gauge lines.

c. This gauge access port shall facilitate correct and accurate condenser pressure readings by enabling the reading with the compressor access panel on.

d. The plug shall be made of a leak proof, UV-resistant, composite material.

3. Compressors:

a. Unit shall use fully hermetic scroll compressors.

b. Compressor motors shall be cooled by refrigerant gas passing through motor windings.

c. Compressors shall be internally protected from high discharge temperature conditions.

d. Compressors shall be protected from an over-temperature and over-amperage conditions by an internal, motor overload device.

e. Compressor shall be factory mounted on rubber grommets.

f. Compressor motors shall have internal line break thermal, current overload and high pressure differential protection.

g. Crankcase heaters shall not be required for normal operating range, unless required by compressor manufacturer due to refrigerant charge limits.

F. EVAPORATOR FAN AND MOTOR

1. Direct Drive Evaporator Fan Motor:

a. Shall be an ECM motor design.

b. Shall be direct drive design for all static options.

c. Shall have permanently lubricated bearings.

d. Shall have inherent automatic-reset thermal overload protection.

e. Shall have slow ramp-up to speed capabilities.

f. Shall require no fan/motor belts for operation, adjustments and or initial fan speed set up.

g. Fan DC voltage set up on Unit Control Board can eliminate the need of removal of blower access door, required on conventional belt drive systems.

h. Shall be internally protected from electrical phase reversal.

2. Evaporator Fan:

a. Speed shall be easily set with dedicated selection switch and adjustment pot on unit control board or through SystemVu™ controller.

b. On sizes 04-06 single speed indoor fan operation provided and on 07 size model with 2 stage cooling capacity control, the indoor fan speed is automatically controlled to meet the code-compliant 66% low fan speed and 100% at full fan speed operation.

c. Blower fan shall be a vane axial fan design with fan assembly secured directly to ECM motor. Additional shafts, belts, pulleys/sheaves, and bearing blocks to drive fan shall not be permitted or necessary.

d. Additional variable frequency drive to control fan motor speed shall not be permitted or necessary. All speed control electronics must be on board fan motor assembly.

e. Shall be constructed of an aluminum stator or high impact composite material on stator, rotor and air inlet casing.

f. Shall be a patented / pending design with a corrosion resistant material.

g. Fan assembly design shall be integrated into fan deck, dynamically balanced, and require no additional vibration isolation for normal operation.

h. Shall have slow ramp-up to speed capabilities to help reduce sound and comfort issues typically associated with single speed belt drive systems.

i. Shall be a slide out design with 2 screw removal.

3. Shall include an easily accessible Unit Control Board to conveniently and safely provide connection points for vital control functions such as: smoke detectors, phase monitor, economizer, thermostat, DDC control options, and low and high pressure switches. Controller shall also provide an intuitive means to adjust the indoor fan speed through a simple switch and pot adjustment design.

G. CONDENSER FAN AND MOTOR

1. Condenser Fan Motors:

a. Shall be a totally enclosed motor.

b. Shall use permanently lubricated bearings.

c. Shall have inherent thermal overload protection with an automatic reset feature.

d. Shall use a shaft-down design on all sizes.

2. Condenser Fans:
    a. Shall be a direct-driven propeller type fan constructed of high impact composite material.
    b. Shall have high impact composite blades completely formed into one piece without blade fasteners or connectors and shall be dynamically balanced.

H. ACCESSORIES
1. Integrated Economizer:
    a. Integrated, gear driven opposing modulating blade design type capable of simultaneous economizer and compressor operation.
    b. Independent modules for vertical or horizontal return configuration shall be available. Vertical return modules shall be available as a factory-installed option.
    c. Damper blades shall be galvanized steel with composite gears. Plastic or composite blades on intake or return shall not be acceptable.
    d. Shall include all hardware and controls to provide free cooling with outdoor air when temperature and/or humidity are below setpoints.
    e. Shall be equipped with gear driven dampers for both the outdoor ventilation air and the return air for positive air stream control.
    f. Low leak rate shall be equipped with dampers not to exceed 2% leakage at 1 in. wg pressure differential.
    g. Gravity economizer relief.
2. Unit-Mounted, Non-Fused Disconnect Switch:
    a. Switch shall be factory installed, internally mounted.
    b. National Electric Code (NEC) and UL approved non-fused switch shall provide unit power shutoff.
    c. Shall be accessible from outside the unit.
    d. Shall provide local shutdown and lockout capability.
    e. Sized only for the unit as ordered from the factory. Does not accommodate field-installed devices.
3. Convenience Outlet:
    a. Factory-Installed Powered Convenience Outlet:
        1) Outlet shall be powered from main line power to the rooftop unit.
        2) Outlet shall be powered from line side or load side of disconnect by installing contractor, as required by code. If outlet is powered from load side of disconnect, unit electrical ratings shall be UL certified and rated for additional outlet amperage.

3) Outlet shall be factory-installed and internally mounted with easily accessible 115-v female receptacle.

4) Outlet shall include 15 amp GFI receptacles with independent fuse protection.

5) Voltage required to operate convenience outlet shall be provided by a factory installed step-down transformer.

6) Outlet shall be accessible from outside the unit.

7) Outlet shall include a field installed “Wet in Use” cover.

4. Thru-the-Base Connectors:

a. Kits shall provide connectors to permit gas and electrical connections to be brought to the unit through the unit basepan.

b. Minimum of 4 connection locations per unit.

c. Economizer controller on EconoMi$er 2 models with SystemVu™ controllers shall be a 4 to 20 mA design controlled directly by the controller. SystemVu controllers meet Cali-fornia Title 24, ASHRAE 90.1 and IECC Fault Detection and Diagnostic (FDD) requirements.

d. Shall be capable of introducing up to 100% outdoor air.

e. Shall be equipped with a barometric relief damper capable of relieving up to 100% return air and contain seals that meet ASHRAE 90.1 requirements.

f. Shall be designed to close damper(s) during loss-of-power situations with spring return built into motor.

g. Dry bulb outdoor air temperature sensor shall be provided as standard. Enthalpy sensor is also available on factory installed only. Outdoor air sensor setpoint shall be adjustable and shall range from 40°F to 100°F (4°C to 38°C). Additional sensor options shall be available as accessories.

h. The economizer controller shall also provide control of an accessory power exhaust unit function. Factory set at 100%, with a range of 0% to 100%.

i. The economizer shall maintain minimum airflow into the building during occupied period and provide design ventilation rate for full occupancy.

j. Dampers shall be completely closed when the unit is in the unoccupied mode.

k. Economizer controller shall accept a 0 to 10 vdc CO_2 sensor input for IAQ/DCV control. In this mode, dampers shall modulate the outdoor air damper to provide ventilation based on the sensor input.

l. Compressor lockout temperature on POL224 control is adjustable from –45°F to 80°F (–43°C to 26°C), set at a factory default of 32°F (0°C).

m. Actuator shall be direct coupled to economizer gear. No linkage arms or control rods shall be acceptable.

n. Contains LED indication for free cooling, sensor, and damper operation.

5. Smoke Detectors:

a. Shall be a 4-wire controller and detector.

b. Shall be environmentally compensated with differential sensing for reliable, stable, and drift-free sensitivity.

c. Shall use magnet-activated test/reset sensor switches.

d. Shall have tool-less connection terminal access.

e. Shall have a recessed momentary switch for testing and resetting the detector.

f. Controller shall include:

1) One set of normally open alarm initiation contacts for connection to an initiating device circuit on a fire alarm control panel.

2) Two Form-C auxiliary alarm relays for interface with rooftop unit or other equipment.

3) One Form-C supervision (trouble) relay to control the operation of the Trouble LED on a remote test/reset station.

4) Capable of direct connection to 2 individual detector modules.

5) Can be wired to up to 14 other duct smoke detectors for multiple fan shutdown applications.

6. Hinged Access Panels:

a. Shall provide easy access through integrated quarter turn latches.

b. Shall be on major panels of: filter, control box, fan motor, and compressor.

7. Condensate Overflow Switch:

This sensor and related controller monitors the condensate level in the drain pan and shuts down compression operation when overflow conditions occur. It includes:

a. Indicator light — solid red (more than 10 seconds on water contact — compressors disabled), blinking red (sensor disconnected).

b. 10 second delay to break — eliminates nuisance trips from splashing or waves in pan (sensor needs 10 seconds of constant water contact before tripping).

c. Disables the compressor(s) operation when condensate plug is detected, but still allows fans to run for economizer.

8. Electric Heat:

a. Heating Section:

1) Heater element open coil resistance wire, nickel-chrome alloy, 0.29 in. inside diameter, strung through ceramic insulators mounted on metal frame. Coil ends are staked and welded to terminal screw slots.

2) Heater assemblies are provided with integral fusing for protection of internal heater circuits. Auto-reset thermo limit controls, magnetic heater contactors (24-v coil), and terminal block all mounted in electric heater control box (minimum 18 ga galvanized steel) attached to end of heater assembly.

I. FILTER SECTION

1. Filter Section:

a. Filters access is specified in the unit cabinet section of this specification.

b. Filters shall be held in place by a pivoting filter tray, facilitating easy removal and installation.

c. Shall consist of factory installed, low velocity, 2 in. MERV 8 filters.

d. Filters shall be standard, commercially available sizes.

e. Only one size filter per unit is allowed.

J. UNIT CONTROLS

1. The Packaged DX system shall be controlled by an onboard digital controller (DDC) that indicates both owner-supplied settings and fault conditions that may occur. The intelligent integrated Direct Digital Control (DDC) shall provide:

a. Integrated unit operation for comfort cooling, heating ventilation as well as all monitoring, recording and reporting capabilities. Controller shall also provide diagnostics and alarms of abnormal unit operation through the controller. Controller shall have an intuitive user display and be able to be used in a standalone operation or via building automation system (BAS).

b. Quick Unit Status LEDs of: Run — meaning all systems are go, ALERT — that indicates there is currently a non-critical issue with the unit, like filters need to be replaced and FAULT — that indicates the unit has a critical issue and will possibly shut down.

c. Six large navigation keys for easy access. Navigation keys shall consist of: TEST, BACK, ENTER, and MENU along with UP and DOWN arrows.

d. Full back lit user display with 4 line by 30 character text capabilities. Display menu shall be designed to provide guided major menus and sub menus main menus provided below:

1) Shutdown Unit

2) Run Status

3) Settings

4) Alerts/Faults

5) Service

6) Inputs

7) Outputs

8) USB

e. The capability for standalone operation with conventional thermostat/sensor or use with building automation systems (BAS) of Carrier i-Vu®, BACnet, and Carrier Comfort Network® (CCN) systems. No special modules or boards are required for these capabilities. Has the capability to work with Equipment Touch™ and System Touch™ devices and ZS Sensors.

f. The ability to read refrigerant pressures at display or via BAS network of; Discharge Pressure and Suction Pressure. The need for traditional refrigerant gauges is not required.

g. USB Data Port for flash drive interaction. This will allow the transfer of data for uploads, downloads, perform software upgrades, back-up and restore data and file transfer data such as component number of starts and run hours.

h. Reverse Rotation Protection of compressors if field 3-phase wiring is misapplied.

i. Provide Service Capabilities of:

1) Auto run test

2) Manual run test

3) Component run hours and starts

4) Commissioning reports

5) Data logging

6) Alarm history

7) Economizer control and diagnostics. Set up economizer operation, receive feedback from actuator. Also meets the most recent California Title 24, ASHRAE 90.1 and IECC Fault Detection and Diagnostic (FDD) requirements.

8) Unit cooling operation down to 40°F (4°C).

9) Controller shall have easy access connections around the controller perimeter area and consist of Mate-N-Lok®, terminal block and RJ style modular jack connections.

10) 365 day real time clock, 20 holiday schedules along with occupied and unoccupied scheduling.

11) Auto-recognition for easy installation and commissioning of devices like economizers, space sensors, etc.

12) A 5°F (3°C) temperature difference between cooling and heating setpoints to meet the latest ASHRAE 90.1 Energy Standard.

13) Contain return air sensor, supply air sensor and outdoor air sensor to help monitor and provide data for the unit comfort operation, diagnostic and alarms.

14) Use of Carrier's field accessory Equipment Touch and System Touch devices.

15) Units with the factory-installed Humidi-MiZer® system option are capable of providing multiple modes of improved dehumidification as a variation of the normal cooling cycle.

16) Supply Air Tempering control operates the gas or electric heat to maintain a minimum supply air temperature during conditions where very cold outdoor air causes the supply air temperature to fall below the configured Supply Air Tempering Setpoint. This occurs during periods where DCV is active and increasing the amount of outdoor air or in cases where the system is operating at very low airflow and the calculated economizer position has increased to maintain a constant ventilation rate.

17) Demand limiting in SystemVu™ is achieved through setpoint expansion. The systems heating and cooling setpoints are expanded in steps or levels. The degree to which the setpoints may be expanded is defined by the 6 demand level offsets and the 2 commanded demand limit levels.

18) 3-year limited part warranty.

2. The unit shall be constructed so that it can function as a stand-alone heating and cooling system controlled by factory-supplied controllers, thermostats and sensors. This unit shall be controlled by a factory-installed microprocessor programmable controller (DDC) that is connected to various optional sensors.

3. Unit shall incorporate a DDC controller with integral LCD screen that provides text readouts of status. DDC controller shall have a built-in keypad to permit operator to access read-out screens without the use of ancillary equipment, devices or software. DDC controllers that require the use of equipment or software that is not factory-installed in the unit are not acceptable. Alarm readouts consisting of flashing light codes are not acceptable. Owner-specified ventilating conditions can be input by means of pushbuttons.

PART III - EXECUTION

3.1 INSPECTION:

A. Examine areas and conditions under which air-handling units are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 INSTALLATION OF PACKAGED ROOFTOP A/C UNITS:

A. General: Install units where indicated, in accordance with equipment manufacturer's published installation instructions, and with recognized industry practices, to ensure that units comply with requirements and serve intended purposes.

B. Coordination: Coordinate with other work, including ductwork, floor construction, roof decking, piping, and electrical as necessary to interface installation of air-handling units with other work.

C. Access: Provide access space around units for service as indicated, but in no case less than that recommended by manufacturer.

D. Support: Install on roof curb.

E. Electrical Wiring: Install electrical devices furnished by manufacturer but not specified to be factory-mounted. Furnish copy of manufacturer's wiring diagram submittal to Electrical Installer.

1. Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements of Division 26 sections. Do not proceed with equipment start-up until wiring installation is acceptable to equipment installer.

F. Piping Connections: Refer to Division 23 HVAC sections. Provide piping, valves, accessories, gages, supports, and flexible connectors as indicated.

G. Duct Connections: Refer to Division 23 Air Distribution sections. Provide ductwork, accessories, and flexible connections as indicated.

H. Grounding: Provide positive equipment ground for air-handling unit components.

3.3 FIELD QUALITY CONTROL:

A. Testing: Upon completion of installation of air-handling units, start-up and operate equipment to demonstrate capability and compliance with requirements. Field correct malfunctioning units, then retest to demonstrate compliance.

B. Do not operate units until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.

C. If specified conditions cannot be obtained due to deficiencies in equipment performance or improper installation or workmanship, the Mechanical Contractor and his subcontractors shall make any changes necessary to obtain the specified conditions.

3.4 EXTRA STOCK:

A. Provide two complete sets of filters for the unit. Install one set of filters at completion of air handling system work, and the other set prior to testing, adjusting, and balancing work. Obtain receipt from Owner that new filters have been installed.

END OF SECTION 237300