

DIVISION 23: HEATING, VENTILATING, AND AIR-CONDITIONING

23 0000 HEATING, VENTILATING, AND AIR-CONDITIONING

23 0501 COMMON HVAC REQUIREMENTS

23 5000 CENTRAL HEATING EQUIPMENT

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SECTION 23 0501 – COMMON HVAC REQUIREMENTS**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

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

1.2 SUMMARY

- A. Furnish labor, materials, and equipment necessary for completion of work as described in Contract Documents.
- B. It is the intent of these specifications that the systems specified herein are to be complete and operational before being turned over to the owner. During the bidding process, the contractor is to ask questions or call to the engineer's attention any items that are not shown or may be required to make the system complete and operational. Once the project is bid and the contractor has accepted the contract, it is his responsibility to furnish and install all equipment and parts necessary to provide a complete and operational system without additional cost to the owner.
- C. Furnish and install fire stopping materials to seal penetrations through fire rated structures and draft stops.
- D. Includes But Not Limited To:
 - 1. General procedures and requirements for HVAC.

1.3 SUBMITTALS

- A. Substitutions: By specific designation and description, standards are established for specialties and equipment. Other makes of specialties and equipment of equal quality will be considered provided such proposed substitutions are submitted to the Architect for his approval, complete with specification data showing how it meets the specifications, at least 5 working days prior to bid opening. A list of approved substitutions will be published as an addendum.
 - 1. Submit a single copy of Manufacturer's catalog data including Manufacturer's complete specification for each proposed substitution.
 - 2. The Architect or Engineer is to be the sole judge as to the quality of any material offered as an equal.
- B. Product Data, Shop Drawings: Within 30 days after award of contract, submit 10 sets of Manufacturer's catalog data for each manufactured item.
 - 1. Literature shall include enough information to show complete compliance with Contract Document requirements.
 - 2. Mark literature to indicate specific item with applicable data underlined.
 - 3. Information shall include but not be limited to capacities, ratings, type of material used, guarantee, and such dimensions as are necessary to check space requirements.
 - 4. When accepted, submittal shall be an addition to Contract Documents and shall be in equal force. No variation shall be permitted.
 - 5. Even though the submittals have been accepted by the Engineer, it does not relieve the contractor from meeting all of the requirements of the plans and specifications and providing a complete and operational system.
- C. Drawings of Record: One complete sets of blue line mechanical drawings shall be provided for the purpose of showing a complete picture of the work as actually installed.
 - 1. These drawings shall serve as work progress report sheets. Contractor shall make notations neat and legible therein daily as the work proceeds.
 - 2. The drawings shall be kept at the job at a location designated by the Mechanical Engineer.
 - 3. At completion of the project these "as-built" drawings shall be signed by the Contractor, dated, and returned to the Architect.

- D. Operating Instructions and Service Manual: The Mechanical Contractor shall prepare 2 copies of an Operation and Maintenance Manual for all mechanical systems and equipment used in this project. Manuals shall be bound in hard-backed binders and the front cover and spine of each binder shall indicate the name and location of the project. Use plastic tab indexes for all sections. Provide a section for each different type of equipment item. The following items shall be included in the manual, together with any other pertinent data. This list is not complete and is to be used as a guide.
1. Provide a master index at the beginning of the manual showing all items included.
 2. The first section of the manual shall contain:
 - a. Names, addresses, and telephone numbers of Architect, Mechanical Engineer, Electrical Engineer, General Contractor, Plumbing Contractor, Sheet Metal Contractor, and Temperature Control Contractor.
 - b. List of Suppliers which shall include a complete list of each piece of equipment used with the name, address, and telephone number of vendor.
 - c. General Description of Systems including –
 - 1) Location of all major equipment
 - 2) Description of the various mechanical systems
 - 3) Description of operation and control of the mechanical systems
 - 4) Suggested maintenance schedule
 - d. Copy of contractor's written warranty
 3. Provide a copy of approved submittal literature for each piece of equipment.
 4. Provide maintenance and operation literature published by the manufacturer for each piece of equipment which includes: oiling, lubrication and greasing data; belt sizes, types and lengths; wiring diagrams; step-by-step procedure to follow in putting each piece of mechanical equipment in operation.
 5. Include parts numbers of all replaceable items.
 6. Provide control diagram and operation sequence, along with labeling of control piping and instruments to match diagram.
 7. Include a valve chart indicating valve locations.

1.4 SUBMITTALS FOR COMMON HVAC REQUIREMENTS

- A. Samples: Sealer and gauze proposed for sealing ductwork.
- B. Quality Assurance / Control:
1. Manufacturer's installation manuals providing detailed instructions on assembly, joint sealing, and system pressure testing for leaks.
 2. Specification data on sealer and gauze proposed for sealing ductwork.
- C. Quality Assurance
1. Requirements: Construction details not specifically called out in Contract Documents shall conform to applicable requirements of SMACNA HVAC Duct Construction Standards.
 2. Pre-Installation Conference: Schedule conference immediately before installation of ductwork.

1.5 QUALITY ASSURANCE

- A. Requirements of Regulatory Agencies:
1. Perform work in accordance with applicable provisions of local and state Plumbing Code, Gas Ordinances, and adoptions thereof. Provide materials and labor necessary to comply with rules, regulations, and ordinances.
 2. In case of differences between building codes, state laws, local ordinances, utility company regulations, and Contract Documents, the most stringent shall govern. Promptly notify Architect in writing of such differences.
- B. Applicable Specifications: Referenced specifications, standards, and publications shall be of the issues in effect on date of Advertisement for Bid.
1. "Heating, Ventilating and Air Conditioning Guide" published by the American Society of Heating and Air Conditioning Engineers.
 2. "Engineering Standards" published by the Heating, Piping, and Air Conditioning Contractors National Association.

3. "2015 International Building Code", "2015 International Mechanical Code", "2015 International Plumbing Code" and "2015 International Fire Code" as published by the International Conference of Building Officials.
 4. "National Electrical Code" as published by the National Fire Protection Association.
 5. "2015 International Energy Conservation Code".
- C. Identification: Motor and equipment name plates as well as applicable UL and AGA labels shall be in place when Project is turned over to Owner.

1.6 INSPECTIONS AND PERMITS

- A. Pay for permits, fees, or charges for inspection or other services. Local and state codes and ordinances must be properly executed without expense to Owner and are considered as minimum requirements. Local and state codes and ordinances do not relieve the Contractor from work shown that exceeds minimum requirements.

1.7 ADDITIONAL WORK:

- A. Design is based on equipment as described in the drawing equipment schedule. Any change in foundation bases, electrical wiring, conduit connections, piping, controls and openings required by alternate equipment submitted and approved shall be paid for by this division. All work shall be in accordance with the requirements of the applicable sections.

PART 2 - PRODUCTS FOR COMMON HVAC REQUIREMENTS

- A. Finishes, Where Applicable: Colors as selected by Architect.
- B. Duct Hangers:
1. One inch 25 mm by 18 ga 1.27 mm galvanized steel straps or steel rods as shown on Drawings, and spaced not more than 96 inches 2 400 mm apart. Do not use wire hangers.
 2. Attaching screws at trusses shall be 2 inch 50 mm No. 10 round head wood screws. Nails not allowed.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Site Inspection:
1. Examine premises and understand the conditions which may affect performance of work of this Division before submitting proposals for this work.
 2. No subsequent allowance for time or money will be considered for any consequence related to failure to examine site conditions.
- B. Drawings:
1. Mechanical drawings show general arrangement of piping, ductwork, equipment, etc, and do not attempt to show complete details of building construction which affect installation. This Contractor shall refer to architectural, structural, and electrical drawings for additional building detail which affect installation of his work.
 - a. Follow mechanical drawings as closely as actual building construction and work of other trades will permit.
 - b. No extra payments will be allowed where piping and/or ductwork must be offset to avoid other work or where minor changes are necessary to facilitate installation.
 - c. Everything shown on the mechanical drawings shall be the responsibility of Mechanical Contractor unless specifically noted otherwise.
 2. Consider architectural and structural drawings part of this work insofar as these drawings furnish information relating to design and construction of building. These drawings take precedence over mechanical drawings.
 3. Because of small scale of mechanical drawings, it is not possible to indicate all offsets, fittings, and accessories which may be required. Investigate structural and finish conditions affecting this

work and arrange work accordingly, providing such fittings, valves, and accessories required to meet conditions. Do not scale drawings for locations of equipment or piping. Refer to large scale dimensioned drawings for exact locations.

- C. Insure that items to be furnished fit space available. Make necessary field measurements to ascertain space requirements including those for connections and furnish and install equipment of size and shape so final installation shall suit true intent and meaning of Contract Documents.
 - 1. If approval is received to use other than specified items, responsibility for specified capacities and insuring that items to be furnished will fit space available lies with this Division.
 - 2. If non-specified equipment is used and it will not fit job site conditions, this Contractor assumes responsibility for replacement with items named in Contract Documents.

3.2 PREPARATION

- A. Cut carefully to minimize necessity for repairs to existing work. Do not cut beams, columns, or trusses.
 - 1. Patch and repair walls, floors, ceilings, and roofs with materials of same quality and appearance as adjacent surfaces unless otherwise shown. Surface finishes shall exactly match existing finishes of same materials.
 - 2. Each Section of this Division shall bear expense of cutting, patching, repairing, and replacing of work of other Sections required because of its fault, error, tardiness, or because of damage done by it.
 - 3. Cutting, patching, repairing, and replacing pavements, sidewalks, roads, and curbs to permit installation of work of this Division is responsibility of Section installing work.

3.3 INSTALLATION

- A. Arrange pipes, ducts, and equipment to permit ready access to valves, unions, traps, starters, motors, control components, and to clear openings of doors and access panels.

3.4 STORAGE AND PROTECTION OF MATERIALS:

- A. Provide storage space for storage of materials and assume complete responsibility for losses due to any cause whatsoever. Storage shall not interfere with traffic conditions in any public thoroughfare.
- B. Protect completed work, work underway, and materials against loss or damage.
- C. Close pipe openings with caps or plugs during installation. Cover fixtures and equipment and protect against dirt, or injury caused by water, chemical, or mechanical accident.

3.5 EXCAVATION AND BACKFILL

- A. Perform necessary excavation of whatever substance encountered for proper laying of all pipes and underground ducts.
 - 1. Excavated materials not required for fill shall be removed from site as directed by Engineer.
 - 2. Excavation shall be carried low enough to allow a minimum coverage over underground piping of 5'-0" or to be below local frost level.
 - 3. Excess excavation below required level shall be backfilled at Contractor's expense with earth, sand, or gravel as directed by Engineer. Tamp ground thoroughly.
 - 4. Ground adjacent to all excavations shall be graded to prevent water running into excavated areas.
- B. Backfill pipe trenches and allow for settlement.
 - 1. Backfill shall be mechanically compacted to same density as surrounding undisturbed earth.
 - 2. Cinders shall not be used in backfilling where steel or iron pipe is used.
 - 3. No backfilling shall be done until installation has been approved by the Engineer.

3.6 COOPERATION

- A. Cooperate with other crafts in coordination of work. Promptly respond when notified that construction is ready for installation of work under Division 23000. Contractor will be held responsible for any delays

which might be caused by his negligence or failure to cooperate with the other Contractors or crafts.

3.7 SUPERVISION

- A. Provide a competent superintendent in charge of the work at all times. Anyone found incompetent shall be removed at once and replaced by someone satisfactory, when requested by the Architect.

3.8 INSTALLATION CHECK:

- A. An experienced, competent, and authorized representative of the manufacturer or supplier of each item of equipment indicated in the equipment schedule shall visit the project to inspect, check, adjust if necessary, and approve the equipment installation. In each case, the equipment supplier's representative shall be present when the equipment is placed in operation. The equipment supplier's representative shall revisit the project as often as necessary until all trouble is corrected and the equipment installation and operation is satisfactory to the Engineer.
- B. Each equipment supplier's representative shall furnish to the Owner, through the Engineer, a written report certifying the following:
 - 1. Equipment has been properly installed and lubricated.
 - 2. Equipment is in accurate alignment.
 - 3. Equipment is free from any undue stress imposed by connecting piping or anchor bolts.
 - 4. Equipment has been operated under full load conditions.
 - 5. Equipment operated satisfactorily.
- C. All costs for this installation check shall be included in the prices quoted by equipment suppliers.

3.9 CLEANING EQUIPMENT AND PREMISES

- A. Properly lubricate equipment before Owner's acceptance.
- B. Clean exposed piping, ductwork, equipment, and fixtures. Repair damaged finishes and leave everything in working order.
- C. Remove stickers from fixtures and adjust flush valves.
- D. At date of Substantial Completion, air filters shall be new, clean, and approved by Owner's representative.
- E. Trap elements shall be removed during cleaning and flushing period. Replace trap elements and adjust after cleaning and flushing period.

3.10 TESTS

- A. No piping work, fixtures, or equipment shall be concealed or covered until they have been inspected and approved by the inspector. Notify inspector when the work is ready for inspection.
- B. All work shall be completely installed, tested as required by Contract Documents and the city and county ordinances and shall be leak-tight before the inspection is requested.
- C. Tests shall be repeated to the satisfaction of those making the inspections.
- D. Water piping shall be flushed out, tested at 100 psi and left under pressure of supply main or a minimum of 40 psi for the balance of the construction period.

3.11 WARRANTY

- A. Contractor shall guarantee work under Division 23 to be free from inherent defects for a period of one year from acceptance.

1. Contractor shall repair, revise or replace any and all such leaks, failure or inoperativeness due to defective work, materials, or parts free of charge for a period of one year from final acceptance, provided such defect is not due to carelessness in operation or maintenance.
 2. In addition, the Contractor shall furnish all refrigeration emergency repairs, emergency service and all refrigerant required due to defective workmanship, materials, or parts for a period of one year from final acceptance at no cost to the Owner, provided such repairs, service and refrigerant are not caused by lack of proper operation and maintenance.
- B. In addition to warrantee specified in General Conditions, heating, cooling, and plumbing systems are to be free from noise in operation that may develop from failure to construct system in accordance with Contract Documents.

3.12 SYSTEM START-UP

- A. Off-Season Start-up
1. If Substantial Completion inspection occurs during heating season, schedule spring start-up of cooling systems. If inspection occurs during cooling season, schedule autumn start-up for heating systems.
 2. Notify Owner 7 days minimum before scheduled start-up.
 3. Time will be allowed to completely service, test, check, and off-season start systems. During allowed time, train Owner's representatives in operation and maintenance of system.
 4. At end of off-season start-up, furnish Owner with letter confirming that above work has been satisfactorily completed.

3.13 PROTECTION

- A. Do not run heat pump, air handling units, fan coil units, or other pieces of equipment used for moving supply air without proper air filters installed properly in system.
- B. The mechanical systems are not designed to be used for temporary construction heat. If any equipment is to be started prior to testing and substantial completion, such equipment will be returned to new condition with full one year warranties, from date of substantial completion after any construction use. This includes, but is not necessarily limited to: Equipment, filters, ductwork, fixtures, etc.

3.14 COMMON HVAC REQUIREMENTS:

- A. INSTALLATION
1. During installation, protect open ends of ducts by covering with plastic sheet tied in place to prevent entrance of debris and dirt.
 2. Make necessary allowances and provisions in installation of sheet metal ducts for structural conditions of building. Revisions in layout and configuration may be allowed, with prior written approval of Architect. Maintain required airflows in suggesting revisions.
 3. Hangers And Supports:
 - a. Install pair of hangers close to each transverse joint and elsewhere as required by spacing indicated in table on Drawings.
 - b. Install upper ends of hanger securely to floor or roof construction above by method shown on Drawings.
 - c. Attach strap hangers to ducts with cadmium-plated screws. Use of pop rivets or other means will not be accepted.
 - d. Where hangers are secured to forms before concrete slabs are poured, cut off flush all nails, strap ends, and other projections after forms are removed.
 - e. Secure vertical ducts passing through floors by extending bracing angles to rest firmly on floors without loose blocking or shimming. Support vertical ducts, which do not pass through floors, by using bands bolted to walls, columns, etc. Size, spacing, and method of attachment to vertical ducts shall be same as specified for hanger bands on horizontal ducts.

END OF SECTION 23 0501

SECTION 23 5416 – SEPARATED COMBUSTION UNIT HEATERS**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings, General Provisions of Contract, including General and Supplementary Conditions and Section 23 0501 apply to this Section.

1.2 SUMMARY

- A. Furnish and install separated combustion unit heaters as described in Contract Documents.

PART 2 - PRODUCTS**2.1 MANUFACTURED UNITS**

- A. Provide high-efficiency, separated combustion, gas fired unit heaters as manufactured by Reznor. They are to be designed for a fuel use improvement of 25% and engineered for use in building areas with negative pressure and/or extremely dirty or mildly corrosive atmospheres. The use of a factory-installed power venter to draw combustion air from outside is to prevent dirt, lint, dust, or other contaminants present in the heated space from entering the unit. The combustion air supply pipe and flue exhaust pipe shall be run parallel to a factory-supplied (horizontal), (vertical) vent terminal assembly. The vent terminal assembly shall be arranged to provide preheating of the combustion supply air and to allow a single wall or roof penetration.
- B. The SC series shall be provided with a 24-volt control transformer, a(n) (single-stage), (two-stage), (electronic modulation) gas control system with a regulated combination redundant gas valve and an intermittent spark pilot with electronic flame supervision (and timed lockout). The SC is to include all limit and safety controls, including a combustion air pressure differential switch to verify proper vent flow before allowing operation of the gas valve.
- C. Each unit shall be equipped for use with natural gas and 120/1, volt power supply. The heat exchanger shall be the Reznor Themrocore design of aluminized, steel and include flared ports and a stainless steel insert. The units shall be designed for 80% thermal efficiency.
- D. These units are to be propeller fan(s), open drip-proof fan motor(s) with internal overloads, and safety fan guard(s). Horizontal (and vertical) louvers shall be provided for directing air flow. The unit must be arranged for ceiling suspension with threaded hanger connections (and provided with hanger kits). The cabinet shall be constructed of zinc grip steel and finished with baked-on enamel.
- E. All separated-combustion unit heaters must be design-certified by the American Gas Association and bear the A.G.A. label.
- F. Provide with low voltage thermostat equal to Honeywell T87.

END OF SECTION 23 5416

SECTION 23 5540 - ELECTRIC RADIANT WALL HEATERS**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings, General Provisions of Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, and Section 23 0501 apply to this Section.

1.2 SUMMARY

- A. Furnish and install wall heaters as described in Contract Documents.

1.3 QUALITY ASSURANCE

- A. Units shall be UL listed and comply with NEC.

PART 2 - PRODUCTS**2.1 MANUFACTURED UNITS**

- A. Fan type for recess mounting in wall.
- B. 20 gauge minimum sheet metal casing.
- C. Heating element shall be encased in steel finned casting and protected by thermal switch.
- D. Fan motor shall be heavy duty enclosed and permanently lubricated.
- E. Fan shall be precision balanced and fan-motor assembly mounted to be vibration free.
- F. Units shall be controlled automatically by integral thermostat when heater is in "ON" position.
- G. Heater shall have built-in fan delay.
- H. Finish - Baked-on enamel.
- I. Approved Manufacturers:
 - 1. Q' Mark
 - 2. Berko
 - 3. Thermador
 - 4. Markel

END OF SECTION 23 5540

END OF DIVISION 23