DIVISION 23: HEATING, VENTILATING, AND AIR-CONDITIONING

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COMMON HVAC REQUIREMENTS

SECTION 23 05 01

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 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.

3.6 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.

3.7 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.

3.8 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.

3.9 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.

3.10 WARRANTEE

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.

3.11 SYSTEM START-UP, OWNER'S INSTRUCTIONS

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.

3.12 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.

B. CLEANING
   1. Clean interior of duct systems before final completion.

END OF SECTION

DEMOLITION AND REPAIR

SECTION 23 05 02

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. Under this section remove obsolete piping and mechanical equipment and relocate, reconnect or replace existing piping affected by demolition or new construction. Remove concealed piping abandoned due to demolition or new construction, or cap piping flush with existing surfaces.

1.3 DRAWINGS AND EXISTING CONDITIONS

A. All relocations, reconnections and removals are not necessarily indicated on the drawings. As such, the Contractor shall make adequate allowance in his proposal for this work as no extra charges will be allowed for these items.

PART 2 - NOT USED

PART 3 - EXECUTION

3.1 TEMPORARY CONNECTIONS

A. Where existing piping must remain in service to supply occupied areas during construction, provide temporary piping, connections, and equipment to maintain service to such areas. All shall be performed in a neat and safe manner to prevent injury to the building or its occupants.

3.2 EXISTING TO BE ABANDONED

A. All required drilling, cutting, block-outs and demolition work required for the removal and/or installation of the mechanical system is the responsibility of this Contractor.

B. No joists, beams, girders, trusses or columns shall be cut by any Contractor without written permission from the Architect.

C. The patching, repair, and finishing to existing or new surfaces is the responsibility of this Contractor, unless specifically called for under sections of specifications covering these materials.

D. Disconnect all equipment that is to be removed or relocated. Relocate any existing equipment that obstructs new construction.

3.3 EXISTING TO REMAIN IN USE

A. Where affected by demolition or new construction, relocate, replace, extend, or repair piping and equipment to allow continued use of same. Use methods and materials as specified for new construction.

3.4 MATERIALS AND EQUIPMENT REMOVED

A. All obsolete materials, piping, and equipment shall become the property of the Contractor and be removed from the site promptly.

END OF SECTION

NATURAL GAS SYSTEMS

SECTION 23 11 23

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 gas piping and fittings within building including connection to meter.

1.3 QUALITY ASSURANCE

A. Qualifications:
   1. Welders shall be certified and bear evidence of certification 30 days prior to commencing work on project. If there is doubt as to proficiency of welder, Owner's Representative may require welder to take another test. This shall be done at no cost to Owner. Certification shall be by Pittsburgh Testing Laboratories or other approved authority.

PART 2 - PRODUCTS

2.1 PIPE

A. Meet requirements of ASTM A 53-89a, "Specification for Pipe, Steel, Black & Hot-Dipped Zinc-Coated Welded & Seamless".

B. Carbon steel, butt welded, Schedule 40 black steel pipe.

2.2 FITTINGS

A. Black Pipe:
   1. Welded forged steel fittings meeting requirements of ASTM A 234-89a, "Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures", or standard weight malleable iron screwed.

2.3 VALVES

A. 125 psi bronze body ball valve, UL listed

B. Approved Manufacturers & Models:
   1. ConBraCo - "Apollo" series 80-100
   2. Jenkins - FIG-30-A
   3. Jomar - Model T-204
   4. McDonald - 3410
   5. PGL Corp - "Red Cap" gas ball valve
   6. Watts - Model B-6000-UL

2.4 PRESSURE REDUCING REGULATORS

A. Corrosion Resistant Brass Body.

B. 1/2" to 4" Threaded NPT

C. 2" and Above Flanged.

D. Max Inlet Pressure 10 psi.

E. Max Outlet Pressure 0.5 psi.

F. Temperature Capabilities - ~20 to 180° F.

G. Approved Manufactures and Models.
   1. Emerson Process Management.
   2. Maxitrol 3UP33
   3. Or approved equal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Pipe installed underground, through air plenums, in walls, and pipes 2-1/2 inches and larger shall have welded fittings and joints. Other pipe may have screwed or welded fittings.

B. Wrap and lay underground pipe in accordance with local gas utility company regulations and specifications.

C. Install gas cocks on lines serving boilers, furnaces, duct heaters, and water heaters adjacent to boiler, furnace, or heater on outside of boiler, furnace, or heater cabinet and easily accessible.

D. Do not use flexible pipe connections to boilers, furnaces, duct heaters, or hot water heaters.

E. Install dirt leg with pipe cap, 6 inches long minimum, on each vertical gas drop to heating equipment.

F. Use fittings for changes of direction in pipe and for branch runouts.

G. Paint exterior exposed gas piping with grey paint to match gas meter.

END OF SECTION

HVAC FANS

SECTION 23 34 50

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 WORK INCLUDED

A. The ceiling mounted, circulation fan shall be Big Ass Fans or approved equal. The fan shall be the model scheduled with the capacities indicated. The fan shall be furnished with standard mounting hardware and variable speed controls.

1.3 RELATED WORK

A. Factory installation services shall be available through the manufacture; consult the appropriate installation scope of work for more information. Installation of the fan, miscellaneous or structural metal work (if required), field electrical wiring, cable, conduit, fuses and disconnect switches other than those not addressed in the installation scope of work consulted, will be provided by others.

PART 2 - PRODUCT

2.1 MANUFACTURER

A. Delta T Corporation, dba Big Ass Fans, PO Box 11307, Lexington, Kentucky 40575. Phone (877) 244-3267. Fax (859) 233-0139. Website: www.bigassfans.com or approved equal.

2.2 HIGH VOLUME, LOW SPEED FANS

A. Complete Unit:
   1. The fan shall be ETL certified and built pursuant to construction guidelines set forth by UL standard 507 and CSA standard 22.2. The fan shall be designed to move an effective amount of air for cooling and destratification in large industrial applications over an extended life. The fan and components shall be designed specifically for high volume, low speed fans to ensure lower noise operation. The sound levels from the fan operating at maximum speed shall not exceed 55 dBA (measured 20’ or 6.1 m below the blades and 20’ or 6.1 m horizontally from the center of the fan).

B. Airfoils:
   1. The fan shall be equipped with ten (10) high volume, low speed airfoils of precision extruded aluminum alloy. Each airfoil shall be of the high performance Powerfoil design. The airfoils shall be connected by means of two (2) locking bolts per airfoil. The airfoils shall be connected to the hub and interlocked with zinc plated steel retainers.

C. Winglets:
   1. The fan shall be equipped with ten (10) Powerfoil winglets designed to redirect outward airflow into downward airflow, thereby enhancing the efficiency and effectiveness of the fan. The winglets shall be molded of high density polypropylene and nominally measure 8-1/2” x 3” (21.6 cm x 7.6 cm). A winglet

shall be attached at the tip of each airfoil by means of a barrel screw. The standard color of the winglets shall be “Safety Yellow.”

D. Motor:
1. The fan motor shall be an AC induction type inverter rated at 1725 RPM, 230/460 VAC, and 60 Hz for 3 φ and 1725 RPM, 208 VAC, and 60 Hz for 1 φ. The motor shall be totally enclosed, fan cooled (TEFC) with an IP55 NEMA classification. NEMA standard frames 56C/143TC/145TC shall be provided for ease of service. The motor shall be manufactured with a double baked Class F insulation and be capable of continuous operation in -30oF to 122oF (-34oC to 50oC) ambient conditions.

E. Gearbox:
1. The fan gearbox shall be a NitroSeal™ Drive designed specifically for the Powerfoil X. The gearbox shall include a high efficiency, hermetically sealed, nitrogen filled, offset helical gear reducer with two stage
2. gearing, a 2-1/2” (6.4 cm) hollow output shaft, cast iron housing, double lip seals, high quality SKF Explorer Series bearings with crowned cages for optimal lubrication flow, and precision machined gearing to maintain backlash less than 11 arc-minutes over the life of the unit. Lubrication shall be a high grade, low foaming synthetic oil with extreme pressure additives and a wide temperature range.
3. The fan gearbox shall be equipped with a passageway in which wiring, piping, etc can be routed below the fan. A non-rotating, standard junction box shall be provided at the base of the fan for installing optional features such as lights, cameras, and VESDA. An aluminum cover plate shall be provided for attachment to the junction box when these features are not installed.

F. Mounting Post:
1. The fan shall be equipped with a mounting post that provides a structural connection between the fan assembly and upper mounting system. The mounting post shall be 3” x 3” (7.6 cm x 7.6 cm) square tubing and powder coated for corrosion resistance and appearance. As an option, mounting post may be colored as specified by the architect or owner.

G. Hub:
1. The fan hub shall be precision cast aluminum alloy for high strength and light weight. The hub shall be secured to the output shaft of the gearbox by means of a steel flange interface. Both hub and flange shall be precision machined to achieve a well balanced and solid rotating assembly. The hub shall incorporate five (5) safety retaining clips made of 1/4” (0.6 cm) thick steel that shall restrain the hub/airfoil assembly in case of gearbox output shaft failure.

H. Mounting System:
1. The fan mounting system shall be designed for quick and secure installation from a structural support beam. All components in the mounting system shall be of welded construction using low carbon steel no less than 3/16” (0.5 cm) thick and be powder coated for appearance and resistance to corrosion. All mounting bolts shall be SAE Grade 8 or equivalent. As an option, mounting components may be colored as specified by the architect or owner.

I. Safety Cable:
1. The fan shall be equipped with a safety cable that provides an additional means of securing the fan assembly to the building structure. The safety cable shall be 3/8” (1 cm) diameter and fabricated out of 7 x 19 stranded galvanized steel. The

loops shall be secured with swaged Nicopress fittings, pre-loaded and tested to 3,000 lb·f (13,345 N).
2. Field construction of safety cables is not permitted.

J. Controller:
1. The fan controller shall be constructed using a Variable Speed Drive (VSD) that is pre-wired to the motor and factory programmed to minimize the starting and braking torques, for smooth and efficient operation. The controller shall be prewired to the motor using a short run of flexible conduit THHM with a dedicated ground conductor to minimize electromagnetic interference (EMI) and radio frequency interference (RFI). An incoming power cord shall also be pre-wired to the controller for ease of installation. The controller shall be contained within a completely sealed aluminum enclosure with an IP45 NEMA classification for 3 φ and a NEMA 4/12 rating for 1 φ. The controller will be secured to the mounting post 'onboard' the fan assembly.

K. Wall Control:
1. The fan shall be equipped with a remote wall control. The wall control shall be a digital keypad device mounted inside an aluminum bezel. The bezel shall be capable of mounting to a standard wall box. The wall control shall be equipped with touchpad controls and an LED display for controlling the fan's direction, operation and speed. Communication with the fan drive and controller shall be by a standard
2. commercially available CAT-5 (or higher) Ethernet cable that is field installed and provided by the installer. A 5' (1.5 m) 'patch cable' shall be provided to test and verify communication signals locally prior to connecting the remote connection cable.
3. The wall control shall be equipped with a simple diagnostic program to identify faults in the system. Provisions must be made for retrieving fan operation and diagnostic data (fault messages) through the remote wall device.

L. Warranty:
1. The manufacturer shall replace any products or components defective in material or workmanship, free of charge to the customer (including transportation charges within the USA, F.O.B. Lexington, KY), pursuant to the complete terms and conditions of the Big Ass Fans Non-Prorated Warranty in accordance to the following schedule:
   a. Airfoils Lifetime (Parts)
   b. Hub Lifetime (Parts)
   c. Motor 10 years (Parts)†
   d. Gearbox 10 years (Parts)†
   e. Controller 10 years (Parts)†
   f. Labor 1 year††
   g. † 10 year parts warranty only valid with factory installation, 5 year parts without factory installation.
   h. †† All reasonable costs of repair or replacement will be paid or reimbursed provided customer obtains pre-approval; see full warranty for details.
2. Further information on the terms and conditions of the warranties can be found in the Installation Guide.

PART 3 - ANCILLARY

3.1 INSTALLATION

A. The fan shall be mounted to an angle iron or I-beam structure. Consult the Installation Guide for acceptable I-beam width, and proper sizing and placement of angle iron for a

span mount. A structural engineer must be consulted for installation methods outside the manufacturer's recommendation and a certification submitted prior to installation.

B. To reduce the risk of injury to persons, the fan shall be installed so that the airfoils are at least 10' (3 m) above the floor. The fan installation area must be free of obstructions such as lights, cables, sprinklers or other building structures; with the airfoils at least 2' (61 cm) clear of all obstructions. The fan should not be installed where it will be continuously subjected to wind gusts or in close proximity to the outputs of HVAC systems.

C. If the fan is hung from an extension tube that measures 4' (1.2 m) or longer, it may be necessary to provide guy cables or struts to limit potential lateral movement of the fan. A stiffening strut braced against an additional beam may be required if there is a close clearance situation.

D. The design criteria for the fan mounting system shall be capable of handling 300 ft·lbs (407 N·m) of torque.

3.2 WORKMANSHIP

A. Good workmanship shall be evident in all aspects of construction. Field balancing of the airfoils shall not be acceptable.

3.3 DOCUMENTATION

A. The manufacturer shall furnish a copy of all operating and maintenance instructions for the fan.

B. All data is subject to change without notice. Data indicated in this document are for your convenience and were correct at the time of printing with the exception of clerical and/or printing errors. This document supersedes all previously published documents.

END OF SECTION

SEPERATED COMBUSTION UNIT HEATERS

SECTION 23 54 16

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 UDS series shall be provided with a 24-volt control transformer, a two-stage 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 Thermocore design of aluminized steel and include flared ports burner air shutters and a stainless-steel insert. The units shall be designed for 80% thermal efficiency.

D. These units are to be propeller fans, open drip-proof fan motors with internal overloads, and safety fan guards. Horizontal 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.

END OF SECTION

END OF DIVISION