SECTION 22 62 19 - VACUUM EQUIPMENT FOR LABORATORY AND HEALTHCARE FACILITIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Package, claw type vacuum pumps.
2. Medical vacuum equipment alarm systems.
3. Computer interface cabinets.

1.3 DEFINITIONS

A. Actual Air: Air delivered at vacuum producer inlet. Flow rate is air measured in expanded cfm (expanded L/s).

B. HVE: High-volume oral evacuation for dental applications in healthcare facilities.

C. Laboratory Vacuum Equipment: Equipment and accessories for nonmedical laboratory facilities.

D. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.

E. Medical vacuum equipment includes medical vacuum, WAGD evacuation and healthcare laboratory vacuum equipment and accessories for healthcare facilities.

F. Standard Air: Free air at 68 deg F (20 deg C) and 1 atmosphere (29.92 in. Hg) before compression or expansion and measured in scfm (standard L/s).

G. WAGD Evacuation: Waste anesthetic gas disposal for medical-surgical applications in healthcare facilities.

1.4 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design vacuum equipment mounting, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Seismic Performance: Vacuum equipment shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

1.5 SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

1. Wiring Diagrams: For power, signal, and control wiring.

B. Delegated-Design Submittal: For vacuum-producing equipment mounting indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Detail fabrication and assembly of supports.
2. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.

C. Qualification Data: For qualified testing agency.

D. Seismic Qualification Certificates: For vacuum producers, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

E. Field quality-control reports.

F. Operation and Maintenance Data: For vacuum equipment to include in operation and maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications:

1. Laboratory Vacuum System Equipment for Nonmedical Laboratory Facilities: An employer of workers trained and approved by manufacturer.
2. Medical Vacuum System Equipment for Healthcare Facilities: Qualify installers according to ASSE 6010.

B. Testing Agency Qualifications: An independent testing agency, with the experience and capability to conduct the vacuum equipment testing indicated, that is an NRTL, and that is acceptable to authorities having jurisdiction.

1. Qualify testing personnel according to ASSE 6020 for inspectors and ASSE 6030 for verifiers.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. ASME Compliance: Fabricate and label receivers to comply with ASME Boiler and Pressure Vessel Code.

E. Comply with NFPA 99, "Health Care Facilities," for vacuum equipment and accessories for medical vacuum systems.

F. Comply with UL 544, "Medical and Dental Equipment," for medical vacuum equipment.

1.7 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

1.8 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Belts: Two for each belt-driven vacuum producer.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PACKAGED VACUUM PUMPS

A. Description: Factory-assembled, -wired, -piped, and -tested; electric-motor-driven; air-cooled; continuous-duty vacuum pumps and receivers.

B. Control Panels: Automatic control station with load control and protection functions. Comply with NEMA ICS 2 and UL 508.

1. Enclosure: NEMA ICS 6, Type 12 control panel unless otherwise indicated.
2. Motor Controllers: Full-voltage, combination-magnetic type with undervoltage release feature and motor-circuit-protector-type disconnecting means and short-circuit protective device.
3. Control Voltage: 120-V ac or less, using integral control power transformer.
4. Motor Overload Protection: Overload relay in each phase.
5. Starting Devices: Hand-off-automatic selector switch in cover of control panel, plus pilot device for automatic control.

6. Automatic control switches to sequence lead-lag vacuum pumps for multiplex vacuum pumps.
7. Instrumentation: Include vacuum pump inlet and receiver vacuum gages, hour meter, vacuum pump discharge-air and coolant temperature gages, and control transformer.
8. Alarm Signal Device: For connection to alarm system to indicate when backup vacuum pump is operating.

C. Receivers: Steel tank constructed according to ASME Boiler and Pressure Vessel Code, Section VIII, Division 1; bearing appropriate code symbols.

1. Interior Finish: Corrosion-resistant coating.
2. Accessories: Include vacuum relief valve, vacuum gage, and drain.

D. Mounting Frame: Fabricate base and attachment to pressure vessel with reinforcement strong enough to resist packaged equipment movement during a seismic event when base is anchored to building structure.

2.2 CLAW TYPE VACUUM PUMPS

A. Furnish and install per plans and specifications one (1) BeaconMedaes Model VHS07D-200V-QCV-SPL Duplex oil-less claw central vacuum system expandable to a quadraplex furnished as a single point connection system. The package is to consist of two (2) 7.5 HP oil-less rotary claw vacuum pumps, each rated for 65 SCFM @ 19" HgV, complete with a quadruplex control panel with variable speed drive inverter, all mounted on a common base frame, ready to accept the future 3rd and 4th vacuum pumps. The common base is to be separable for transport through a standard 34.5" doorway. The vacuum receiver is to be ASME coded and have a three-valve bypass system to allow for draining of the receiver without interrupting the vacuum service. A manual drain to be provided on the receiver. Each pump and the receiver is connected to a common intake manifold. A single point of connection to the intake of the system is provided. A single point of connection to the electrical panel of the system is also required. The package must be completely tested prior to shipment.

B. Each pump is to be direct driven by a 7.5 HP motor and feature a non-contacting claw capable of operating down to 27" HgV continuous duty. The pump must be completely air-cooled with no water requirements. The pump is to have an inlet air filter and be equipped with a vacuum relief valve, check valve to prevent blackflow through off-cycle units, flexible connector, isolation valve, high discharge, temperature switch, high inlet vacuum switch, oil drain valve, oil sight glass, and exhaust muffler at each pump location.

C. The motors are to be continuous duty, NEMA rated, C-face, TEFC, 3450 RPM with a 1.15 service factor suitable for 208V or 230/460V-3PH-60HZ, 3-phase electrical service.

D. Each vacuum pump is to have a factory piped intake with integral flex connector, isolation valve, and check valve. Interconnecting piping is to consist of powder-coated steel tubing and flanges. The vacuum receiver tank is to be a 200 gallon ASME code stamped and rated for a minimum of 150 psig design pressure.

E. Each vacuum pump is to be factory piped to an exhaust manifold with integral flex connector, isolation valve and drip leg with ball valve and condensate drain interconnecting piping to consist of powder-coated steel tubing and flanges. An exhaust muffler is shipped loose.

F. The quadraplex mounted and wired TotalAlert Embedded control system is to be U.L. labeled. The control system is to provide automatic lead/lag sequencing and automatic alternation of vacuum pumps based on first-on/first-off principle with provision for simultaneous operation if required. Automatic activation of reserve unit, if required, will active an audible alarm as well as a visual alarm on the display screen. Additional components will include

1. Single Variable Speed Drive
2. Circuit Breaker disconnects with external operators for each vacuum pump (including future pumps)
3. Full voltage motor starters with overload protection

G. A touch screen control which features one 5.7” master screen and a 3.5” operating screen for each vacuum pump to be included. Screen displays and functions to include:

1. Service Alerts, runtime hourmeters for each pump, system status, system vacuum level.
2. Visual/audible alarm indications with isolated contacts for all standard remote alarms
3. Event log recording alarms and system activity
4. Event log recording service warnings and service history
5. Trend graphs for vacuum level, pump operations, and ambient temperature
6. Ethernet connectivity and embedded web page for remote monitoring
7. Electronic notifications of alarms and warnings
8. Integral connectivity to TotalAlert medical gas network via Ethernet

H. System must be warranted to be free of defects in material and workmanship under normal use for a period not to exceed thirty (30) months from date of shipment, or twenty four (24) months from date of start-up.

2.3 MEDICAL VACUUM EQUIPMENT ALARM SYSTEMS

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

1. Amico Corporation.
2. BeaconMedaes.

B. General Requirements for Medical Vacuum Equipment Alarm System: Compatible alarm panels, remote sensing devices, and other related components as required by NFPA 99 for Level 1 alarm systems. Refer to Division 22 Section "Vacuum Piping for Laboratory and Healthcare Facilities" for medical vacuum piping and alarm systems. Power wiring is specified in Division 26 Sections.

C. Components: Designed for continuous service and to operate on power supplied from 120-V ac power source to alarm panels and with connections for low-voltage wiring to remote sensing devices. Include step-down transformers if required.

D. Vacuum Switches or Transducer Sensors: Continuous equipment monitoring with electrical connections for alarm system.

1. Vacuum Switches: 0- to 30-in. Hg (0- to 101-kPa) vacuum operating range.

E. General Requirements for Medical Vacuum Equipment Alarm Panels: Factory wired with audible and color-coded visible signals to indicate specified functions.

1. Mounting: Recessed installation.
2. Enclosures: Fabricated from minimum 0.047-inch- (1.2-mm-) thick steel or minimum 0.05-inch- (1.27-mm-) thick aluminum, with knockouts for electrical and piping connections.

F. Local and Master Alarm Panels: Separate trouble alarm signals and pressure gages to indicate function of medical vacuum equipment when the following conditions exist:

1. Medical Vacuum Equipment: Drops below 12-in. Hg (40.6-kPa) vacuum, backup vacuum producer is in operation, and high water level is in receiver.

2.4 MOTORS

A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 22 Section "Common Motor Requirements for Plumbing Equipment."

1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
2. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 26 Sections.

2.5 COMPUTER INTERFACE CABINET

A. Description:

1. Wall mounting.
2. Welded steel with white-enamel finish.
3. Gasketed door.
4. Grounding device.
5. Factory-installed signal circuit boards.
6. Power transformer.
7. Circuit breaker.
8. Wiring terminal board.
9. Internal wiring capable of interfacing 20 alarm signals.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean vacuum equipment, accessories, and components that have not been cleaned for oxygen service and sealed or that are furnished unsuitable for medical vacuum applications, according to CGA G4.1, "Cleaning Equipment for Oxygen Service."

3.2 VACUUM EQUIPMENT INSTALLATION

A. Install vacuum equipment for healthcare facilities according to ASSE 6010 and NFPA 99.

B. Equipment Mounting: Install vacuum producerson concrete bases using elastomeric pads. Comply with requirements in Division 03 Section "Cast-in-Place Concrete." Comply with requirements for vibration isolation devices specified in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment."

1. Minimum Deflection: 1/4 inch (6 mm).
2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
3. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to supported equipment.

C. Install vacuum equipment anchored to substrate.

D. Orient equipment so controls and devices are accessible for servicing.

E. Maintain manufacturer's recommended clearances for service and maintenance.

F. Install the following devices on vacuum equipment:

1. Thermometer, Vacuum Gage, and Pressure Relief Valve: Install on each vacuum pump receiver.
2. Drain Valves: Install on receivers. Discharge receiver condensate over nearest floor drain. Discharge separator oral evacuation fluids by direct connection into sanitary waste piping system.

3.3 MEDICAL VACUUM EQUIPMENT ALARM SYSTEM INSTALLATION

A. Alarm panels for medical vacuum equipment may be combined in single panels with medical air equipment and medical gas piping systems.

B. Install medical vacuum equipment alarm system components in locations required by and according to NFPA 99.

C. Install medical vacuum equipment local and master alarm panels where indicated.

3.4 COMPUTER INTERFACE CABINET INSTALLATION

A. Install computer interface cabinet with connection to medical vacuum piping alarm system and to facility computer.

3.5 CONNECTIONS

A. Comply with requirements for water-supply piping specified in Division 22 Section "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Comply with requirements for drain piping specified in Division 22 Section "Sanitary Waste and Vent Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

C. Comply with requirements for vacuum piping specified in Division 22 Section "Vacuum Piping for Laboratory and Healthcare Facilities." Drawings indicate general arrangement of piping, fittings, and specialties.

D. Install piping adjacent to equipment to allow service and maintenance.

E. Connect vacuum piping to vacuum equipment, accessories, and specialties with shutoff valve and union or flanged connection.

F. Connect water supply to vacuum equipment that requires water. Include backflow preventer. Backflow preventers are specified in Division 22 Section "Domestic Water Piping Specialties."

3.6 IDENTIFICATION

A. Identify nonmedical laboratory vacuum equipment system components. Comply with requirements for identification specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

B. Identify medical vacuum equipment system components. Comply with requirements for identification specified in Division 22 Section "Identification for Plumbing Piping and Equipment." and with NFPA 99.

3.7 FIELD QUALITY CONTROL FOR HEALTHCARE-FACILITY MEDICAL VACUUM EQUIPMENT

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

D. Tests and Inspections:

1. Medical Vacuum Equipment Testing Coordination: Perform tests, inspections, verifications, and certification of medical vacuum equipment concurrently with tests, inspections, and certification of medical compressed-air equipment, medical compressed-air piping, medical vacuum piping and medical gas piping systems.
2. Preparation: Perform medical vacuum equipment tests according to requirements in NFPA 99 for the following:

    a. System operation test.

3. Equipment Verification: Comply with requirements in ASSE 6020, ASSE 6030, and NFPA 99 for verification of medical vacuum equipment.
4. Replace damaged and malfunctioning controls and equipment.
5. Testing Certification: Certify that specified tests, inspections, and procedures have been performed and certify report results. Include the following:

    a. Inspections performed.
    b. Procedures and materials used.
    c. Test methods used.
    d. Results of tests.

E. Components will be considered defective if they do not pass tests and inspections.

F. Prepare test and inspection reports.

3.8 STARTUP SERVICE

A. Perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. Check for lubricating oil in lubricated-type equipment.
3. Check belt drives for proper tension.
4. Verify that vacuum producer outlet piping is clear.
5. Check for equipment vibration-control supports and flexible pipe connectors and verify that equipment is properly attached to substrate.
6. Check safety valves for correct settings.
7. Check for proper seismic restraints.
8. Drain receiver tank(s).

9. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
10. Test and adjust controls and safeties.

B. Verify that vacuum equipment is installed and connected according to the Contract Documents.

C. Verify that electrical wiring installation complies with manufacturer's submittal and written installation requirements in Division 26 Sections.

D. Prepare written report documenting testing procedures and results.

3.9 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain vacuum producers.

END OF SECTION