SECTION 226119 - COMPRESSED-AIR EQUIPMENT FOR LABORATORY AND HEALTHCARE FACILITIES

Revise this Section by deleting and inserting text to meet Project-specific requirements.

Verify that Section titles referenced in this Section are correct for this Project's Specifications; Section titles may have changed.

1. GENERAL
	* + 1. RELATED DOCUMENTS

Retain or delete this article in all Sections of Project Manual.

* + - * 1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
			1. SUMMARY
				1. Section Includes:

Oil-free, reciprocating air compressors.

Oilless, reciprocating air compressors.

Liquid-ring air compressors.

Rotary-screw air compressors.

Scroll air compressors.

Diaphragm air compressors.

Inlet-air filters.

Refrigerant compressed-air dryers.

Desiccant compressed-air dryers.

Compressed-air purification systems.

Compressed-air filter assemblies.

Dental air compressors.

Dental air-compressor control panels.

* + - * 1. Related Requirements:

Retain subparagraph below to cross-reference requirements Contractor might expect to find in this Section but are specified in other Sections.

Section 226400 "Medical Gas Alarms" for compressed-air equipment local alarms.

* + - 1. DEFINITIONS

Retain terms that remain after this Section has been edited for a project.

* + - * 1. Actual Air: Air delivered at air-compressor outlet. Flow rate is compressed air delivered and measured in acfm.

Equipment for laboratory air systems in "Laboratory Air Equipment" paragraph below is not required to comply with NFPA 99.

* + - * 1. Laboratory Air Equipment: Compressed-air equipment and accessories for nonmedical laboratory facilities.
				2. Medical air equipment includes [**medical**] [**dental**] [**instrument**] [**and**] [**healthcare laboratory**] air compressors and accessories for healthcare facilities.
				3. Standard Air: Free air at 68 deg F and 1 atmosphere before compression or expansion and measured in scfm.
			1. SUBMITTALS
				1. Submittals for this section are subject to the re-evaluation fee identified in Article 4 of the General Conditions.
				2. Manufacturer’s installation instructions shall be provided along with product data.
				3. Submittals shall be provided in the order in which they are specified and tabbed (for combined submittals).
				4. Product Data: For each type of product.
				5. Shop Drawings: For air compressors[**, compressed-air dryers,**] [**and**] [**compressed-air purification systems**].

Include plans, elevations, sections, and[**mounting**] details.

Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.

Include diagrams for power, signal, and control wiring.

Coordinate "Qualification Data" paragraph below with qualification requirements and as may be supplemented in "Quality Assurance" Article.

* + - * 1. Qualification Data: For [**Installer**] [**and**] [**testing agency**].

Retain "Seismic Qualification Certificates" paragraph below if required by seismic criteria applicable to Project. Coordinate with Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment." See ASCE/SEI 7 for certification requirements for equipment and components.

* + - * 1. Seismic Qualification Certificates: For air compressors, accessories, and components from manufacturer.

Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculations.

Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

Retain "Field quality-control reports" paragraph below if Contractor is responsible for field quality-control testing and inspecting.

* + - * 1. Field quality-control reports.
			1. CLOSEOUT SUBMITTALS
				1. Operation and Maintenance Data: For compressed-air equipment to include in operation and maintenance manuals.
			2. MAINTENANCE MATERIAL SUBMITTALS
				1. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

Air-Compressor, Inlet-Air Filter Elements: Equal to <**Insert number**> percent of quantity installed, but no fewer than <**Insert number**> units.

Belts: [**One**] [**Two**] <**Insert number**> for each belt-driven compressor.

* + - 1. QUALITY ASSURANCE
				1. Installer Qualifications:

Retain "Laboratory Air Equipment for Nonmedical Laboratory Facilities" subparagraph below for equipment in nonmedical laboratory facilities.

Laboratory Air Equipment for Nonmedical Laboratory Facilities: An employer of workers trained and approved by manufacturer.

Retain "Medical Air Equipment for Healthcare Facilities" subparagraph below for equipment in healthcare facilities.

Medical Air Equipment for Healthcare Facilities: Qualify installers according to ASSE 6010 “Medical Gas System Installer”.

Retain "Testing Agency Qualifications" paragraph below if Contractor selects testing agency or if Contractor is required to provide services of a qualified testing agency in "Field Quality Control for Healthcare-Facility Medical Compressed-Air Equipment" Article.

Retain "Testing Agency Qualifications" paragraph for medical air system equipment.

* + - * 1. Testing Agency Qualifications: An independent testing agency, with the experience and capability to conduct the compressed-air equipment testing indicated, that is[**a member of the Medical Gas Professional Healthcare Organization or is**] an NRTL and that is acceptable to authorities having jurisdiction.

Qualify testing personnel according to ASSE 6020 “Medical Gas System Inspector” for inspectors and ASSE 6030 “Medical Gas System Verifier” for verifiers.

1. PRODUCTS

See Editing Instruction No. 1 in the Evaluations for cautions about named manufacturers and products.

Where the term "simplex" is used in this Section, it means one of the indicated items; "duplex" means two; and "multiplex" means more than two.

* + - 1. PERFORMANCE REQUIREMENTS

Retain "Delegated Design" paragraph below if Contractor is required to assume responsibility for design.

* + - * 1. Delegated Design: Engage a qualified professional Director’s Representative to design compressed-air equipment mounting.

Retain "Seismic Performance" paragraph below with "Seismic Qualification Certificates" paragraph in "Informational Submittals" Article for projects requiring seismic design. Delete paragraph if performance requirements are indicated on Drawings. Model building codes and ASCE/SEI 7 establish criteria for buildings subject to earthquake motions. Coordinate requirements with structural engineer.

* + - * 1. Seismic Performance: Air compressors[**and accessories**] shall withstand the effects of earthquake motions determined according to [**ASCE/SEI 7**] <**Insert requirement**>.

Retain first subparagraph below to define the term "withstand" as it applies to this Project. Definition varies with type of building and occupancy and is critical to valid certification. Option is used for essential facilities where equipment must operate immediately after an earthquake.

The term "withstand" means "the air compressor[**and receiver**] will remain in place without separation of any parts when subjected to the seismic forces specified[**and the unit will be fully operational after the seismic event**]."

For life-safety components required to function after an earthquake (such as fire-sprinkler systems), the Component Importance Factor is 1.5. For other components, the Component Importance Factor is 1.0 unless the structure is in Seismic Use Group III and component is necessary for continued operation of facility or failure of component could impair continued operation of facility, in which case the Component Importance Factor is 1.5.

Component Importance Factor: [**1.5**] [**1.0**].

See ASCE/SEI 7, Coefficients for Architectural Component Table and Seismic Coefficients for Mechanical and Electrical Components Table for requirements to be inserted in subparagraph below.

<**Insert requirements for Component Amplification Factor and Component Response Modification Factor**>.

* + - 1. GENERAL REQUIREMENTS FOR AIR COMPRESSORS
				1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70 “Standard for Electrical Safety in the Workplace”, by a qualified testing agency, and marked for intended location and application.
				2. Comply with NFPA 99, "Health Care Facilities," for compressed-air equipment and accessories for medical compressed-air systems.
				3. Comply with UL 544, "Medical and Dental Equipment," for medical compressed-air equipment.
				4. Description: Factory-assembled, -wired, -piped, and -tested; electric-motor-driven; air-cooled; continuous-duty air compressors and receivers that deliver air of quality equal to intake air.
				5. Control Panels: Automatic control station with load control and protection functions. Comply with NEMA ICS 2 “Industrial Control and Systems Controllers, Contractors and Overload Relays Rated 600 Volts” and UL 508 “Standard for Safety for Industrial Control Equipment”.

Enclosure: NEMA ICS 6 “Industrial Control and Systems: Enclosures”, Type 12 control panel unless otherwise indicated.

Motor Controllers: Full-voltage, combination-magnetic type with undervoltage release feature and motor-circuit-protector-type disconnecting means and short-circuit protective device.

Control Voltage: 120-V ac or less, using integral control power transformer.

Motor Overload Protection: Overload relay in each phase.

Starting Devices: Hand-off-automatic selector switch in cover of control panel, plus pilot device for automatic control.

Retain first subparagraph below for duplex and multiplex air compressors.

Automatic control switches to [**alternate lead-lag air compressors for duplex**] [**and**] [**sequence lead-lag air compressors for multiplex**] air compressors.

Instrumentation: Include discharge-air and receiver pressure gages, air-filter maintenance indicator, hour meter, air-compressor discharge-air and coolant temperature gages, and control transformer.

Alarm Signal Device: For connection to alarm system to indicate when backup air compressor is operating.

* + - * 1. Receivers: Steel tank constructed according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

Pressure Rating: At least as high as highest discharge pressure of connected air compressors and bearing appropriate code symbols.

Interior Finish: Corrosion-resistant coating.

Accessories: Include safety valve, pressure gage, automatic drain, and pressure regulator.

Retain "Mounting Frame" paragraph below for projects in seismic areas.

* + - * 1. Mounting Frame: Fabricate base and attachment to air compressor and components with reinforcement strong enough to resist movement during a seismic event when base is anchored to building structure.
			1. RECIPROCATING AIR COMPRESSORS

Copy "Oil-Free, Reciprocating Air Compressors" paragraph below and re-edit for each type of oil-free, reciprocating air compressor required.

Insert drawing designation for each product required. Use these designations on Drawings to identify each oil-free, reciprocating air compressor.

* + - * 1. Oil-Free, Reciprocating Air Compressors <**Insert drawing designation**>:

Description: Packaged unit.

Air Compressor(s): Oil-free, reciprocating-piston type with nonlubricated compression chamber and lubricated crankcase, and of construction that prohibits oil from entering compression chamber.

Submerged gear-type oil pump, and oil filter.

Intercooler between stages of two-stage units.

Combined high discharge-air temperature and low lubrication-oil pressure switch.

Belt guard totally enclosing pulleys and belts.

Receiver and accessories.

Copy "Oilless, Reciprocating Air Compressors" paragraph below and re-edit for each type of oilless, reciprocating air compressor required.

Insert drawing designation for each product required. Use these designations on Drawings to identify each oilless, reciprocating air compressor.

* + - * 1. Oilless, Reciprocating Air Compressors <**Insert drawing designation**>:

Description: Packaged unit.

Air Compressor(s): [**Single**] [**or**] [**two**]-stage, oilless (nonlubricated), reciprocating-piston type, with sealed oil-free bearings, that will deliver air of quality equal to intake air.

High discharge-air temperature switch.

Belt guard totally enclosing pulleys and belts.

Intercooler between stages of two-stage units.

Receiver and accessories.

If Project has more than one type or configuration of air compressor, delete "Capacities and Characteristics" paragraph below and schedule air compressors on Drawings.

Coordinate data specified in "Capacities and Characteristics" paragraph below with piping systems in Section 226113 "Compressed-Air Piping for Laboratory and Healthcare Facilities" and with alarm systems in Section 226400 "Medical Gas Alarms."

* + - * 1. Capacities and Characteristics:

Compressed-Air Service: [**Medical**] [**Dental**] [**Instrument**] [**Medical laboratory**] [**Nonmedical laboratory**] <**Insert service**> air.

Air Compressor(s): [**One**] [**Two**] [**Three**] <**Insert number**>.

Retain one of or both "Standard-Air Capacity of Each Air Compressor" and "Actual-Air Capacity of Each Air Compressor" subparagraphs below.

Standard-Air Capacity of Each Air Compressor: <**Insert scfm**> free air.

Actual-Air Capacity of Each Air Compressor: <**Insert acfm**> delivered.

Discharge-Air Pressure: [**80 psig**] [**125 psig**] [**175 psig**] <**Insert value**>.

Intake-Air Temperature: <**Insert deg F**>.

Discharge-Air Temperature: <**Insert deg F**>.

Mounting: [**Freestanding**] [**Tank mounted**].

Motor (Each Air Compressor):

Horsepower: <**Insert value**>.

Speed: [**1750**] [**3400**] <**Insert speed**> rpm.

Electrical Characteristics:

Volts: <**Insert value**>.

Phase(s): [**Single**] [**Three**].

Hertz: [**60**] <**Insert value**>.

Full-Load Amperes: <**Insert value**>.

Minimum Circuit Ampacity: <**Insert value**>.

Maximum Overcurrent Protection: <**Insert amperage**>.

Receiver:

Orientation: [**Horizontal**] [**Vertical**] arrangement.

Capacity: <**Insert gal.**>.

Interior Finish: [**Epoxy**] [**Epoxy or galvanized**] [**Galvanized**] <**Insert coating**>.

Pressure Rating: [**100 psig**] [**125 psig**] [**150 psig**] [**200 psig**] <**Insert value**> minimum.

Pressure Regulator Setting: <**Insert psig**>.

Pressure Relief Valve Setting: <**Insert psig**>.

Drain: [**Automatic**] [**Manual**] valve.

* + - 1. LIQUID-RING AIR COMPRESSORS

Copy "Liquid-Ring Air Compressors" paragraph below and re-edit for each type of liquid-ring air compressor required.

Insert drawing designation for each product required. Use these designations on Drawings to identify each liquid-ring air compressor.

* + - * 1. Liquid-Ring Air Compressors <**Insert drawing designation**>:

Description: Packaged unit.

Air Compressor(s): Nonpulsating, rotary, liquid-ring type.

Construction: [**Cast-iron body with bronze rotor**] [**Bronze body and rotor**] [**Cast-iron or bronze body and bronze rotor**].

Coupling: Nonlubricated, flexible type.

Sealing Fluid: Potable water. Water circulation is prohibited.

If Project has more than one type or configuration of liquid-ring air compressor, delete "Capacities and Characteristics" paragraph below and schedule air compressors on Drawings.

Coordinate data specified in "Capacities and Characteristics" paragraph below with piping systems in Section 226113 "Compressed-Air Piping for Laboratory and Healthcare Facilities" and with alarm systems in Section 226400 "Medical Gas Alarms."

* + - * 1. Capacities and Characteristics:

Compressed-Air Service: [**Medical**] [**Medical laboratory**] [**Nonmedical laboratory**] <**Insert service**> air.

Air Compressor(s): [**One**] [**Two**] [**Three**] <**Insert number**>.

Retain one of or both "Standard-Air Capacity of Each Air Compressor" and "Actual-Air Capacity of Each Air Compressor" subparagraphs below.

Standard-Air Capacity of Each Air Compressor: <**Insert scfm**> free air.

Actual-Air Capacity of Each Air Compressor: <**Insert acfm**> delivered.

Discharge-Air Pressure: [**80 psig**] [**100 psig**] <**Insert value**>.

Intake-Air Temperature: <**Insert deg F**>.

Discharge-Air Temperature: <**Insert deg F**>.

Mounting: [**Freestanding**] [**Tank mounted**].

Motor (Each Air Compressor):

Horsepower: <**Insert value**>.

Speed: [**1750**] [**3400**] <**Insert speed**> rpm.

Electrical Characteristics:

Volts: <**Insert value**>.

Phase(s): [**Single**] [**Three**].

Hertz: [**60**] <**Insert value**>.

Full-Load Amperes: <**Insert value**>.

Minimum Circuit Ampacity: <**Insert value**>.

Maximum Overcurrent Protection: <**Insert amperage**>.

Receiver: ASME construction steel tank.

Orientation: [**Horizontal**] [**Vertical**] arrangement.

Capacity: <**Insert gal.**>.

Interior Finish: [**Epoxy**] [**Epoxy or galvanized**] [**Galvanized**] <**Insert coating**>.

Pressure Rating: [**100 psig**] [**125 psig**] [**150 psig**] <**Insert value**> minimum.

Pressure Regulator Setting: <**Insert psig**>.

Pressure Relief Valve Setting: <**Insert psig**>.

Drain: [**Automatic**] [**Manual**] valve.

* + - 1. ROTARY-SCREW AIR COMPRESSORS

Verify that manufacturers and units can produce volume of air at pressure required. To prevent possible compressor malfunction and oil carryover into compressed-air system, use purification systems with this type of air compressor.

Copy "Rotary-Screw Air Compressors" paragraph below and re-edit for each type of rotary-screw air compressor required.

Insert drawing designation for each product required. Use these designations on Drawings to identify each rotary-screw air compressor.

* + - * 1. Rotary-Screw Air Compressors <**Insert drawing designation**>:

Description: Packaged unit.

Air Compressor(s): Single-stage, oil-free, rotary-screw type with nonlubricated helical screws and lubricated gearbox, and of construction that prohibits oil from entering compression chamber.

Cooling/Lubrication System: Unit-mounted, air-cooled exchanger package prepiped to unit; with air-pressure circulation system with coolant stop valve, full-flow coolant filter, and thermal-bypass valve.

Air Filter: Dry type, with maintenance indicator and cleanable replaceable filter element.

Air/Coolant Receiver and Separation System: 150-psig- rated steel tank with ASME safety valve, coolant-level gage, multistage air-coolant separator element, minimum pressure valve, blowdown valve, discharge check valve, coolant stop valve, full-flow coolant filter, and thermal-bypass valve.

Capacity Control: Capacity modulation between zero and 100 percent air delivery, with operating pressures between 50 and 100 psig. Include necessary control to hold constant pressure. When air demand is zero, unload compressor by using pressure switch and blowdown valve.

Mounting: Freestanding.

Sound-attenuation enclosure.

If Project has more than one type or configuration of rotary-screw air compressor, delete "Capacities and Characteristics" paragraph below and schedule air compressors on Drawings.

Coordinate data specified in "Capacities and Characteristics" paragraph below with piping systems in Section 226113 "Compressed-Air Piping for Laboratory and Healthcare Facilities" and with alarm systems in Section 226400 "Medical Gas Alarms."

* + - * 1. Capacities and Characteristics:

Compressed-Air Service: [**Medical**] [**Dental**] [**Instrument**] [**Medical laboratory**] [**Nonmedical laboratory**] <**Insert service**> air.

Air Compressor(s): [**One**] [**Two**].

Retain one of or both "Standard-Air Capacity of Each Air Compressor" and "Actual-Air Capacity of Each Air Compressor" subparagraphs below.

Standard-Air Capacity of Each Air Compressor: <**Insert scfm**> free air.

Actual-Air Capacity of Each Air Compressor: <**Insert acfm**> delivered.

Discharge-Air Pressure: [**80 psig**] [**110 psig**] <**Insert value**>.

Intake-Air Temperature: <**Insert deg F**>.

Discharge-Air Temperature: <**Insert deg F**>.

Motor (Each Air Compressor):

Horsepower: <**Insert value**>.

Speed: [**1750**] [**3400**] <**Insert speed**> rpm.

Electrical Characteristics:

Volts: <**Insert value**>.

Phase(s): [**Single**] [**Three**].

Hertz: [**60**] <**Insert value**>.

Full-Load Amperes: <**Insert value**>.

Minimum Circuit Ampacity: <**Insert value**>.

Maximum Overcurrent Protection: <**Insert amperage**>.

Receiver: ASME construction steel tank.

Orientation: [**Horizontal**] [**Vertical**] arrangement.

Capacity: <**Insert gal.**>.

Interior Finish: [**Epoxy**] [**Epoxy or galvanized**] [**Galvanized**] <**Insert coating**>.

Pressure Rating: [**100 psig**] [**125 psig**] [**150 psig**] <**Insert value**> minimum.

Pressure Regulator Setting: <**Insert psig**>.

Pressure Relief Valve Setting: <**Insert psig**>.

Drain: [**Automatic**] [**Manual**] valve.

* + - 1. SCROLL AIR COMPRESSORS

Verify that manufacturers and units can produce volume of air at pressure required. To prevent possible compressor malfunction and oil carryover into compressed-air system, use purification systems with this type of air compressor.

Copy "Scroll Air Compressors" paragraph below and re-edit for each type of scroll air compressor required.

Insert drawing designation for each product required. Use these designations on Drawings to identify each scroll air compressor.

* + - * 1. Scroll Air Compressors <**Insert drawing designation**>:

Description: Packaged unit.

Air Compressor(s): Single-stage, oil-free, rotary, oscillating-volute type of construction that prohibits oil from entering compression chamber.

Mounting: Freestanding.

If Project has more than one type or configuration of scroll air compressor, delete "Capacities and Characteristics" paragraph below and schedule air compressors on Drawings.

Coordinate data specified in "Capacities and Characteristics" paragraph below with piping systems in Section 226113 "Compressed-Air Piping for Laboratory and Healthcare Facilities" and with alarm systems in Section 226400 "Medical Gas Alarms."

* + - * 1. Capacities and Characteristics:

Compressed-Air Service: [**Medical**] [**Dental**] [**Instrument**] [**Medical laboratory**] [**Nonmedical laboratory**] <**Insert service**> air.

Air Compressor(s): [**One**] [**Two**].

Retain one of or both "Standard-Air Capacity of Each Air Compressor" and "Actual-Air Capacity of Each Air Compressor" subparagraphs below.

Standard-Air Capacity of Each Air Compressor: <**Insert scfm**> free air.

Actual-Air Capacity of Each Air Compressor: <**Insert acfm**> delivered.

Discharge-Air Pressure: [**80 psig**] [**110 psig**] <**Insert value**>.

Intake-Air Temperature: <**Insert deg F**>.

Discharge-Air Temperature: <**Insert deg F**>.

Motor (Each Air Compressor):

Horsepower: <**Insert value**>.

Speed: [**1750**] [**3400**] <**Insert speed**> rpm.

Electrical Characteristics:

Volts: <**Insert value**>.

Phase(s): [**Single**] [**Three**].

Hertz: [**60**] <**Insert value**>.

Full-Load Amperes: <**Insert value**>.

Minimum Circuit Ampacity: <**Insert value**>.

Maximum Overcurrent Protection: <**Insert amperage**>.

Receiver: ASME construction steel tank.

Orientation: [**Horizontal**] [**Vertical**] arrangement.

Capacity: <**Insert gal.**>.

Interior Finish: [**Epoxy**] [**Epoxy or galvanized**] [**Galvanized**] <**Insert coating**>.

Pressure Rating: [**100 psig**] [**125 psig**] [**150 psig**] <**Insert value**> minimum.

Pressure Regulator Setting: <**Insert psig**>.

Pressure Relief Valve Setting: <**Insert psig**>.

Drain: [**Automatic**] [**Manual**] valve.

* + - 1. DIAPHRAGM AIR COMPRESSORS

Copy "Diaphragm Air Compressors" paragraph below and re-edit for each type of diaphragm air compressor required.

Insert drawing designation for each product required. Use these designations on Drawings to identify each diaphragm air compressor.

* + - * 1. Diaphragm Air Compressors <**Insert drawing designation**>:

Diaphragm air compressors typically have very low capacities and do not have a receiver. Verify that manufacturers and units can produce volume of air at pressure required.

Description: Simplex, single-stage, oil-free diaphragm air compressor with nonlubricated compression chamber and lubricated or dry crankcase, and of construction that prohibits oil from entering compression chamber.

Retain "Option" subparagraph below if these types are acceptable.

Option: Construction may be articulating-piston, reciprocating-piston, or rotary-sliding-vane type.

Control: Adjustable pressure switch.

Mounting: Freestanding.

If Project has more than one type or configuration of diaphragm air compressor, delete "Capacities and Characteristics" paragraph below and schedule air compressors on Drawings.

Coordinate data specified in "Capacities and Characteristics" paragraph below with piping systems in Section 226113 "Compressed-Air Piping for Laboratory and Healthcare Facilities."

* + - * 1. Capacities and Characteristics:

Compressed-Air Service: [**Medical laboratory**] [**Nonmedical laboratory**] <**Insert service**> air.

Retain one of or both "Standard-Air Capacity of Air Compressor" and "Actual-Air Capacity of Air Compressor" subparagraphs below.

Standard-Air Capacity of Air Compressor: <**Insert scfm**> free air.

Actual-Air Capacity of Air Compressor: <**Insert acfm**> delivered.

Discharge-Air Pressure: [**10 psig**] [**15 psig**] <**Insert value**>.

Retain one of or both "Intake-Air Temperature" and "Discharge-Air Temperature" subparagraphs below if either is required.

Intake-Air Temperature: <**Insert deg F**>.

Discharge-Air Temperature: <**Insert deg F**>.

Motor (Each Air Compressor):

Horsepower: <**Insert value**>.

Speed: [**1750**] [**3400**] <**Insert speed**> rpm.

Electrical Characteristics:

Volts: <**Insert value**>.

Phase(s): [**Single**] [**Three**].

Hertz: [**60**] <**Insert value**>.

Full-Load Amperes: <**Insert value**>.

Minimum Circuit Ampacity: <**Insert value**>.

Maximum Overcurrent Protection: <**Insert amperage**>.

* + - 1. INLET-AIR FILTERS

Retain one of two "Description" paragraphs in this article.

* + - * 1. Description: Combination inlet-air filter-silencer, suitable for remote installation, for each air compressor.

Revise "Construction" subparagraph below if filter is in-line type and installed in an interior space. Install gooseneck with screen on exterior air inlet.

Construction: Weatherproof housing for replaceable, dry-type filter element, with silencer tubes or other method of sound reduction.

Capacity: Match capacity of air compressor, with collection efficiency of 99 percent retention of particles larger than 10 micrometers.

* + - * 1. Description: Combination inlet-air filter-silencer, suitable for remote installation, for multiple air compressors.

Revise "Construction" subparagraph below if filter is in-line type and installed in an interior space. Install gooseneck with screen on exterior air inlet.

Construction: Weatherproof housing for replaceable, dry-type filter element, with silencer tubes or other method of sound reduction.

Capacity: Match total capacity of connected air compressors, with collection efficiency of 99 percent retention of particles larger than 10 micrometers.

* + - 1. COMPRESSED-AIR DRYERS

Copy "Refrigerant Compressed-Air Dryers" paragraph below and re-edit for each type of refrigerant compressed-air dryer required.

Insert drawing designation for each product required. Use these designations on Drawings to identify each refrigerant compressed-air dryer.

* + - * 1. Refrigerant Compressed-Air Dryers <**Insert drawing designation**>:

Description: Noncycling, air-cooled, electric-motor-driven unit with steel enclosure and capability to deliver 35 deg F, 100-psig air at dew point. Include automatic ejection of condensate from airstream, step-down transformers, disconnect switches, inlet and outlet pressure gages, thermometers, automatic controls, and filters.

Copy "Desiccant Compressed-Air Dryers" paragraph below and re-edit for each type of desiccant dryer required.

Insert drawing designation for each product required. Use these designations on Drawings to identify each desiccant compressed-air dryer.

* + - * 1. Desiccant Compressed-Air Dryers <**Insert drawing designation**>:

Description: Twin-tower unit with purge system, mufflers, and capability to deliver [**plus 10 deg F**] <**Insert temperature**>, 100-psig air at dew point. Include dew point controlled purge, step-down transformers, disconnect switches, inlet and outlet pressure gages, thermometers, automatic controls, and filters.

If Project has more than one type or configuration of compressed-air dryer, delete "Capacities and Characteristics" paragraph below and schedule compressed-air dryers on Drawings.

* + - * 1. Capacities and Characteristics:

Standard-Air Capacity of Each Compressed-Air Dryer: <**Insert scfm**> free air.

Pressure: <**Insert psig**>.

Entering-Air Temperature: <**Insert deg F**>.

Leaving-Air Temperature: <**Insert deg F**>.

Leaving-Air Pressure Dew Point: <**Insert deg F**>.

Ambient-Air Temperature: <**Insert deg F**>.

Maximum Air-Pressure Drop: <**Insert psig**>.

Inlet Filter: [**5**] <**Insert number**> micrometers.

Outlet Filter: [**1**] <**Insert number**> micrometer(s).

Motor Horsepower: <**Insert value**>.

Electrical Characteristics:

Volts: <**Insert value**>.

Phase(s): [**Single**] [**Three**].

Hertz: [**60**] <**Insert value**>.

Full-Load Amperes: <**Insert value**>.

Minimum Circuit Ampacity: <**Insert value**>.

Maximum Overcurrent Protection: <**Insert amperage**>.

* + - 1. COMPRESSED-AIR PURIFICATION SYSTEMS

Copy "Compressed-Air Purification Systems " paragraph below and re-edit for each type of compressed-air purification system required.

Insert drawing designation for each product required. Use these designations on Drawings to identify each compressed-air purification system.

* + - * 1. Compressed-Air Purification Systems <**Insert drawing designation**>:

Description: Compressed-air purification system sized for maximum connected equipment capacity with coalescing, particulate, and activated-charcoal filters; compressed-air dryer; catalytic converter; gages and thermometers; and controls.

Include the following capabilities:

Removal of excessive moisture, solid particulates, oil and oil mist, carbon monoxide, and hydrocarbon vapors.

Automatic ejection of condensate from airstream.

Production of air complying with USP - NF for medical air.

Capacity and dew point indicated, but not higher than [**35 deg F at 100 psig**] <**Insert temperature and value**>.

Filters: Parallel duplex filters, each sized for maximum system demand, with valved bypass for filter servicing.

Inlet Filters: [**5**] <**Insert number**> micrometers.

Outlet Filters: [**1**] <**Insert number**> micrometer(s).

Accessories: Inlet and outlet pressure gages, thermometers, safety valves, and shutoff valves; and automatic ejection of condensate from airstream.

Differential Pressure Switch: Adjustable, diaphragm type, with electrical connections for alarm system, to indicate when air-pressure drop through filters rises to more than 2 psig greater than when new and clean.

Inlet Connection: From inlet to particulate filter.

Outlet Connection: To outlet from final activated-charcoal filter.

Compressed-Air Dryer: [**Twin-tower desiccant type with automatic controls, purge system, and mufflers**] [**Noncycling refrigerant type**].

If Project has more than one type or configuration of compressed-air purification system, delete "Capacities and Characteristics" paragraph below and schedule compressed-air purification systems on Drawings.

* + - * 1. Capacities and Characteristics:

Standard-Air Capacity of Each Compressed-Air Purification System: <**Insert scfm**> free air.

Entering Compressed-Air Pressure: <**Insert psig**>.

Entering Compressed-Air Temperature: <**Insert deg F**>.

Leaving Compressed-Air Temperature: <**Insert deg F**>.

Leaving Compressed-Air Pressure Dew Point: <**Insert deg F**>.

Ambient-Air Temperature: <**Insert deg F**>.

Maximum Compressed-Air Pressure Drop: <**Insert psig**>.

Electrical Characteristics:

Volts: <**Insert value**>.

Phase(s): [**Single**] [**Three**].

Hertz: [**60**] <**Insert value**>.

Full-Load Amperes: <**Insert value**>.

Minimum Circuit Ampacity: <**Insert value**>.

Maximum Overcurrent Protection: <**Insert amperage**>.

* + - 1. COMPRESSED-AIR FILTER ASSEMBLIES

Copy "Compressed-Air Filter Assemblies " paragraph below and re-edit for each type of compressed-air filter assembly required.

Insert drawing designation for each product required. Use these designations on Drawings to identify each compressed-air filter assembly.

* + - * 1. Compressed-Air Filter Assemblies <**Insert drawing designation**>:

Description: Filter assemblies suitable for compressed air, in parallel duplex arrangement. Size each assembly for maximum capacity of connected equipment and operating pressure of compressed-air system. Include automatic ejection of condensate from airstream, inlet and outlet pressure gages, and shutoff valves.

Option: Factory-fabricated filter system consisting of three air filters equivalent to those specified, pipe, fittings, valves, differential pressure switch, and enclosure; and with additional automatic drain traps and gages.

Size filter assemblies for [**5-psig**] <**Insert value**> maximum air-pressure drop when filters are new and clean, at system rated capacity, and at 100-psig pressure.

Differential Pressure Switch: Adjustable, diaphragm type, with electrical connections for alarm system, to indicate when air-pressure drop through filters rises to more than 2 psig greater than when new and clean.

Particulate Filters: Collection efficiency of 98 percent retention of particles 1 micrometer and larger.

Odor and Taste Filters: Vapor-absorbing, activated charcoal.

Coalescing Filters: Collection efficiency of 99.9 percent retention of particles 0.3 micrometer and smaller.

Include automatic drain trap for each filter.

* + - 1. DENTAL AIR COMPRESSORS

Retain this article only for small (typically up to four workstations) office's dental equipment. Dental air equipment in this article is of limited capacity.

Retain "General Requirements for Air Compressors" Article if specifying a diaphragm air compressor.

Copy "Dental Air Compressors" paragraph below and re-edit for each type of dental air compressor required.

Insert drawing designation for each product required. Use these designations on Drawings to identify each dental air compressor.

* + - * 1. Dental Air Compressors <**Insert drawing designation**>:

Description: Factory-assembled, -tested, and -packaged; automatic, dental compressed-air system that will deliver air of quality at least equal to intake air; suitable for dental applications and capable of producing air at [**80 psig**] <**Insert value**>.

Air Compressor(s): Oilless reciprocating type.

Retain "Option" subparagraph below if these types are acceptable.

Option: Construction may be oil-free, sliding-vane or scroll type.

Compressor Controls: Adjustable, tank-mounted, pressure [**switches and alternator for duplex air compressors**] [**switch for simplex air compressor**].

Check Valves: In discharge piping of each air compressor.

Air Filter: Integral with air compressor or separate unit for field installation in compressed-air piping.

Retain one of two "Dryer" subparagraphs below.

Dryer: Desiccant type integral with air compressor or separate unit for field installation in compressed-air piping.

Dryer: Refrigerated [**35 deg F**] <**Insert temperature**> dew point, in cabinet with automatic controls, for remote installation. Include on-off switch, on light, inlet and outlet temperature indicators, high-temperature alarm, and rubber isolators on feet.

Receiver: Steel tank rated for at least 100 psig with rubber isolators on feet.

Pressure Regulator: Adjustable.

Safety Valve: ASME relief valve with setting of 100 psig or less.

Drain: [**Automatic**] [**Manual**] valve.

Retain "Cabinet" subparagraph below if cabinet is required.

Cabinet: Enameled steel, with control panel with manual on-off switch, on light, and pressure gage.[**Refrigeration-type dryer may be separate with integral cabinet.**]

If Project has more than one type or configuration of dental air compressor, delete "Capacities and Characteristics" paragraph below and schedule air compressors on Drawings.

* + - * 1. Capacities and Characteristics:

Air Compressors: [**One**] [**Two**].

Retain one of or both "Standard-Air Capacity of Each Air Compressor" and "Actual-Air Capacity of Each Air Compressor" subparagraphs below.

Standard-Air Capacity of Each Air Compressor: <**Insert scfm**> free air.

Actual-Air Capacity of Each Air Compressor: <**Insert acfm**> delivered.

Discharge-Air Pressure: [**80 psig**] <**Insert value**>.

Arrangement: [**Duplex, mounted on horizontal**] [**Simplex, mounted on horizontal**] [**Simplex, mounted on vertical**] receiver.

Motor (Each Air Compressor):

Horsepower: <**Insert value**>.

Speed: [**1750**] [**3400**] <**Insert speed**> rpm.

Electrical Characteristics:

Volts: <**Insert value**>.

Phase(s): [**Single**] [**Three**].

Hertz: [**60**] <**Insert value**>.

Full-Load Amperes: <**Insert value**>.

Minimum Circuit Ampacity: <**Insert value**>.

Maximum Overcurrent Protection: <**Insert amperage**>.

* + - 1. DENTAL AIR-COMPRESSOR CONTROL PANELS

Retain this article only for small (typically up to four workstations) office's dental equipment.

Copy "Dental Air-Compressor Control Panels" paragraph below and re-edit for each type of dental air-compressor control panel required.

Insert drawing designation for each product required. Use these designations on Drawings to identify each dental air-compressor control panel.

* + - * 1. Dental Air-Compressor Control Panels <**Insert drawing designation**>:

Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70 “Standard for Electrical Safety in the Workplace”, by a qualified testing agency, and marked for intended location and application.

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

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

Description: Wall-mounted type with visual indicators to indicate equipment in operation and to perform the following:

Shut off dental air equipment.

Shut off water supply to dental air equipment. Include solenoid-operated valve for installation in water piping.

* + - * 1. Control panels may be combined with dental vacuum pump control panels in single dental equipment control panels.
			1. MOTORS

Default motor characteristics are specified in Section 220513 "Common Motor Requirements for Plumbing Equipment."

* + - * 1. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 220513 "Common Motor Requirements for Plumbing Equipment."

Verify enclosure types with manufacturer of specified equipment. Delete "Enclosure" subparagraph below if included in schedule on Drawings or in "Capacities and Characteristics" paragraphs.

Enclosure: [**Open, dripproof**] [**Totally enclosed, fan cooled**] [**Totally enclosed, air over**] [**Open, externally ventilated**] [**Totally enclosed, nonventilated**] [**Severe duty**] [**Explosion proof**] [**Dust-ignition-proof machine**].

Retain "Enclosure Materials," "Motor Bearings," "Unusual Service Conditions," "Efficiency," "NEMA Design," and "Service Factor" subparagraphs below if options are available from equipment manufacturers and are different from default requirements specified in Section 220513 "Common Motor Requirements for Plumbing Equipment." Consider each subparagraph and retain only those that vary from default requirements.

Enclosure Materials: [**Cast iron**] [**Cast aluminum**] [**Rolled steel**].

Motor Bearings: <**Insert requirements**>.

Unusual Service Conditions:

Ambient Temperature: <**Insert deg C**>.

Altitude: <**Insert feet**> above sea level.

High humidity.

<**Insert conditions**>.

Efficiency: Premium efficient.

NEMA Design: <**Insert designation**>.

Service Factor: <**Insert value**>.

Retain "Electrical Characteristics" subparagraph below if characteristics are not indicated on Drawings or in "Capacities and Characteristics" paragraphs.

Electrical Characteristics:

Horsepower: <**Insert horsepower**>.

Volts: [**120**] [**208**] [**230**] [**460**] <**Insert value**>.

Phase: [**Single**] [**Poly**].

Hertz: [**60**] <**Insert value**>.

Full-Load Amperes: <**Insert value**>.

Minimum Circuit Ampacity: <**Insert value**>.

Maximum Overcurrent Protection: <**Insert amperage**>.

1. EXECUTION
	* + 1. PREPARATION
				1. Clean compressed-air equipment, accessories, and components that have not been cleaned for oxygen service and sealed or that are furnished unsuitable for [**laboratory air**] [**and**] [**medical air**] applications, according to CGA G-4.1, "Cleaning Equipment for Oxygen Service."
			2. COMPRESSED-AIR EQUIPMENT INSTALLATION
				1. General Requirements for Compressed-Air Equipment Installation:

Install compressed-air equipment to allow maximum headroom unless specific mounting heights are indicated.

Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces unless otherwise indicated.

Install mechanical equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

Install equipment to allow right of way for piping installed at required slope.

Install the following devices on compressed-air equipment:

Thermometer, Pressure Gage, and Safety Valve: Install on each compressed-air receiver.

Pressure Regulators: Install downstream from air compressors, dryers, purification units, and filter assemblies.

Drain Valves: Install on aftercoolers, receivers, and dryers. Discharge condensate over nearest floor drain.

Retain "Nonmedical Laboratory Compressed-Air Equipment Installation" paragraph below for nonmedical compressed-air equipment in laboratory facilities.

* + - * 1. Nonmedical Laboratory Compressed-Air Equipment Installation:

Retain first subparagraph below to require equipment to be installed on cast-in-place concrete equipment bases.

Install compressed-air equipment, except wall-mounted equipment[**and diaphragm air compressors**], on cast-in-place concrete equipment bases. Comply with requirements for equipment bases and foundations specified in Section 033000 "Cast-in-Place Concrete."

Retain one of two subparagraphs below. Retain first for projects in seismic areas; retain second for projects not in seismic areas. Indicate vibration isolation and seismic-control device type and minimum deflection in supported equipment schedule on Drawings.

Comply with requirements for vibration isolation and seismic control devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment"

Comply with requirements for vibration isolation devices specified in Section 220548.13 "Vibration Controls for Plumbing Piping and Equipment."

Install diaphragm air compressors on [**floor**] [**counter**] <**Insert location**>.

Anchor air compressors to surface according to manufacturer's written instructions[**and seismic criteria applicable to Project**].

Retain "Medical Compressed-Air Equipment Installation" paragraph below for medical compressed-air equipment in healthcare facilities.

* + - * 1. Medical Compressed-Air Equipment Installation:

Install according to ASSE 6010 “Medical Gas System Installer” and NFPA 99 “Health Care Facilities Code”.

Retain first subparagraph below to require equipment to be installed on cast-in-place concrete equipment bases.

Install compressed-air equipment, except wall-mounted equipment, on cast-in-place concrete equipment bases. Comply with requirements for equipment bases and foundations specified in Section 033000 "Cast-in-Place Concrete."

Retain one of two subparagraphs below. Retain first for projects in seismic areas; retain second for projects not in seismic areas. Indicate vibration isolation and seismic-control device type and minimum deflection in supported equipment schedule on Drawings.

Comply with requirements for vibration isolation and seismic control devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment"

Comply with requirements for vibration isolation devices specified in Section 220548.13 "Vibration Controls for Plumbing Piping and Equipment."

Retain "Dental Air System Equipment Installation" paragraph below for dental air system equipment in a small dental office.

* + - * 1. Dental Air System Equipment Installation:

Install according to ASSE 6010 “Medical Gas System Installer” and NFPA 99 “Health Care Facilities Code”.

Retain first subparagraph below to require equipment to be installed on cast-in-place concrete equipment bases.

Install dental air system units on cast-in-place concrete equipment bases. Comply with requirements for equipment bases and foundations specified in Section 033000 "Cast-in-Place Concrete."

Retain one of first two subparagraphs below. Retain first for projects in seismic areas; retain second for projects not in seismic areas. Indicate vibration isolation and seismic-control device type and minimum deflection in supported equipment schedule on Drawings.

Comply with requirements for vibration isolation and seismic control devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment"

Comply with requirements for vibration isolation devices specified in Section 220548.13 "Vibration Controls for Plumbing Piping and Equipment."

Maintain manufacturer's recommended clearances for service and maintenance.

Install control panels for dental compressed-air equipment on wall near [**equipment**] [**office entrance**] <**Insert location**>.

* + - 1. CONNECTIONS

Coordinate piping installations and specialty arrangements with schematics on Drawings and with requirements specified in piping systems. If Drawings are explicit enough, these requirements may be reduced or omitted.

* + - * 1. Comply with requirements for water-supply piping specified in Section 221116 "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties.
				2. Comply with requirements for drain piping specified in Section 221316 "Sanitary Waste and Vent Piping." Drawings indicate general arrangement of piping, fittings, and specialties.
				3. Comply with requirements for compressed-air piping specified in Section 226113 "Compressed-Air Piping for Laboratory and Healthcare Facilities." Drawings indicate general arrangement of piping, fittings, and specialties.
				4. Where installing piping adjacent to equipment, allow space for service and maintenance.
				5. Connect compressed-air piping to compressed-air equipment, accessories, and specialties with shutoff valve and union or flanged connection.
				6. Connect water supply to compressed-air equipment that requires water. Include backflow preventer. Backflow preventers are specified in Section 221119 "Domestic Water Piping Specialties."
			1. IDENTIFICATION
				1. Identify nonmedical laboratory compressed-air equipment system components. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."
				2. Identify medical compressed-air equipment system components. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment." and with NFPA 99 “Health Care Facilities Code”.
			2. FIELD QUALITY CONTROL FOR HEALTHCARE-FACILITY MEDICAL COMPRESSED-AIR EQUIPMENT

Retain "Testing Agency," "Manufacturer's Field Service," and "Perform the following tests and inspections" paragraphs below to identify who shall perform tests and inspections. If retaining second option in "Testing Agency" paragraph or if retaining "Manufacturer's Field Service" or "Perform the following tests and inspections" paragraph, retain "Field quality-control reports" paragraph in "Informational Submittals" Article.

* + - * 1. Testing Agency: [**Director’s Representative will engage**] [**Engage**] a qualified testing agency to perform tests and inspections.

Retain "Manufacturer's Field Service" paragraph below to require a factory-authorized service representative to perform tests and inspections.

* + - * 1. Manufacturer's Field Service: Engage a Company Field Advisor per OGS Spec Section 014216 to test and inspect components, assemblies, and equipment installations, including connections.

Retain "Perform the following tests and inspections" paragraph below to require Contractor to perform tests and inspections.

* + - * 1. Perform the following tests and inspections[**with the Company Field Advisor per OGS Spec Section 014216**].

Medical Compressed-Air Equipment Testing Coordination: Perform tests, inspections, verifications, and certification of medical compressed-air equipment concurrently with tests, inspections, and certification of [**medical vacuum equipment**] [**medical vacuum piping**] [**medical compressed-air piping**] [**and**] [**medical gas piping**] systems.

Tests in "Preparation" subparagraph below are required by Installer before verification by testing agency.

Preparation: Perform medical compressed-air equipment tests according to requirements in NFPA 99 “Health Care Facilities Code” for the following:

Air-quality purity test.

System operation test.

Equipment Verification: Comply with requirements in ASSE 6020 “Medical Gas System Inspector”, ASSE 6030 “Medical Gas System Verifier”, and NFPA 99 “Health Care Facilities Code” for verification of medical compressed-air equipment.

Replace damaged and malfunctioning controls and equipment.

Revise "Testing Certification" subparagraph below for exact certification material required.

Testing Certification: Certify that specified tests, inspections, and procedures have been performed and certify report results. Include the following:

Inspections performed.

Procedures, materials, and gases used.

Test methods used.

Results of tests.

* + - * 1. Components will be considered defective if they do not pass tests and inspections.
				2. Prepare test and inspection reports.
			1. STARTUP SERVICE
				1. [**Engage a Company Field Advisor per OGS Spec Section 014216to perform**] [**Perform**] startup service.

Complete installation and startup checks according to manufacturer's written instructions.

Check for lubricating oil in lubricated-type equipment.

Check belt drives for proper tension.

Verify that air-compressor inlet filters and piping are clear.

Check for equipment vibration-control supports and flexible pipe connectors and verify that equipment is properly attached to substrate.

Check safety valves for correct settings. Ensure that settings are higher than air-compressor discharge pressure, but not higher than rating of system components.

Retain first subparagraph below if seismic restraints are required.

Check for proper seismic restraints.

Drain receiver tank(s).

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

Test and adjust controls and safeties.

* + - * 1. Prepare written report documenting testing procedures and results.
			1. DEMONSTRATION
				1. [**Engage a Company Field Advisor per OGS Spec Section 014216 to train**] [**Train**] Director’s Representative's Facility’s maintenance personnel to adjust, operate, and maintain air compressors[**, compressed-air dryers**] [**compressed-air purification units**] [**and**] [**compressed-air filter assemblies**].

END OF SECTION 226119