PART 1 - GENERAL

1.1 APPLICABLE REQUIREMENTS

A. All work to be furnished and installed under this section shall comply with all the requirements of General Conditions, Supplemental Conditions, Division 01 - General Requirements, Section 220500 - Basic Plumbing Materials and Methods, and other Sections in Division 22 specified herein.

1.2 SCOPE

A. This Section specifies the requirements to furnish and install clean, dry, oil-free, and shop compressed air equipment.

B. Compressed Air Equipment:
1. Oil-free, rotary screw, water-cooled air compressor.
2. Heatless type regenerative desiccant compressed air dryer.

1.3 RELATED WORK SPECIFIED ELSEWHERE

A. Section 220500: Basic Plumbing Materials and Methods

B. Section 222117: Process Piping

C. Division 26: Electrical

1.4 QUALITY ASSURANCE

A. Comply with codes and standards required for proper system installation.

B. The compressed air equipment manufacturer shall have established an ongoing Quality Assurance/Quality Control program, including manuals available for inspection at their plant.

1.5 WORKMANSHIP

A. Install all work pertaining to compressed air equipment as close as possible to layout shown on the drawings. Employ skilled mechanics to install all systems in a manner acceptable to the owner.

1.6 SUBMITTALS

A. Prior to construction submit for approval all materials and equipment in accordance with Division 01 requirements.

B. Provide the following in addition to the standard requirements:
1. Complete layout drawings including plan, elevations, and relevant details.
2. Complete catalog information on the compressed air equipment and accessories listed including:
   a. Motors
   b. Sequence control panel
   c. Accessories and piping

3. Control panel layout, control ladder diagram, and a written sequence of operations.
4. Factory test results and certifications

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site under provisions of Division 01. Deliver products to the site in containers with manufacturer's stamp or label affixed.

B. Store/protect products under provisions of Division 01. Protect products against dirt, water, chemical, and mechanical damage. Do not install damaged products - remove from project site.

1.8 WARRANTY

A. All compressed air equipment shall be guaranteed against defective design, material, and workmanship in accordance with the terms of the Purchase Order. In addition, guarantee performance of the compressed air equipment, in accordance with the process conditions of the individual pieces of equipment. Upon satisfactory proof that the compressed air equipment furnished do not meet specified operating conditions, furnish to the point of use any necessary additional equipment to meet specified conditions or make changes, as required, to the original equipment furnished.

PART 2 - PRODUCTS

2.1 GENERAL

A. Furnish a complete compressed air system including air compressors, dryers, and filters as necessary to serve the programmed air delivery requirement to all lab air stations.

2.2 OIL FREE ROTARY SCREW WATER-COOLED AIR COMPRESSOR

A. 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. System shall include variable speed drives for improved efficiency.

B. Supply a positive displacement rotary screw air compressor capable of delivering 100% oil-free air (less than two parts per million before aftercooler). The assembly shall be fully packaged, including air compressor, main drive motor, oil cooler, intercooler and after cooler, separate motor driven lubrication system, fan, regulation and control systems, all mounted on a common base frame and fully enclosed by a steel sound dampening enclosure.

C. 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.
1. 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.

2. Air Filter: Dry type, with maintenance indicator and cleanable replaceable filter element.
3. 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.
4. 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.
5. Mounting: Freestanding.
6. Sound-attenuation enclosure.
7. Capacities and Characteristics:
   a. Compressed-Air Service: Nonmedical laboratory air.
   b. Air Compressor: Two.

D. Receiver: Steel tank constructed according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
1. Orientation: Horizontal or vertical arrangement.
2. Interior Finish: Epoxy.
3. Pressure Rating: 150 psig minimum.
4. Drain: Automatic valve.
5. Accessories: Include safety valve, pressure gage, automatic drain, and pressure regulator.

E. 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.

F. 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: 120V 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 alternate lead-lag air compressors for duplex air compressors.
7. 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.
8. Alarm Signal Device: For connection to alarm system to indicate when backup air compressor is operating.

G. 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.

H. Manufacturers: Atlas Copco, Ingersoll – Rand, Champion, Gardner Denver, Quincy, Kobelco, compare or equal.

2.3 HEATLESS TYPE REGENERATIVE DESICCANT COMPRESSED AIR DRYER

A. Supply a heatless type regenerative desiccant compressed air dryer over all load conditions from 0-100%.

B. The air dryer system shall be fabricated with dual desiccant chambers. Inlet switching valves shall be two 2-way no-lube, pilot air operated, normally open. Outlet valves shall be soft seated, silent check valves. The purge valves shall be air operated, normally closed, so that in case of power failure or when the unit is de-energized, both the inlet valves are open and purge and depressurizing valves are closed to avoid any air loss. The dryer unit shall be completely prepped, prewired, and test run before shipment. Dryers up to 1600 SCFM shall be shipped with a full charge of desiccant, and larger dryers shall be shipped with loose desiccant to be charged to the vessels on site by the customer. The dryer shall operate on a 10 minute cycle (5 minutes drying and 5 minutes regenerating). The dryer shall be the manufacturer's standard internally located regenerative desiccant compressed air dryer.

C. Features to include: dew point controlled purge, step-down transformers, disconnect switches, inlet and outlet pressure gages, thermometers, automatic controls, and filters.

D. Manufacturers: BeaconMedaes, Champion, ZEKS, Zurn, Pneumatech, Ingersoll – Rand, or equal.

2.4 INLET-AIR FILTERS

A. Description: Combination inlet-air filter-silencer, suitable for remote installation, for multiple air compressors.
   1. Construction: Weatherproof housing for replaceable, dry-type filter element, with silencer tubes or other method of sound reduction.
   2. Capacity: Match total capacity of connected air compressors, with collection efficiency of 99 percent retention of particles larger than 10 micrometers.

2.5 COALESCING COMPRESSED AIR FILTER

A. The entire filter assembly shall be constructed of non-corrosive materials which are approved by USDA and USFDA for use in compressed air and respiratory air systems and are entirely compatible with all natural, as well as synthetic, lubricating oils. The assembly shall be capable of operating at temperature levels up to 225°F., and shall induce, when operated at rated flow, a maximum pressure drop of 1-1/2 psi dry.

B. The filter housing shall be a T-type pressure vessel, 500 psi operating pressure, with a one piece element having a minimum D.O.P. efficiency of 99.97% (.3-.6 min. aerosols), tested according to MIL-STD-282 shall not pass solids larger than .3um or liquid aerosols larger than .75um, shall be a minimum of 99.98% efficient on all sizes, and a manual or automatic drain device.

C. Manufacturers: Parker, ZEKS, Zurn, Ingersoll – Rand, or equal.

2.6 SEQUENCE CONTROL PANELS FOR AIR COMPRESSOR

A. Provide a sequence control panel which is UL approved. The following components, as a minimum, shall be provided in a NEMA 12 enclosure.
1. Automatic lead-lag operation of compressors
2. Automatic lead-compressor alteration capability

B. Compressor shall have automatic shut-off switches for the following conditions:
1. Low oil pressure
2. High first stage discharge air temperature.
3. High second stage discharge air temperature.
4. High second stage inlet air temperature.
5. High oil temperature
6. Motor overload
7. High cabinet temperature
8. Reset switch

C. Panel Location
1. Provide for required electrical clearances

2.7 SEQUENCE CONTROL PANELS FOR COMPRESSED AIR DRYER

A. The compressed air dryer manufacturer shall provide a sequence control panel which is UL listed the following components, as a minimum shall be provided in a NEMA 12 enclosure:
1. Automatic lead-lag operation of dryers
2. Automatic lead dryer alteration capability
3. Outlet air pressure gauge
4. Inlet air temperature
5. Refrigerant low pressure gauge
6. Refrigerant high pressure gauge
7. High dewpoint indication
8. Automatic drain float trap
9. Automatic drain electronic timer

B. Panel Location
1. Provide for required electrical clearances

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with the manufacturer's recommendations. Locate compressed air equipment and a concrete housekeeping pad and provide connection to system piping as shown on the drawings. Provide process cooling water supply and return as requried and piping connection.

END OF SECTION