SECTION 22 15 00

GENERAL SERVICE COMPRESSED-AIR SYSTEMS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Pipe and pipe fittings.

B. Valve.

C. Utility air compressors.

D. Rotary screw compressors.

E. Air dryer.

F. Compressed air aftercooler.

G. Receivers.

H. Coalescing air filters.

I. Compressor motors.

J. Wiring.

K. Grounding and bonding.

L. Piping accessories.

1.02 RELATED SECTIONS

A. The compressed air systems, as indicated, show facilities diagrammatically and do not show offsets, fittings, and accessories that may be required. Investigate carefully the existing condition of air compressors, air dryers, air filters, pressure regulators, piping, and other accessories relative to compressed air system and report deficiencies to Engineer.

1.03 MEASUREMENT AND PAYMENT

A. Separate measurement or payment will not be made for the work required under this Section. All costs in connection with the Work specified herein will be considered to be included or incidental to the Work of this Contract.

1.04 REFERENCES

A.	ASME B.16.22	Wrought Copper and Bronze Solder Joint Pressure Fittings.
B.	ASME B.16.3	Malleable Iron Threaded Fittings.

C. ASTMA53 Specification for pipe, steel, black and hot-dipped zinc-coated, welded and seamless.

D. ASTMA234/A34M Pipe fitting, flange fittings, and flanges, steel and malleable iron (threaded and butt welding), class 150.

E. Specifications Section 01 42 19 - Reference Standards.

F. MSS SP-80 Bronze Gate, Globe, Angle and Check Value.

G. MSS SP-110-Ball Values threaded, socket welded, solder joint, groove and flared ends.

H. Trade Standards: Compressed Air and Gas Institute (CAGI)

I. CGAG – 7 = Compressed Air for Human Respiration

J. FSWW-V-54 Valve, Gate, Bronze

K. FSWW-V-35 Valve Ball

1.05 SUBMITTALS

A. General: Refer to Contract Specifications Section 01 33 00 - Submittal Procedures, and Section 01 33 23 - Shop Drawings, Product Data, and Samples, for submittal requirements and procedures.

B. Product Data:

1. Air-to-Air Pressure Booster (Amplifier)

2. Receiver Tank

3. Combination Coalizer/Filter

C. Certificate of Compliance: Submit such certified test reports for materials and equipment as necessary to demonstrate compliance with specification requirements.

D. Operation and Maintenance Data: Submit operation and maintenance data for the equipment provided in accordance with Contract Specifications Section 01 78 23 - Operation and Maintenance Data. Include recommended spare parts list.

E. Submit manufacturer's product data for the equipment, defining size and arrangement, and for related materials, appurtenances, and installation accessories. Include manufacturer's certified performance data.

F. Submit shop drawings and details, installation instructions, wiring diagrams, assembly and other items required for a coordinated installation.

G. Submit certified copies of factory test reports.

H. Submit Electrical and Communication equipment and materials.

I. Prior to field-testing submit to the Engineer for approval the test procedure along with manufacturer's recommendations for startup and test. After testing, submit written records of tests.

PART 2 - PRODUCTS

2.01 PIPE AND PIPE FITTINGS

A. Class E, Type K copper pipe in accordance with Section 20 10 13, Article 2.01 I except grooved fitting coupling gaskets as specified in Section 20 10 13, Article 2.01 I.6, shall be nitrile gasket, Victaulic Type T (Orange Stripe), Gustin Bacon, or equal gasket having resistance to compressed air having synthetic oil. Unions for connecting steel pipe to copper tubing and tube shall be Dielectric union type

B. Provide expansive joints, in accordance with Section 20 10 13 - Common Materials and Methods for Facility Services – Fire Suppression, Plumbing and HVAC.

C. Only Ptee tape shall be used on threaded connection. Paste compound shall not be used.

2.02 VALVES

A. Gate, Globe angle, check, butterfly and ball valves. Refer to Contract Specifications Section 20 10 13 - Common Materials and Methods for Facility Services – Fire Suppression, Plumbing and HVAC, for requirements.

B. Air Outlets: (To be District furnished)

C. Air Dryer required.

D. Plug Valves: Plug valves shall have brass or bronze body and plug. Sealing O-rings shall be TFE-coated viton. Snap ring shall be molybdenum stainless steel. End connections shall be as shown on the Contract Drawings.

2.03 QUALITY ASSURANCE

A. The Contractor shall ensure that manufacturer of air compressors and associated hardware is a firm that has been regularly engaged in the manufacture of compressors of similar type and size, and has a history of at least five successful similar installations in operation for at least three years.

B. The Contractor shall ensure that the air compressors electrical equipment and materials quality assurance shall be in accordance with the Contract Specifications.

C. All equipment shall be rated in accordance with CAGI standards.

2.04 SITE CONDITIONS

A. Inspect the conditions of the area where products are to be placed or installed before the work of this Section begins. Provide surfaces and structures capable of supporting the

products. Electrical products that serve the equipment shall have been installed, tested, and accepted before equipment is started and operated.

2.05 UTILITY AIR COMPRESSORS

A. Single Stage: Provide heavy duty single stage reciprocating air cooled compressor with positive oil pump lubrication system, suction inlet screen, discharge service valves unit with either cast iron cylinders or aluminum cylinders with cast iron cylinder liners, steel valves, ductile iron crankshaft, splash lubrication, and drive pulleys. Mount compressor head, motor and drive belt on receiver-mounted base with vibration isolators. Rotating drive elements shall be covered by a guard plate or screen.

B. Two Stage: Same as single stage with interstage cooler.

C. Units shall be equipped with the following items:

1. Oil fill and drain plugs.
2. Air intake filter/silencer.
3. Automatic pressure switch.
4. Air receiver.
5. After cooler.
6. Air dryer and operating controls.
7. Control panel.
8. Starter and safety controls.

D. Motors shall be three phase, 460V, 60Hz and suitable for full voltage across the line starting. Motor enclosure shall be totally enclosed fan cooled or non-ventilated. Motors shall be provided and factory tested in accordance with Contract Specifications Section 20 60 13 - Motors for Facility Services.

E. Motor starters shall be across the line magnetic starter operable on 480V, three phase, 60Hz supply. Motor starters enclosure shall be NEMA 4 type. Enclosure shall be manufactured to fit single or dual starters with the necessary auxiliary relays, terminal blocks, other associated electrical components. Compressor controls, indication lights, and local annunciator. Motor starters shall be provided and factory tested in accordance with the Contract Specification Section 26 24 22 - Motor Starters and Contactors.

2.06 ROTARY SCREW AIR COMPRESSORS

A. Provide rotary screw air compressor with splash type lubrication sized to deliver air at the volume and pressure required for the application, with air cooled after cooler, coalescing type oil filter, air intake filter, silencer and sound attenuation weather resistant housing for outdoor installation.

B. The compressor shall be direct driven by and electric motor having a maximum speed of 1,800 rpm. The motor shall be provided with a magnetic type across-the-line starter, enclosed in a watertight enclosure meeting the requirements of NEMA 4. It shall have a molded case circuit breaker with thermal and overload protection. Guards, meeting OSHA requirements, shall be provided for all exposed moving parts.

C. Safety shutdown devices including, but not necessarily limited to, low oil pressure and high oil temperature devices shall be provided. Safety valves shall be installed on the compressor.

D. The air compressor shall be a self-contained, packaged unit complete with master slave controller, start/stop and high temperature and low oil pressure shut down controls. It shall also be equipped with external connections for electrical, supply and discharge air piping.

2.07 AIR DRYER

A. Air Dryer refrigerant type shall be provided having a rated capacity equal to or greater than compressor capacity and maximum operating pressure. Refrigerated compressed air dryer shall have a built-in oil and dirt removal filter and a pre-cooler section to improve energy efficiency. A separator with moisture accumulator and timer controlled solenoid valve for moisture removal shall be provided to maintain high efficiency separation and prevent moisture carry over. No outside cooling water supply or external cooling packages are allowed.

B. Air Connections: Inlet and outlet connections at same level, factory insulated.

C. Heat Exchangers: Air to air and refrigerant to air coils. Furnish heat exchangers with automatic control system to bypass refrigeration system on low or no load condition.

D. Moisture Separator: Centrifugal type located at discharge of heat exchanger.

E. Refrigeration Unit: Hermetically sealed type to operate continuously to maintain specified 21 degrees F (-6 degrees C) dew point. House unit in steel cabinet with access door and panel for maintenance and inspection.

F. Accessories: Air inlet temperature gage, air inlet pressure gage, on/off switch, high temperature light, power on light, refrigerant gage, air outlet temperature gage, air outlet pressure gage.

2.08 COMPRESSED AIR AFTERCOOLER

A. Construction: Removable tube nests of non-ferrous metal tubes and corrosion resistant tube plates, safety valves, pressure gage, moisture separator, moisture drain valve, water inlet piping with automatic water valve, automatic condensate trap and overflow piping with open funnel.

B. Working Pressure: 135 psi.

C. Discharge: Cool air to within 12 degrees F (7 degrees C) of ambient air temperature at specified flow capacity.

2.09 RECEIVERS

A. Receiver shall be vertical or horizontal as indicated on the Contract Drawings. The receiver shall be an ASME and National Board stamped pressure vessel. A base plate for mounting the compressor shall be welded to the receiver.

B. The following accessories shall be provided:

1. ASME certified pressure relief valve.
2. Gate valve for air discharge.
3. Pressure gage.
4. Manual drain valve.
5. Automatic tank drain.

2.10 COALESCING AIR FILTERS

A. Coalescing air filters shall be provided as specified or indicated. Filters shall be rated to trap all 0.3 micron sized particles and above. Filter shall be rated at minimum 200 psig. A pressure drop indicator shall be provided to show when filter element should be replaced. An automatic moisture drain shall be provided.

2.11 COMPRESSOR MOTORS

A. Motors shall be three phase, 460V, 60Hz and suitable for full voltage across the line starting.

B. Motor enclosure shall be manufacturer standard drop-proof fully guarded type. Motors shall be suitable for mounting as specified in Articles 2.01 and 2.02.

C. Motors shall be provided and factory tested in accordance with Contract Specifications Section 20 60 13 - Motors for Facility Services.

2.12 MOTOR STARTERS

A. Motor starters shall be across the line magnetic starter operable on 480V, three phase, 60Hz supply.

B. Motor starters enclosure shall be NEMA 12 indoor type. Enclosure shall be manufactured to fit single or dual starters with the necessary auxiliary relays, terminal blocks, and other associated electrical components. Enclosure door shall be cut out and wired to fit the Contactor provided compressor controls, indication lights, and local annunciator and the DFE air compressor-monitoring unit.

C. Motor starters shall be provided and factory tested in accordance with the Contract Specification Section 26 24 22 - Motor Starters and Contactors.

2.13 WIRING

A. Power, control, signal, and communication wiring shall be provided and factory tested in accordance with Contract Specification Section 26 05 24 - Low and Medium Voltage Wires and Cables.

B. ACMU and pressure transmitter control and signal wiring shall be shielded twisted pair type.

2.14 GROUNDING AND BONDING

A. Electrical equipment, devices, and materials shall be grounded in accordance with Contract Specifications Section 26 05 26 - Grounding and Bonding for Electrical Systems.

2.15 PIPING ACCESSORIES

A. Provide piping accessories of types and sizes as required.

B. Provide escutcheons as specified in Contract Specifications, Section 20 20 13 - Pipe Sleeves, Supports, and Anchors for Facility Services.

C. Hose and blowguns.

1. Hose shall be self-retracting nylon air hose. Fittings shall be brass. Each end shall be fitted with a swivel coupling.

2. Blowguns shall have aluminum body. Tamperproof pressure reducers shall limit outlet pressure to 30 psi, and comply with Cal-OSHA requirements.

D. Hose reels: Hose reels shall be enclosed and shall be of heavy steel construction. Drum shall be ratcheting, self-retracting. Hose shall be for intended service.

E. Condensate Trap Drains: Trap drains shall consist of brass, bronze, or 304 stainless steel bowl and internal components. Internal components shall consist of float, outlet valve and piston that automatically open to eject moisture that has collected in the system. Materials shall be compatible with synthetic compressor oils.

F. Wall sleeves and seals shall be in accordance with Contract Specifications, Section 20 20 13 - Pipe Sleeves, Supports, and Anchors for Facility Services

PART 3 - EXECUTION

3.01 INSTALLATION (PIPING)

A. Install piping true to line and grade, supported and guided to ensure alignment under all conditions. Installed piping shall clear obstructions, preserve headroom, and keep openings and passageways clear.

B. All air line branch connections shall be made off the top of the header. All condensate of drain connections shall be made off the bottom. Lines shall be pitched toward drip legs and receivers.

C. Install drip legs and automatic drain traps at all low points in the system. Pipe condensate drains to floor drains or other acceptable locations.

D. Valves shall be accessible for operation and servicing. Valves located in furred spaces shall be accessible through access panels or access doors. Valves shall be installed as required, and shall not be installed having stems located below the horizontal position.

E. Pipe joints on copper piping shall e made with soldered connections unless otherwise noted or required.

F. Threaded joints shall only be made with PTFE sealing tape. Thread sealing compounds shall not be used.

G. Install unions at each connection to valves, equipment, and tanks. Soldered-to-threaded connections shall be made-up with male thread-to-solder adapters.

H. After installation of pipes, end of pipes shall be either capped or plugged. No piping shall be buried, furred in, or concealed before being inspected and tested.

I. Provide access panels in accordance with Contract Specifications, Section 20 10 13 - Common Materials and Methods for Facility Services – Fire Suppression, Plumbing and HVAC.

3.02 INSTALLATION (AIR COMPRESSOR)

A. Install, align, connect, and test the equipment in accordance with the manufacturer's installation instructions and recommendations.

B. Install conduits in accordance with Contract Specifications Section 20 50 13 - Raceways for Facility Services

C. Install, connect, and test power cables and control wires in accordance with Contract Specification Section 26 05 24 - Low and Medium Voltage Wires and Cables.

D. Install and test motor starters in accordance with Contract Specification Section 26 24 22 - Motor Starters and Contactors.

E. Pipe drains to disposal location.

F. Make adjustments required to place system in proper operating condition in accordance with the manufacturer's instructions and recommendations.

G. Set pressure switches as required.

3.03 FIELD TESTS

A. Perform field test for each installation in the presence of the Engineer. The Contractor shall give 48 hours notice to the Engineer prior to the test. Provide all necessary instruments, test setup, connections, labor and tools for testing. Defective workmanship, materials and equipment shall be corrected or replaced in accordance with the manufacturer's recommendations and to the satisfaction of the Engineer at no additional cost to the District. All corrected work shall be retested to ensure compliance with these specifications.

B. Field tests shall demonstrate workmanship, operation, and performance. Each test attribute shall be completed to the satisfaction of the Engineer. Submit written record indicating that the following items have been completed:

1. Compressor starts below switch set point.

2. Compressor stops at switch set point.

3. Automatic drain valve discharges; and

4. Operation of pressure relief valves.

C. Field testing of electrical equipment and devices shall include the field tests specified in the following Contract Specifications Sections

1. Section 20 60 13 – Motors for Facility Services;

2. Section 26 05 24 – Low and Medium Voltage Wires and Cables

3. Section 26 05 26 – Grounding and Bonding for Electrical Systems

4. Section 26 24 22 – Motor Starters and Contactors.

D. Test compressed air piping system, pneumatically in sections, to a pressure of at least 150 psi for not less than 15 minutes witnessed by the Engineer. Repair leaks and retest the system until the system is leak free. Use testing instruments calibrated by a qualified laboratory in accordance with Contract Specifications Section 01 43 00 - Quality Assurance. Test sequence shall be as follows:

1. Lines will be fully blown out.

2. Lines shall be pneumatically tested.

3.04 ADJUSTING AND CLEANING

A. Make adjustments required to place system in proper operating condition in accordance with manufacturer's instructions and recommendations.

B. Remove foreign materials from the installed air-to-air booster equipment and piping system.

C. Provide training of District personnel in accordance with Contract Specifications Section 01 79 00 - Demonstration and Training.

3.05 IDENTIFICATION

A. Comply with the requirements of Contract Specifications, Section 20 40 13 - Identification for Facility Services

3.06 PAINTING

A. Except where indicated, piping systems shall not be painted. Where pipes are indicated to be painted, prepare and paint pipe in accordance with Contract Specifications, Section 09 91 00 - Painting.

END OF SECTION 22 15 00