

# Compressor Specification

## Two-Stage, Water-Cooled Variable-Speed, Oil-Free Rotary Screw

### 1. Scope

- 1.1. This specification is for an oil-free, air-cooled rotary screw air compressor. The compressor shall be Atlas Copco model ZR110VSD+-P-10.4-60-460V CSA-UL. or pre-approved equivalent.
- 1.2. The compressor shall deliver 164 to 586 acfm at 150 psi in accordance with ISO 1217, Annex E. acfm is actual cubic feet per minute at inlet conditions.
- 1.3. The units shall be manufactured in accordance with this specification. The construction as described in this specification is considered essential and critical to the application. The vendor shall state in his quotation any and all exceptions to the specification.

### 2. General

- 2.1. A positive displacement rotary screw compressor capable of delivering 100% oil-free air. There shall be no lubricant within the compression chamber. Unit to be delivered fully packaged including air compressor, prime mover, coolers, lubrication system, regulation, and control system mounted on a common base frame and fully enclosed steel sound-dampening canopy. Silencers, lubricating system, cooling system, control system, and driver shall be mounted as a part of the package.
- 2.2. The compressor shall consist of two compressor stages flanged to an integral speed increaser. Each stage is to be driven from a common bull gear to insure optimum speed and highest possible efficiency. Multi-stage compressors have an inter-cooler placed between stages and an after-cooler installed in the package
- 2.3. There shall be provisions for an optional heat of compression dryer to be mounted within the compressor canopy. Interconnecting piping, pressure dewpoint sensor, and wiring between the compressor and dryer shall be included.

### 3. Compressor Unit

- 3.1. **Casing** - The compressor element enclosure shall be a cast iron, one-piece casing housing two precision-made screw-type rotors. The housing shall have integral passages for lubrication and cooling medium. It shall be designed with a dedicated and optimized cooling jacket to prevent irregular deformation and overheating Increases turndown capacity.
- 3.2. **Rotors** - Rotors and shaft shall be of one-piece carbon steel construction. Internal rotor cooling shall not be required. Rotors are to have a corrosion-resistant coating. The rotors shall have an asymmetric profile that keeps leakage losses at a minimum to ensure high efficiency. Rotors must be balanced in accordance to ISO 1940 to guarantee the dynamic and static tolerances.
- 3.3. **Timing Gears** - Timing gears shall be fitted on the rotor shafts to maintain the rotors in correct position relative to each other. The compressor shall be of such design that the timing gears eliminate any contact between the rotors
- 3.4. **Bearings** - Bearings shall be of the high precision anti-friction type. Radial loads shall be carried by roller bearings and axial loads by ball bearings.
- 3.5. **Seals** - The seals shall be a restrictive-ring type design. The seal rings and retainers shall be stainless steel construction and be free for radial self-adjustment along the rotor shafts. The seals shall have an atmospheric vent to prevent air and oil leakage along the shaft into the elements.
- 3.6. **Lubrication** - Lubrication and cooling on the precision bearings shall be by forced oil jet directly into the bearing to reduce bearing losses and heat generation in the bearings.

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- 3.7. **Coolers** - The compressor package shall be equipped with all required coolers as follows:
- 3.7.1. A high performance oil cooler, inter-cooler and after-cooler shall be provided and mounted via couplings for stress free connections. All coolers will receive the same temperature cooling air (one pass design). The inter- and after-coolers shall have a separator and drain for optimal efficiency and ease of maintenance. Zero air loss drains with high level alarm shall be included.
  - 3.7.2. The coolers shall be designed for 150 psig operation and include stainless steel pre-coolers for optimum life time and shall be capable of providing approach temperatures of less than 15°F at design conditions.
- 3.8. **Motor** - The motor shall be ultra premium high efficiency (IE5), water-cooled, permanent magnet motor with class H insulation. For increased reliability, the insulation temperature rise shall be limited to 125°C. IP 66 protection rating allows no dust or water ingress. There is no shaft seal resulting in no required shaft seal replacement during the entire lifetime of the motor. The oil lubricated bearings will require no lubrication or frequent maintenance.
- 3.9. **Motor Gears** - Unit is to be provided with long lasting helical gears in accordance to Standard AGMA 2015 A5.
- 3.10. **Electrical Drive System**
- 3.10.1. **Drive** - Inverter for variable speed drive compressor shall be of Atlas Copco NEOS design and will have quantity of (2), one for the low pressure and one for the high pressure elements
    - 3.10.1.1. The variable speed drive shall comply with IEC 62061: SIL Level 3
    - 3.10.1.2. The variable speed drive for the main motor must be IP5X (power electronics) / IP2X (control board) / IP1X (connection terminals)
    - 3.10.1.3. The variable speed drive shall comply with IEC 62061: SIL Level 3
    - 3.10.1.4. Cooling shall be forced ventilation – aircooled
    - 3.10.1.5. The variable speed drive shall be CE, cULus and RCM certified.
  - 3.10.2. **Electrical Cubicle**
    - 3.10.2.1. Constructed as IP 54 enclosure
    - 3.10.2.2. SCCR rated cubicle as standard, 65kA (60Hz/CSA-UL), and 50 kA (50Hz/IEC)
    - 3.10.2.3. Fast acting fuses installed in cubicle.
  - 3.10.3. **Control Panel**
    - 3.10.3.1. Maximum operating temperature shall be 122°F standard with a 131°F option
    - 3.10.3.2. Anti-condensation heater installed in motor
    - 3.10.3.3. Control panels complies with IEC61800-3
    - 3.10.3.4. Thermal, bearing currents, and magnetic overload protection standard
- 3.11. **Control System**
- 3.11.1. **Protections**
    - 3.11.1.1. Standard sensors shall be pressure and temperature, oil level gauge, and SPM and PT 100 (motor)
  - 3.11.2. **Control Panel**
    - 3.11.2.1. Screen shall be touch screen TFT-LCD 4.3" graphic display
    - 3.11.2.2. Shall be included with 533MHz and 32 RAM
    - 3.11.2.3. Ethernet-Bus, CAN-Bus slot, RS485-Bus, IO-Bus
    - 3.11.2.4. Shall be of protection type IP54 front
- 3.12. **Air Circuit**
- 3.12.1. **Filters** - High efficiency paper filter in accordance with SAE fine 1µm 98%, 2µm 99.5%, 3µm 99.9%
  - 3.12.2. **Blow Off Valve** - Included standard is a low and high pressure blow off with no unloader valve
- 3.13. **Water Circuit**
- 3.13.1. **Water Separator** - The compressor shall be equipped with a labyrinth style water separator
  - 3.13.2. **ERD Drains**
    - 3.13.2.1. The compressor will have a zero loss electronic water drain plumbed to the aftercooler.



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- 3.13.2.2. These drains shall discharge no compressed air during removal of the condensate.
- 3.13.2.3. The zero loss drains shall be monitored by the microprocessor controller.
- 3.13.2.4. A manual condensate drain shall also be included.
  
- 3.13.3. **Water Valve** – Factory installed water shutoff valve shall be standard inside the canopy at the water outlet
- 3.14. **Oil System** – The entire oil system shall be copper free and supply oil to the bearings and gears
  - 3.14.1. **Oil Pump** – The oil pump shall be a gerotor type gear pump mounted on a main shaft
  - 3.14.2. **Oil Level Indication** – The oil circuit shall contain an integrated oil level sight glass
  - 3.14.3. **Oil Cooler** – The oil cooler shall be made of stainless steel plates and copper brazed
  - 3.14.4. **Oil Filter** – The oil filter shall be “click” system (bayonet coupling) and element will be high efficiency with a  $\beta_{12} \geq 200$  rating
  - 3.14.5. **Oil Fume Breather** – The filter element will be installed before the air is released into the atmosphere, keeping the air around the compressor oil/oil fumes free
  
- 3.15. **Monitoring Capabilities** – The compressor package shall have the appropriate displays, controls, and indicators to monitor operation as specified below:

### Status Indicators

- Stopped/Running
- Compressor Status
- Machine Control Mode
- Automatic Restart
- Week Timer
- Active Protection Functions
- Service
- Main Screen

### Machine Control Mode

- Local Start / Stop
- Remote Start / Stop
- Network Control

### Week Timer

- Week Action Schemes
- Week Cycle
- Status
- Remaining Running Time

### Active Protection Functions

- Emergency Stop
- Shutdown
- Warning

### Service

- Overview
- Service Plan
- Next Service
- History

### Counters

- Running Hours
- Loaded Hours
- Motor Starts
- Load Relay
- Fast Starts
- Fan Starts
- Module Hours
- Emergency Stops

### Regulation

- Unloading Pressure 1
- Loading Pressure 1
- Unloading Pressure 2
- Loading pressure 2
- Pressure Band Used
- Digital Pressure Band Selection

### Inputs

- General
- Elements
- Dryer
- Drains
- Main Motor
- Network
- Cooler
- Oil Circuit



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## Outputs

- General
- Dryer
- Drains
- Main Motor

## SP (Shock Pulse Method)

- Motor, Drive End
- Motor, Non-drive End
- Low Pressure Stage, Drive End
- Low Pressure Stage, Non-drive End
- High Pressure Stage, Drive End
- High Pressure Stage, Non-drive End
- Gearbox

## 4. Shipment and Delivery Preparation

- 4.1. Plastic foil to protect against rain
- 4.2. Wooden pallet
- 4.3. VCI paper to protect against corrosion due to moisture in the environment

## 5. General Installation Requirements

- 5.1. Upon placement on a level surface and connection to essential utilities, the unit shall be provided available for immediate operation.
- 5.2. The compressor does not require bolting to the floor.