

**WATER SUPPLIES DEPARTMENT**

**STANDARD SPECIFICATION M-07-01**

**MOTOR-DRIVEN AIR COMPRESSOR**

**UP TO 40 kW FOR INDOOR INSTALLATION**

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This specification shall be read in conjunction with the following WSD Standard Specifications, which shall be applicable to the equipment supplied with the air compressor:

- (a) E-11-02 for Control Panels and Switchboards Rated up to 160A;
- (b) E-51-04 for Squirrel Cage Induction Motors below 40kW;
- (c) E-86-11 for Electro-mechanical Pressure Switches; and
- (d) EM-01-03 for Pressure Gauges.

**1. GENERAL DESIGN**

The compressor shall be suitable for continuous operation in a tropical climate with a maximum relative humidity of 100% and a maximum ambient temperature of 40°C.

The compressor shall be motor driven, air cooled and of maximum two-stage compression. The maximum sound pressure level measured at 1m from the compressor shall not exceed 90dB(A). Pressure relief valves on the interstage and delivery pipes shall be provided.

The compressor shall comply with the following requirements according to the type specified:

**2. OIL-LUBRICATED COMPRESSOR**

**2.1 Reciprocating Compressor**

Reciprocating compressor shall be of single acting and oil-lubricated type. Unit with an integral air receiver is acceptable unless otherwise specified.

**2.2 Rotary Compressor**

Rotary compressor shall be of screw type with oil injection. The rotors of the compressor shall be carried on heavy-duty double ball/roller type bearings with long design life. Any intermeshing rotors shall be ground precisely with no relative sliding movement and all moving elements shall be well balanced to reduce the bearing load. The rotors shall be housed in a high quality cast iron casing.

An air valve shall be provided to seal the intake of the compressor when at 'no load' or 'stop' condition, and to prevent air/oil mixture in the compressor to discharge through the air intake.

An efficient oil separator with easily removable filter shall be fitted at the compressor outlet to limit the amount of lubricant being carried over to not more than 5 ppm. A full-flow oil filter with replaceable element shall be fitted in the oil return line to the compressor.

A combined check and minimum pressure valve shall be fitted at the oil separator outlet to ensure that high pressure air cannot flow back into the system and that the rapid rise of air pressure in the oil separator can be attained in order to supply oil for lubrication and cooling.

### 3. **OIL-FREE COMPRESSOR**

Oil-free compressor shall meet the requirements as specified in Clauses 2.1 and 2.2 where applicable.

#### 3.1 **Reciprocating Compressor**

The piston in the cylinder of the reciprocating compressor shall be fitted with self-lubricating PTFE rings or equivalent materials acceptable for oil-free operation.

#### 3.2 **Rotary Type Compressor**

The intermeshing rotors in the rotary type compressor shall be synchronised through timing gears in such a way that they rotate in a sealing arrangement without touching each other. The rotor shafts shall be provided with air and oil sealing rings to prevent lubrication oil from entering the compression space, thus ensuring oil-free air delivery.

### 4. **AIR INTAKE SYSTEM**

A dry-type air filter with replaceable element and an effective silencer shall be fitted to the intake. The silencer shall be located downstream of the air filter to minimise pulsation effect.

### 5. **COOLING**

Aftercooler (completed with a water separator) and intercooler of fin-tube type, safety valves, pressure gauges and automatic drainage arrangement shall be fitted if necessary. Forced draught cooling shall be provided for the compressor block, oil cooler (if applicable), aftercooler and intercooler by an integral fan with a proper metal guard for safety in compliance with the requirements of Factories and Industrial Undertakings Ordinance, Chapter 59.

Any parts with external surface temperature in excess of 55°C which may be accidentally contacted by personnel in normal operation shall be guarded or insulated

by proper lagging.

**6. REGULATION AND CONTROL**

The compressor shall be suitable for manual or automatic start/stop control. An automatic unloading device shall be provided for light starting of the compressor motor and for unloaded operation when the maximum setting of the working pressure is reached.

**7. LUBRICATION SYSTEM**

The compressor lubrication system shall be fitted with built-in oil pump or splash pin, oil breather cap, sump drain cock (or plug as appropriate) and level sight indicator. If built-in oil pump is fitted, oil filter, oil pressure switch and oil pressure gauge shall be incorporated also. The oil pressure switch shall trip the driving motor in case of low oil pressure.

Lubricating oil shall be maintained at an optimum operating temperature to prevent condensation of atmospheric moisture in the system. If an oil cooler is fitted, a thermo-controlled three-way valve shall be provided in case necessary.

**8. DRIVE ARRANGEMENT**

The compressor may be designed for multi-vee endless belt drive or direct drive through a flexible coupling connected to the driving motor. Means shall be provided for adjusting the tension of the belt for belt drive, or for aligning the motor and the compressor for direct drive. The belt loading shall be designed in such a way that if one belt fails, the remaining belts can also transmit the full load. All exposed moving parts shall be properly guarded for safety.

**9. AIR RECEIVER**

The air receiver shall be of welded steel construction and be designed for the maximum pressure of the compressor. Safety valve, pressure indicating devices, drain valve and suitable footing shall be fitted. The receiver shall be hydraulically tested in accordance with the requirements as stipulated in the Boilers and Pressure Vessels Ordinance, Chapter 56. The test pressure shall be in accordance with a recognised engineering standard or code, or twice the maximum permissible working pressure when the working pressure does not exceed 7 bars, and one and one-half times the maximum permissible working pressure plus 3.5 bars when the working pressure exceeds 7 bars.

Test pressure and date of testing shall be legibly and permanently marked on the air receiver. Pressure gauges shall be graduated in kPa or in bar.

**10. CONTROL CUBICLE**

A local control cubicle shall be provided for termination of the field instruments of the compressor unit. The enclosure shall be a standard mass production product made of fine coated sheet steel of not less than 1.5 mm thick. An emergency stop push button of red mushroom headed stay-put type shall be provided at the control cubicle.

**11. COMPRESSOR MOUNTING**

The compressor, motor and control cubicle shall be mounted on a common bedplate. Effective anti-vibration mountings shall be used to eliminate the transmission of the machine vibrations onto the foundation.

**12. TEST CERTIFICATES**

Manufacturer's works test certificates for the compressor, motor, air receiver, and safety valve shall all be submitted. Type test certificates for compressor and motor are acceptable unless otherwise specified.

**13. INFORMATION TO BE SUBMITTED**

The following information shall be provided and summarized in material submission for material approval / acceptance by the Engineer or the *Project Manager*:

Item No.	Description
Compressor General Information	
1	Manufacturer
2	Country of Origin
3	Type of Compressor
4	Model Number
5	No. of Stage of Compressor
6	Rated Air Pressure at Discharge
7	Maximum Cut Out Pressure at Discharge
8	Maximum Cut In Pressure at Discharge
9	Free Air Delivery
10	Capacity of Air Tank
11	Sound Pressure Level
12	Weight
13	Dimension
Compressor Motor Information	
1	Manufacturer
2	Country of Origin
3	Rated Output
4	Rated System Voltage
5	Rated Full Load Current

6	Motor Speed
7	Applicable Standard
8	Type and IP Rating of Enclosure
9	Class of Insulation
10	Starting Current
11	Maximum Permitted Number of Starts per Hour
12	Power Factor at Rated Load
13	Motor Efficiency at Rated Load
14	Power and Voltage of Anti-condensation Heater if Applicable

- End of Specification -