

**Specification No: RDSO/2008/EL/SPEC/0076, Rev. '2'**

**GOVERNMENT OF INDIA  
MINISTRY OF RAILWAYS**



**TECHNICAL SPECIFICATION FOR  
1750 LPM OIL FREE COMPRESSOR  
FOR**

- (1) THREE PHASE ELECTRIC LOCOMOTIVES**
- (2) WAP4- ELECTRIC LOCOMOTIVES**

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**Issue Date /Year AUGUST 2013**


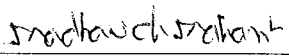

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**RESEARCH DESIGNS AND STANDARDS ORGANISATION  
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**FOREWORD**

- 0.1 This is a general technical specification for motor driven oil free compressor of 1750 LPM (FAD) capacity for three phase & WAP-4 class of electric locomotive application fitted with 180 KVA SIV. There is additional load on the locomotive air supply circuit (FP circuit) with introduction of LHB rakes, hence it felt necessary to enhance the air capacity of WAP-4 locomotives hauling Duranto Trains.
- 0.2 The compressor shall be mounted in the under frame of the existing three phase electric locomotives WAP-5, WAP-7, WAG-9 & as under slung/on-board in WAP-4 class of electric locomotives fitted with 180 KVA SIV. The mounting arrangement in 3-phase locomotives shall be as per CLW drawing no.1209.02.127.084.The overall dimensions for mounting of high capacity oil free compressor are different for three phase locomotives & WAP-4 locomotive due to space constraints in WAP-4 locomotives for fitment of high capacity oil free compressor. The overall dimensions for mounting of high capacity oil free compressor in three phase locomotive & WAP-4 locomotive have been specified separately in clause 7.3. The purchaser shall specify the requirement of high capacity oil free compressor for three phase electric locomotives or WAP-4 class of electric locomotives clearly in the Tender documents.
- 0.3 The inlet air for the compressor shall be unfiltered atmospheric air at ambient temperature and pressure.
- 0.4 The suppliers are required to familiarize themselves with the layout of the equipment of the locomotives, including the pneumatic circuit and pipe layout before quoting for their products. Adequate clearance from adjacent equipment of locomotive shall be maintained.
- 0.5 This specification covers clauses which call for agreements between the Indian Railway and the supplier and supply of certain technical information by the Manufacturer / Supplier at the time of submitting tenders for the equipment.
- 0.6 Any deviations from this specification, with a view to improving the performance may be given due consideration, provided, full particulars with

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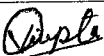


justification, thereof are furnished. It may however be noted that due to limited availability of space in locomotive and the necessary to ensure inter changeability with existing equipment increase in the overall size and mounting dimensions shall not be allowed normally.

## 1.0 SCOPE

This specification covers motor driven oil free 1750 LPM under slung air compressors for use on three phase & WAP-4 class of electric locomotives fitted with 180 KVA SIV as on-board/under-slung mounting. This is a general technical specification does not cover all the necessary provision of a contract.

## 2.0 TERMINOLOGY

- 2.1 For the purpose of this standard, the following definitions in addition to these given in Indian Standard "Glossary of Terms Relating to Compressors and Exhausters" IS 5727:1981, Reaffirmed 2001 shall apply.
- 2.2 **Manufacturer:** The party manufacturing the machine. The manufacturer may or may not be the Supplier.
- 2.3 **Engineers:** The term 'Engineers' shall apply to the Director General, Research Designs and Standards Organization, Ministry of Railways, Lucknow - 226011, Dy. Chief Electrical Engineer (D), CLW / Chittaranjan and person to persons authorised by them.
- 2.4 **Sub-Contractors:** Sub-Contractor means person to persons from whom the manufacturer buys parts / assembles for fitment to the equipment to be supplied.
- 2.5 **Supplier:** The party supplying the machine.

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### 3.0 STANDARDS:

In preparing this specification, assistance has been drawn from the following specifications.

Sl.No.	Specification No.	Description
2.	IS 5456 : 1985 Reaffirmed 2001	Code of practice for testing of positive displacement type air compressors and exhausters.
3.	IS 10431 : 1994 Reaffirmed 1999	Measurement of air flow of compressors and exhausters by nozzles
4.	IS 5727:1970 Reaffirmed 2001	Glossary of terms relating to compressors and exhausters
5.	BS 1571 (Part II) :1975 (1984)	Methods for simplified acceptance testing for air compressors and exhausters
6.	SPEC.NO.SPEC/E- 10/3/09(Motor) August 1997 With Amendment 1,2,3& 4	Technical specification and test schedule for single phase / three phase Induction motors for driving blowers, compressors and pumps for three phase drive electric locomotives.

3.1 Other relevant IEC, IS and BS specifications quoted in the appropriate clause of the specification will also apply except where modified/ amended by the provisions of this specification.

3.2 Latest version/revision of the standards and specifications etc shall be followed, unless specifically mentioned otherwise.

### 4.0 DESIGN FEATURES AND SERVICE CONDITIONS

4.1 The equipment offered shall preferably be of -

- Simple in design
- Good workmanship
- Easy for maintenance and operation
- Robust and rugged in construction, suitable for traction duty application.

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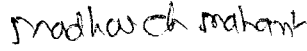

- 4.2 Inter cooling and after cooling arrangement of air shall be provided with the compressor so as to limit the final delivery temperature of air shall not be more than **20°C** above ambient when working at a pressure of 10.5 kg/cm<sup>2</sup>.
- 4.3 The FAD of the compressor should not be less then 1750 LPM at 1000 meters altitude above sea level at 20°C with relative humidity of 95% at 10.5 kg/cm<sup>2</sup>.

**5.0 NORMAL DUTY:**

- 5.1 The compressor motor set shall be suitable for continuous operation at pressure of 10.5 kg/cm<sup>2</sup> without causing higher temperature, damage and unusual wear to the components.
- 5.2 The compressor will work continuously but after building up a pressure of 10.5 kg/cm<sup>2</sup> in the main reservoir, compressor motor supply cut off by the pressure governor setting and restarts at 8.0 Kg/cm<sup>2</sup>.

**6.0 DRIVE :**

- 6.1 The compressor shall be driven by 3- phase induction motors controlled by a 3- phase contactor will be started direct on line start.
- 6.2 The drive to the compressor shall be either direct or through a suitable flexible coupling.
- 6.3 Flexible coupling shall be of proven design. It shall be selected to suit the arduous duty encountered in normal service without the necessity of renewing any wearing part within three years of its operation. It shall be of simple design and shall require minimum attention during maintenance. It shall be possible to replace the wearing components of the coupling in situ without disturbing the machine alignment.
- 6.4 The limits of angular, radial and axial misalignments, which the coupling is capable of withstanding, shall be intimated to 'Engineers' and their approval be obtained.
- 6.5 The coupling shall be designed suitable to withstand shocks due to frequent starting and stopping and variation of load on compressor

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motor set. Manufacturer shall advise technical details including breakaway torque of the coupling.

6.6 The drive arrangement of the compressor shall be subject to the approval of the "Engineers".

**7.0 MOUNTING AND LIFTING ARRANGEMENTS:**

7.1 Three point mounting arrangement with proven design damping preferably of metallic helical coil type in 3-phase locomotives and four point mounting arrangement with proven design damping in WAP-4 locomotives fitted with 180 KVA SIV. The resilient mounts shall be suitable for absorbing the vibration level up to 90% of the level generated on the motor and compressor side.

7.2 The compressor and its mounting arrangement shall be of robust design for traction duty and shall withstand satisfactorily the vibrations and shocks normally encountered in service.

7.3 The overall dimensions for mounting in three phase locomotives shall be preferably fall within the limits of :

Length= 1460 mm

Width = 740 mm

Height = 825 mm

The overall dimension of compressor-motor unit in WAP-4 locomotive shall be preferably fall within the limit of :

Length= 1400 mm


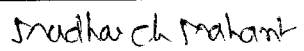

Width = 640 mm

Height = 600 mm

7.4 The compressor shall be provided with suitable safety slings to prevent it from falling down in case of failure/breakage of the under-slung mounting arrangement.

7.5 Adequate numbers of lifting hooks shall be provided to facilitate lifting of the compressor motor set.

7.6 For On board mounting of compressor in WAP-4 loco fitted with 180 KVA SIV, mounting holes of compressor motor unit shall be in accordance

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with mounting holes provided in machine room of locomotive for fitment of compressor.

**8.0 COOLING :**

- 8.1 The compressor shall be air cooled. A cooling fan of adequate capacity, of simple and rugged design and light weight shall be provided.
- 8.2 The fan shall be mounted on the shaft and shall be dynamically balanced, suitable protection guard also to be provided, to prevent the hitting of foreign object during run of the locomotive.

**9.0 INTERCOOLER:**

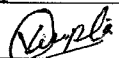
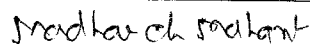
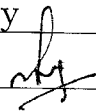
Intercooler of adequate cooling capacity / shall be provided as an integral part of the compressors unit. The Intercooler shall not interface with free access to other equipment of the compressor.

**10.0 AFTERCOOLER :**

After cooler of radiator type or superior design shall be provided compressor.

**11.0 MISCELLANEOUS:**

- 11.1 For securing protective hoods, pipe brackets etc. foundation and cylinder head bolts shall not be utilized. If aluminum alloy is used, threaded connections in aluminum portion for fastening of components shall not be used.
- 11.2 Wherever bearings are grease lubricated, easy accessible grease nipples to IS 4971:1968 "Recommendations for selection of industrial floor finishes" shall be provided. Suitable vent for overflow of excess grease shall also be provided. Type of indigenously available grease to be used, shall be specified.
- 11.3 Direction plate with 50 mm arrow shall be fitted on the compressor and motor, separately to indicate the normal direction of rotation.

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**12.0 NAME PLATE:**

The compressor shall have indelibly marked on a nameplate at least the following information.

- a. Manufacturer's name and also brand name monogram if any.
- b. Type and serial no.
- c. Capacity (FAD) in liters / minute.
- d. Effective pressure.
- e. Month & year of manufacture

**13.0 LUBRICATION CHART:**

Periodical lubricating instructions shall be affixed at a convenient location indicating the type, quantity and the frequency of lubrication required for the compressor's Bearings if required.

**14.0 SERVICE CONDITIONS:**

14.1 The compressor shall be capable of working satisfactorily under the following conditions:



- Ambient temperature - 5° to 55 °C.
- Maximum temperature of air at inlet port – Up to 60°C.
- Relative humidity – Up to 100%.
- Altitude – Sea level to 1776 m.
- The equipment shall be capable of operating satisfactorily in spite of dust, dirt, mist, rain and heavy dust storm to which rolling stock is normally exposed in service. The equipment shall also be capable of withstanding continuous contact of prolonged exposure to petroleum products without any effect on its efficiency.

14.2 The equipment shall withstand satisfactorily the vibration and shock normally encountered in service as per IEC 61373 Category-1 Class - A

**15.0 ACCESSORIES:**

15.1 The compressor unit shall be fitted with the following accessories:

- i. Dry type air filter for suction and an indication to indicate the level of carbonization/ blockage of filter element.
- ii. Intercooler Safety valve and drain cock.

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- iii. After cooler, fitted with auto drain valve.
- iv. Flexible pipe for use on the delivery side, which shall be capable of withstanding the delivery of hot air temperature.
- v. Suitable resilient mount of proven design.
- vi. Suitable safety sling / safety arrangement to prevent the compressor from falling in case of failure/breakage of the mounting arrangement.

**16.0 TESTING & INSPECTION :**

**16.1 TYPE TESTS:**

16.1.1 The testing shall be conducted on the compressor unit and testing shall generally conform to IS 5456: 1969 or relevant BS specification. The motor for compressor shall be procured from RDSO approved sources only. If, however, the motor is procured from any other sources, it shall also be subjected to type tests separately and shall be witnessed by RDSO.

16.1.2 Whenever a new series of compressor is manufactured, a unit shall be subjected to a series of tests to establish the reliability and performance of the compressor.

16.1.3 The type tests shall be witnessed by RDSO representative.

16.1.4 The type tests shall be constituted the following tests and measurements.

Sl.No.	Tests	Clause No. of the Specification
1.	Mechanical tests	Clause 17.0
2.	Capacity (output) measurements at 8, 9, 10.5 kg/cm <sup>2</sup> pressure.	Clause 17.1
3.	Starting tests	Clause 17.2
4.	400 hrs. Endurance test	Clause 17.3
5.	Tests at higher environmental Temperature.	Clause 18.0

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6.	Weight measurement	Clause 19.0
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### 17.0 MECHANICAL TESTS :

The mechanical tests are intended to ascertain the reliability of the machine and its accessories. Prior to the starting of this test, essential working parts of compressor and its accessories shall be checked for accuracy with the manufacturer's drawings. All mechanical parts shall also be checked for proper functioning when assembled and in operation.


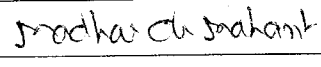
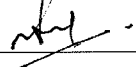
The duration of the separate stages of type tests shall be as given in the table below:

Tests	Duration
Running of compressor on discharge pressure of	
i. 8 kg/cm <sup>2</sup>	5 Hours
ii. 9 kg/cm <sup>2</sup>	7 Hours
iii. 10.5 kg/cm <sup>2</sup>	10 Hours

The supply shall be from a source of 415 V, unbalanced 3- phases at 50 C/s. During these tests measure individual line voltage, phase currents, power input, frequency, speed, time to come up to full speed and ambient temperature. Measure the temperature by thermometer/ Temperature sensor / Laser gun of Inlet and Outlet air of Inter Cooler & After Cooler, bearings, LP, HP cylinder heads & the delivery air temperature. Record the above measurements with supply voltage of 415V when the compressor is working at 10.5 kg/cm<sup>2</sup> pressure.

#### 17.1 CAPACITY (OUTPUT ) MEASUREMENTS

During the above tests arrange to measure Air flow when the compressor is working against pressure of 8 kg/cm<sup>2</sup>, 9 kg/cm<sup>2</sup> & 10.5 kg/cm<sup>2</sup>, after all parts have attained the maximum temperature the FAD should not be less then 1750 LPM.

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Repeat measurements of Air flow when the unit is operating at rated pressure of 10.5 kg/cm<sup>2</sup> and when the motor is supplied with 415 volt at 50 c/s for 1750 LPM compressor.

Calculate value of free air delivery (FAD) volumetric efficiency and record it. Measure the temperature rise for each stator winding by resistance method with 415V, 390V & 435 V unbalanced at 50 c/s supply for 1750 LPM under slung compressor.

### 17.2 STARTING TESTS (COMBINED UNIT TEST)

Immediately after completion of the tests under clause 17.1 above always operating against the same pressure (10.5 kg/cm<sup>2</sup>) compressor motor unit shall be run successfully as follows.



- 10 minutes under 90% rated voltage.  
1 minute stop
- 5 minutes under 110% rated voltage.  
1 minute stop
- 10 minutes under 90% rated voltage.  
1 minute stop
- 10 minutes under 110% rated voltage.

### 17.3 ENDURANCE TESTS

Run the compressor on load at 10.5 kg/cm<sup>2</sup> pressure. The compressor shall run of full load for a minimum period of 8 hours at a stretch. At least for half and hour in the 8 hours running, the compressor shall be loaded and unloaded at frequent intervals to check the performance of the unloading mechanism. In addition, the compressor shall be run at 10% over load for 10% of the time disturbed over the entire run of endurance tests.

Following measurement shall be made during the endurance tests at intervals of one hour.

- i. Ambient temperature
- ii. Speed (r.p.m.)

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- iii. Discharge air pressure L.P. Cylinder
- iv. Discharge air pressure H.P. Cylinder
- v. Temperature of air at Suction.
- vi. Temperature of air at LP discharge
- vii. Temperature of air at HP discharge / Delivery air temp.
- viii. Intercooler and after cooler Inlet & Outlet temperature.
- ix. Temperature of Cylinder heads LP & HP.
- x. Temperature of crank case body.
- xi Temperature of Motor body.

17.4 Before and after completion of the endurance tests, the compressor shall be opened and dimensions of all the wearing parts shall be recorded.

17.5 The endurance tests of 400 hours shall also be applicable to the existing design of compressors, in case of change in operating requirements such as increase in speed of operation, working pressure etc.

**18.0 TESTS AT HIGHER ENVIRONMENTAL TEMPERATURE:**

A test run of 48 hours shall be conducted at inlet temperature of 60°C. The compressor shall run at 10.5 kg/cm<sup>2</sup> pressure for 8.00 hours and will be stopped for half and hour for cooling under prevailing atmospheric conditions. Six such cycles shall be performed. During these tests measurements as for endurance tests (17.3) shall be made.

**19.0 WEIGHT:**

The weight of the complete set and bare compressor and Motor shall be taken separately. Design should ensure minimum weight of the compressor motor set.

**20.0 ROUTINE TESTS:**

These tests shall be carried out on all the compressors before acceptance by the Engineer. The supplier shall also supply a copy of the test report with every machine. Following tests shall be conducted.

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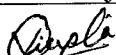
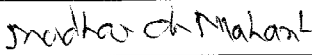

- 20.1 Run the compressor at maximum rated speed at 10.5 kg/cm<sup>2</sup> pressure for two hours and check the general mechanical and electrical test results and with values recorded during type tests with 415 V supply at 50 c/s. The discharge air temperature shall be recorded at half an hours interval.
- 20.2 Assure the capacity (output) of the compressors at the rated maximum speed and 10.5 kg/cm<sup>2</sup> pressure. This will be done in one compressor unit of a batch of fifteen.
- 20.3 At least 10% of the total lot of compressor on order, selected at random, shall be subjected to a run of 48 hours with 30 minutes shut off at 8 hours interval, at the maximum rated speed and 10.5 kg/cm<sup>2</sup> pressure. Readings as for endurance tests shall also be recorded.

**21.0 TESTING OF ACCESSORIES :**

- 21.1 The supplier shall indicate the test specification for the following accessories components.
  - i. Inter cooler & after cooler.
  - ii. Filter – Air suction.
  - iii. Inter cooler safety valve.
  - iv. Resilient mountings.
- 21.2 The test specification of the accessories shall have RDSO's approval prior to the commencement of the type tests.

**22.0 GENERAL CONDITIONS FOR INSPECTION & TESTS**

- 22.1 All tests shall be conducted at Manufacturer's premises. Any shortcoming or defect noticed during the type test shall be pointed out to the manufacturer by the Engineer or his representative to enable him to incorporate the necessary improvements before bulk manufacture is commenced, without affecting the guaranteed deliveries or guaranteed performance characteristics.
- 22.2 Any additional tests trials, if considered necessary by the Engineers, shall also be arranged the suppliers free of cost.

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- 22.3 The Engineer or their representative shall have access for stage inspection, to those portions of the manufacturer's works in which production is being carried out and where the testing is taking place. This also applies to the items procured from sub suppliers.
- 22.4 The Engineer, at the time of inspection, shall have the power to ask for additional information and/or tests he may consider necessary to satisfy him that proper materials and parts specified are actually used during the manufacture of the compressor.
- 22.5 The manufacturer shall provide labour or appliances required by the Engineer, free of charge, for inspection and testing of the compressor and its components, as required.
- 22.6 If any part of the compressor unit requires alteration or any defect appear during the tests or trials, the supplier shall, without any extra charge, make such alterations or rectify the defects to the satisfaction of the engineer or his representative.
- 22.7 Any modification or alteration to the components during the supply of the order shall be made only after the approval of the Engineer. The unit after such modifications / alterations shall be subjected to such tests as considered necessary by the engineer.
- 22.8 Zinc yellow passivation /Blackening shall be done on all hardware.

**23.0 SPARES :**

- 23.1 Along with the quotation for supply of air compressor the tenderer shall also furnish a recommended list of spares for two years and quotations thereof. The tenderer shall also agree to hold the price of spares for a period of one year from the date of supply of the compressor.

**24.0 INFORMATION TO BE FURNISHED BY TENDERER:**

- 24.1 Data as per Annexure I & II shall be furnished by the tenderer along with their QAP for this item.

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**25.0 TOOL KIT**

The price for tool kit for the maintenance of the compressor shall be indicated separately, along with the tender.

**26.0 MAINTENANCE MANUALS**

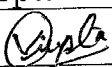
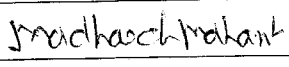
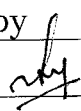
The tenderer shall supply copies of exhaustive, fully illustrated manuals covering among other items, the following vital details, to the "Engineer" with the tender.

1. Description and arrangement.
2. Technical data.
3. Dismantling and assembly instructions.
4. Commissioning instructions
5. Particulars of indigenously available recommended lubricants.
6. Periodical inspection schedules.
7. Periodical maintenance instructions along with trouble shooting instructions.
8. Testing procedure for the equipment and other auxiliaries like oil pump etc, if applicable.
9. Wear limits for vital components.
10. Detailed parts catalogue with description of items. The parts shall be detailed by sketches to facilitate ordering.
11. Instructions for reclamation of worn out components.
12. List of special tools with instruction for use.

Two copies of the Maintenance Manual shall be supplied with the quotation. One copy of the manual shall be supplied with every 10 compressor sets or a part thereof.

**27.0 TRAINING:**

The supplier shall provide facilities for free training of the railway maintenance staff at their works on aspects of maintenance, overhaul and testing of the compressor.

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**28.0 SPECIAL CONDITIONS:**

28.1 At the time of approval of the prototype unit the manufacturer / supplier shall furnish the list of names and addresses of their Sub supplier of the main items of the equipment and important raw materials which they have used in the prototype unit and shall not make any changes in the sources of supply without prior approval of RDSO.

28.2 Field Trial: After successful completion of the type test the compressor shall be subjected to extended field trial for a minimum period of six months before according the prototype approval.

28.3 Consistency test: In case of large scale failures being reported from the zonal railway/CLW and/or in case of major design change, one unit of compressor motor set selected at random to be offered for consistency test to be witnessed by RDSO. Consistency tests shall generally cover those type tests which provide valuable information on the reasons of failures and/or can establish the efficacy of the design changes. The periodicity and scope of such a test shall be decided by RDSO prior to undertaking such a test.

28.4 Identification of manufacturer: The compressor manufacturer should clearly emboss the following details :

a) Year and month of manufacturing

b) Sl. no.

c) Name of manufacturer at suitable places on various parts viz. crank case, cylinder head, crank-shaft etc. to assess the performance of various makes of machines and to determine their codal life for replacement decision.

**29.0 FINISH:**

The compressor motor set shall be suitably treated to remove rust and should be coated with antirust primer and finished with two coats of light grey or black paint as per IS 5:1994.

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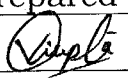

**30.0 ISO CERTIFICATION:**

Indian Railway reserves the right to procure the item from ISO certified manufacturers only.

**31.0 HARDWARE:**

All types of high tensile fasteners including spring washer shall be of either from RDSO's or CLW's approved sources only. Prior approval shall be taken from RDSO/CLW if any other makes are proposed to be used.

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
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	Shachar Ch Mahant	

**ANNEXURE - I**

**BROAD TECHNICAL FEATURES OF THE COMPRESSOR**

1. Type, make and model.
2. Graph showing free air delivery (FAD) against 8, 9 and 10.5 Kg/cm<sup>2</sup> at 100% duty cycle and maximum rated speed.
3. Displacement at rated r.p.m.
4. Horse power consumption at rated capacity and speed against 8, 9 and 10.5 kg/cm<sup>2</sup>.
5. Maximum permissible temperature at inlet and exhaust ports.
6. Weight of the unit complete with accessories.
7. Details of drive arrangements.
8. Details of couplings (if used) including alignment data and method of checking alignment.
9. Details of mounting arrangement with overall dimensions.
10. Overall space requirements, inclusive of all accessories for the compressor. (Any additional space required for removal of valves in position, attending to air inlet filters and topping up of oil etc. shall also be indicated). Layout drawings shall be supplied.
11. List of major wearing components and their expected life.
12. Complete details of resilient mounts.

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## ANNEXURE - II


### GENERAL DATA OF COMPRESSORS

1. Type, make and model.
2. Details of Technical collaboration if any.
3. Basic design data:
  - Cylinder arrangement
  - No. of LP cylinders
  - No. of HP cylinders
  - L.P. cylinder bore dia - mm
  - H.P. cylinder bore dia - mm
  - Expected life of cylinder
  - Expected life of piston
  - No. of LP piston rings
  - No. of HP piston rings
  - Expected life of piston rings
  - Details of inlet and the exhaust valves and their expected life.
  - Stroke length - mm
  - Piston speed (max)
  - Head clearance
  - Ratio of compression per stage.
  - Air temperature at L.P discharge and intercooler discharge and final delivery at rated capacity and 8, 9 and 10.5 kg/cm<sup>2</sup> with inlet temperature range up to 60°C.
  - Dimension, material specification, heat treatment and method of manufacture of:-  
Piston, Piston Rings, Valves, Cylinder Heads, Crank Shafts, Connecting Rods & Crank Pin.
4. Starting and running torque required for the compressor against a back pressure of 10.5 Kg/cm<sup>2</sup>.
5. Type, details of suction air filter used in the compressor. Indicate filtering efficiency and dust retentively.

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6. Materials and specifications used for gaskets.
7. Location of rubber or synthetic sealing media, if used.
8. Details of unloading arrangement, if provided.
9. Details of cooling fan, fan guard including mounting drawings.
10. Details (with over all dimensions) of coupling used. The permissible limits of misalignments and guaranteed trouble free service life shall also be indicated.
11. Type, specifications, make and average life of main and connecting rod bearings.
12. Lubrication details of bearing, type of grease, quantity, frequency.
13. Type, details and working of
  - (i) Inter cooler safety valve
  - (ii) Auto drain valve
14. Type, specification, make and average life of resilient mount.  
Mounting and maintenance details of resilient mount.

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	Santhosh Ch Melant	