

ANNEXURE - ITECHNICAL SPECIFICATIONSDESCRIPTION OF WORK:

Design, manufacture and Supply of Lubricating Oil system for uninterrupted oil supply to Bearings & Gear Box of High speed Compressor test rig running at maximum speed of 15000 RPM.

Lube Oil Requirement:

- Gear Box : 120 LPM at 2.0 bar (gauge) at bearing inlet
- 90 mm Journal Bearings - 2 Nos. : 2 x 40 LPM at 1.5 bar (gauge) at bearing inlet
- Thrust Bearing 8" Dia. : 100 LPM at 1.0 bar (gauge) at bearing inlet
- Total Oil Requirement : 300 LPM
- System Operation : Indoor
- Oil Grade : Servo Prime57
- Specific Gravity : 0.83 to 0.88
- Cleanliness Level Requirement : ISO 15/12 grade or NAS-6 grade
- Oil Reservoir Capacity : 1500 Ltrs. (Approx.)  $\pm$  50 Ltrs.
- Height of Compressor center : 1.8 - 2.0 Meters (Approx.)  
Line from floor

SCOPE OF WORK:

Design of Lubricating oil system with piping circuit, design of Oil Cooler, selection of variable speed motors with pump, Instrumentation, Control panel and VFD panel. Supply & assembly of sub systems, erection, commissioning & testing of total system for various flow conditions. Various sub-systems requirements are given below:

1.0 Lube Oil Power Pack Requirements

- 1.1 Supply & Installation of Suitable oil Pumps with Electrical Motors one number each for pressure & suction line.
- 1.2 Oil Filters with 5 Microns Filtering Capacity and 0.2 bar Pressure drop across the filter for upstream and return lines with digital LED indication for clogging. The material shall be Fibre glass/S.S pleating material with S.S support.
- 1.3 Digital oil Flow meters with an accuracy of 1% of full scale with local LED display and 4-20 mA signal out put for connection to data logger - 5 Nos. (0-50 LPM range - 2 Nos., 0-150 LPM range - 2 Nos. and 0-350 LPM range - 1 No. for return line).
- 1.4 Digital pressure gauges 0-5 bar range with an accuracy of 1% of full scale with local LED display and 4-20 mA signal out put for data recording - 9 Nos. (5 Nos. in control panel and 4 Nos. in oil supply line at the close to bearings location out side of compressor casing).
- 1.5 Digital Temp. Indicators 0-100 °C range with an accuracy of 1% of full scale - 9 Nos. (4 Nos. in the upstream lines, 4 Nos. in the return lines at the casing exit and 1 No. in oil reservoir).
- 1.6 Pressure & Flow regulators in control panel for all the four upstream lines.
- 1.7 Pressure safety valves for safe operation of overall system.
- 1.8 Oil level indicator for reservoir with digital indication with (4-20 mA) standard output and hooter indication.
- 1.9 Oil reservoir minimum capacity 1500 Liters.  $\pm$  50 Ltrs. with drain valve, manhole for cleaning, suitable corrosion protection coating and lifting hooks.

- 1.10 Fault buzzer for failure of Lubrication system.
- 1.11 Suitable SS pipe lines for Pressure and return line as per the site condition.
- 1.12 Sight glass for flow visualization in both pressure and suction lines.
- 1.13 Other accessories like Pressure relief valves, Pressure regulating valves, throttle valves, pressure switches, gate, globe & check valves, thermo switch, hoses and fittings etc. are to be provided as per requirements of the total lube oil system.

## **2.0 Oil cooler**

- 2.1 Selection & supply of Oil cooler suitable for minimum 1,20,000 K Cal/hr heat load capacity with corrosion protection coating.
- 2.2 Cooling water circuit is to be designed to suit the existing Cooling tower capacity of 95 Tons Nominal, with 1425 LPM water flow rate available at BHEL. In case higher flow rate is required, please specify.
- 2.3 Cooling water requirement and pipe connection sizes for supply of cooling water need to be furnished.
- 2.4 Overall design layout of Oil cooler to be furnished.

## **3.0 VFD with Battery Backup facility**

- 3.1 Suitable VFDs with control panel for the pressure and suction line Motors with common Battery back-up for Lube Oil System as given in Sec. 1.0. Accepted make for VFDs: Yaskawa / Mitsubishi / Emerson / ABB / Hitachi Hi-Rel / Siemens only. Accepted make for Batteries: Exide / Panasonic / Amron / HBL only. Please indicate the Make, Model and Capacity for VFDs and Batteries.
- 3.2 **VFD Panel type, construction and cooling:** Totally enclosed construction with suitable ventilation & cooling and External forced cooled with air as medium.
- 3.3 LED indicators for **MAINS ON, CHARGER ON, BATTERY CUT OFF, BACKUP ON, BATTERY LOW VOLTAGE, BATTERY CHARGING OVER VOLTAGE** and **BATTERY CHARGING OVER CURRENT** Etc. on Front Door of the Control panel.
- 3.4 VFD by pass provision in control panel to run the motors with DOL on AC mains power in case of VFD failure.
- 3.5 POTs for variation of motors speed while running on VFD.
- 3.6 Digital panel meters with an accuracy of 0.1% of full scale  $\pm 1$  digit on Front Door of the Control Panel for indication of the following parameters:
  - a) Input Voltage.
  - b) Input current.
  - c) RPM Indication for both the motors
  - d) Battery Bank D.C Voltage.
  - e) Battery Bank charging Voltage
  - f) Battery Bank Charging Current
- 3.7 Three Phase mains Input power indicating LED lamps for R, Y, B phases.
- 3.8 LED lamp Indication for **DRIVE RUN, DRIVE FAULT, BYPASS DOL ON, BYPASS DOL TRIP**, etc. on Front Door of the Control panel..
- 3.9 Push buttons for **DRIVE START, DRIVE STOP, BYPASS DOL START, BYPASS DOL STOP** and **EMERGENCY STOP** for each motor separately on Front Door of the Control panel.
- 3.10 TPN SFUs for both the motors in control panel.
- 3.11 Battery backup time of 10 minutes is to be provided for VFD's in case of power failure with suitable Battery Bank.
- 3.12 D.C Power isolation MCCB in VFD control panel.

3.13 Battery should be connected to VFD with suitable change over mechanism. In case of Power failure change over time should be less than 20 milli seconds and Motors should not stop & and restart.

3.14 Stand alone Battery Bank with SMF batteries in suitable closed enclosure type cabinet with necessary ventilation and cooling arrangement. Vendor shall specify AH capacity and No. of cells for 10 min back up at 100% load.

3.15 Protection for preventing over discharge of Battery bank. Cell voltage of battery shall not get discharged less than 1.75 Volts.

3.16 High capacity battery charger has to be used for quick recharging of batteries. The typical charging time for battery recharging should be 4 hours or less for 90% of full battery capacity.

3.17 Two charge / discharge cycles of Battery Bank will be carried out at site during commissioning. Vendor shall specify expected battery life under normal working condition.

3.18 Detailed calculation of battery AH capacity and battery back-up time taking End Cell voltage of 1.75 volts should be submitted along with technical bid.

3.19 Separate MCCB/Fuse for battery Bank is to be provided.

3.20 Battery charger with Micro Controller based Charge Control Unit should be provided.

3.21 Protection in battery charger for **OVER CHARGE, OVER VOLTAGE** and **OVER CHARGING CURRENT** should be provided.

#### **4.00 General Requirements**

4.1 Test and Quality plan for verification of specified pressure and flow of four pressure lines and performance of oil cooler. Vendor shall submit the complete 'Quality Plan' for the project along with the detailed procedures for all the checks and performance tests to be carried out at works as well as after installation along with the technical offer.

4.2 The equipment shall confirm to relevant safety standards.

4.3 The operating noise of the system should be below 80 db.

4.4 **The above system is to be supplied with 3 Years warranty and also with Performance Bank Guarantee for 10 % value of the order.**

4.5 Yearly calibration of all the gauges of the Lube Oil system like Flow Meters, Pressure Gauges and Temp. Indicators Etc. are to be carried out **free of cost** during the 3 years warrantee period.

4.6 Please quote **yearly AMC charges as an option separately for 3 and 5 Years** after expiry of 3 years warrantee period along with calibration charges for power pack measuring instruments.

4.7 Two sets of Spare Oil filter cartridges along with gaskets & "O" rings (The material shall be non-asbestos type) are to be supplied along with the above system.

4.8 A list of mandatory spares must be provided by the supplier and a set of special tools and commissioning spares are to be included in the supply.

4.9 All the Components, measuring instruments, equipments of the above system should of standard make from reputed brands. Details are to be furnished by the Vendor.

4.10 System lay out drawings are to be submitted for approval before starting manufacturing activity.

4.11 The vendors shall visit TML lab for assessment of space availability for designing of the system, quantum of work and for any technical clarifications. Vendor shall submit the tentative layout of the total lube oil system offered by them along with the technical bid.

4.12 **The scope includes (but not limited to):** design, material, fabrication, assembly, testing (at works and at BHEL site), supply, packing, forwarding, transportation, receipt, unloading, storage, erection (all tools tackles, crane, equipments that would be required for erection is to be arranged by supplier) , installation, testing (supplier must arrange for all materials, instruments and equipments that will be required for the testing), commissioning of the complete system and proving of performance at site etc.

4.13 Any other requirements not set forth in these specifications, but necessary for the safe and reliable operation of the equipment shall be included. Quantities other than specified shall be supplied for satisfactory commissioning of the equipment. Variations due to site requirement shall be incorporated.

4.14 Equipment operation instructions, maintenance and service manuals (together with all VENDOR manuals for bought out items), Mechanical and Electrical drawings, Part list are to be supplied in 3 sets each.

4.15 The vendor shall have experience in design, manufacture & supply of such type of Lube Oil systems. Vendor shall provide the credentials regarding manufacturing & supply above system and also enclose a selected list of customers for whom such systems have been supplied in last 5 years, along with the technical bid.

4.16 **Vendor should furnish TECHNICAL COMPLIANCE STATEMENT in the enclosed format as per ANNEXURE-II along with Technical bid FOR EACH OF THE ITEMS OFFERD SEPERATLY.** The Vendor should not say Complied, should explicitly specify the specification of the items offered. The deviations if any may clearly be indicated, in case of it either being better or worse than the indicated requirements. BHEL reserves the option to disqualify the tender if the statement as per ANNEXURE-II is not submitted and relevant information is not indicated in the compliance statement.

4.17 Vendor must submit complete information against clause No. 4.15 & 4.16. The offer meeting this clause would only be processed. BHEL reserve the option to disqualify the tender in case of non-conformity of the above conditions (4.15 & 4.16).

#### 5.00 Purchaser's scope:

5.1 Electrical power supply 415 V AC +/- 10 %, 3 Phase, 50 HZ +/- 3%, 4 wire supply of suitable capacity will be provided with a DB at one point. The cabling is to be done from this point by the supplier.

5.2 Cooling Water for Oil Cooler will be provided. Please furnish the pipe sizes and flow/quantity requirements.

#### 6.00 Deliverables:

6.1 System & Sub-systems Layout details & Part lists.

6.2 Testing plan to meet the desired specifications.

6.3 Calibration reports for all flow & temp. measuring instruments like oil flow meters, pressure gauges and temp. indicators.

6.4 Project management and documentation/final inspections as per applicable standards.

6.5 Performance test report for the total system and oil cooler.

6.6 Equipment operation instructions, maintenance and service manuals (together with all VENDOR manuals for bought out items).

6.7 Warranty certificate along performance Bank Guarantee for 3 years.

  
**K S R SWAMY**  
**MANAGER / TML**