



JOB SPECIFICATION (GAS TURBINE DRIVEN CENTRIFUGAL COMPRESSOR PACKAGE)

PROJECT : Installation of New GTC Compressor at Gandhar,
Gujarat,

OWNER : Gas Authority of India Limited

PMC : Engineers India Limited

JOB NO. : B240

A	16.04.19	ISSUED WITH MR	AS	NK	NK
Rev. No	Date	Purpose	Prepared by	Checked by	Approved by

1.0 GENERAL

1.1 Scope

This specification describes the minimum requirements for design, engineering, manufacture, testing, supply & supervision of erection and commissioning of Gas Turbine Driven Centrifugal Compressor package as described hereunder and in various attachments forming part of Inquiry document.

- 1.2 The intent of these requirements is to supplement, highlight and modify the requirements as given in the datasheets, specifications as listed under list of attachments forming part of the MR and other applicable standards and codes as specified therein.

1.3 Other General Requirements

- 1.3.1 The design, construction, manufacture, supply & testing and other general requirements of the compressor package shall be strictly in accordance with the data sheets, this job specification, Drawings, standard specifications etc. as listed under "List of Attachments" as well as other referred codes, standards and recommended practices etc. which also form a part of this specification.

- 1.3.2 Along with compliance with this specification, bidder shall also have responsibilities of furnishing equipment and accessories of proper design, materials and workmanship to meet the specified start-up and operating conditions.

- 1.3.3 Compliance with this specification shall not relieve the Vendor of the responsibility of furnishing equipment and auxiliaries of proper design, materials and workmanship to meet specified operating conditions.

2.0 SITE & UTILITY DATA

- 2.1 Refer Doc. No. B240-910-80-42-SU-5010 forming part of inquiry document.

3.0 LOADING & PENALTY CRITERIA

- 3.1 Refer Doc. No. B240-910-80-42-LP-5010 forming part of inquiry document.

4.0 QUALIFICATION CRITERIA

- 4.1 Refer Bidder Qualification Criteria enclosed elsewhere with the RFQ. Bidder shall submit Proven Track Record Proforma duly filled-in alongwith supporting documents for Bidder Qualification attached with the RFQ.

4.2 QUALIFYING CRITERIA (QC) FOR AUXILIARIES:

- (a). QC for Dry Gas Seal/Dry Gas Seal skid and Gear-unit are as specified in the successive clauses.
- (b). The offers submitted by the bidders shall be evaluated based on the basis of offers meeting the QC of main equipment and the information required to satisfy the QC requirements of auxiliaries/bought-out shall be submitted post-order after finalizing the details of such bought-out equipment.
- (c). Pumps coming in auxiliary systems such as Lube oil system etc. included in the package shall be of field proven design sourced from the approved vendors as listed in ANNEXURE-A to this job specification. The equipments sourced by the package vendor shall comply to the relevant standards indicated in the inquiry document. In case of an order, Bidder shall furnish details of all auxiliaries, as asked under vendor data requirements, during detailed engineering stage i.e. post order. Reference list for the auxiliaries shall be submitted during detailed engineering stage post-order.

5.0 SCOPE OF SUPPLY/ WORK & EXCLUSIONS

- 5.1 The Compressor manufacturer of the Proposed Compressor model shall be the Single Point responsibility Vendor (SPRV).

Single point responsibility Vendor's scope of supply is described in data sheets, specifications, Process P&ID's, equipment layout and scope of supply doc. no. B240-910-80-

42-SS-5010 forming part of the inquiry document.

However, it shall be the responsibility of the SPRV to furnish a safe operating unit. For this purpose, in case SPRV envisages additional equipment / instruments / control and safety devices, the same shall be offered by the SPRV and included in his scope of supply. Such additional items shall be separately listed with reasons for their inclusion.

5.2 Bidder to note that during detail engineering stage, the compressor package shall be studied for HAZOP review. Any suggestions/modifications raised during HAZOP review shall be implemented by vendor without any cost/time implication to the purchaser. Generally the additional scope may be limited to supply of few instrumentation, valves, etc (as required).

5.3 Exclusions

Following are excluded from Vendor's scope of supply:

- Foundation & civil works.
- Compressor shelter, other Civil & structural work.
- Erection & Commissioning (Except supervision).

6.0 GAS TURBINE AND COMPRESSOR SIZING

6.1 The enclosed Process Datasheet specifies two cases of operation i.e. Case-1 and Case-2.

Case-1 represents while GANDHAR GPU is running condition (normal & mst prevelant operating case). Case-2 represents while GANDHAR GPU is stopped condition.

6.2 GTC train shall be selected to suit all the operating cases as per Process Datasheet with **Case-1B-2** as the Certified/Guarantee case as indicated in Compressor Datasheet (Doc. No. B240-910-80-42-SP-5010).

The continuous base rating of Gas turbine at the specified site conditions of altitude, intake & exhaust losses, site rated temperature, humidity shall not be less than:

(a). 110% of maximum compressor power required for Case-1.

(b). 105% of maximum compressor power required for Case-2.

including any Transmission losses. Following Site conditions shall be considered for arriving at GT rating:

Site Altitude	m	8 m above MSL
Max. Inlet Loss (At Site)	mm H ₂ O	100
Max. Exhaust Loss (At site)	mm H ₂ O	100
Site Rated/peak Temperature	°C	47°C
Relative Humidity	%	90% @ 47°C

7.0 Piping termination and Vendor's battery limit

7.1 Process Gas Piping

The Compressor shall be supplied flange to flange. No process gas piping (inlet/inter-stage/discharge) is included in the Vendor's scope of supply.

7.2 Utility Piping

(a). The purchaser shall supply single point supply connection near the compressor package battery limit for all utilities like:

- Nitrogen.
- Instrument Air.
- Fuel Gas.
- Starting Gas.
- Seal Gas etc.

P&IDs as attached may please be referred for further details.

(b). Bidder shall furnish Utility consumption requirements for Nitrogen, Instrument Air , Fuel

gas, Starting Gas, electrical load requirements for auxiliary systems (i.e. lube oil pumps, portable lube oil purifier, portable oil filling & emptying Pump etc) for the offered compressor package.

- (c). All interconnecting distribution piping to various consumption points within Vendor's Battery Limit, tubing, cabling, supports including isolation valves at the tie-up points of Vendor's battery limit shall be engineered, designed and supplied by the Vendor.
- (d). All Piping shall be supplied prefabricated with minimum field joints and as a commercial length, where prefabrication is not possible due to general erection constraints. Refer Tentative Layout for compressor package for "Piping Battery limits for Utility Piping" near to the compressor package battery limit.
- (e). All vents pipes shall be supplied by the Vendor with valves, fittings etc. and terminated to the safe elevation outside the compressor house.
- (f). Vendor shall terminate all the drains at the grade level with isolation valves for further connection to purchaser CBD/ OWS system. Also Vendor shall terminate all the compressor-casing drains manifolded to single connection at the grade level for further connection to purchaser CBD/ OWS system. Further, any device if required to match with the operating and design conditions of existing CBD/ OWS system shall be in Vendor's scope.
- (g). All flare lines required for the package shall be piped by the Vendor up to purchaser's flare header and shall be free draining towards the flare header.

8.0 OPERATING & CONTROL PHILOSOPHY

8.1 The unit start-up shall be essentially automatic with two button operation along with "Confirm operation Button". Pressing of the first button & "Confirm operation Button" shall initiate the sequential steps leading to a purged and pressurised compression system ready for start. Pressing of the second button & "Confirm operation Button" shall cause sequential start-up of gas turbine compressor train, bringing the unit to speed and loading it.

In the event of pressing the normal stop button, the shutdown sequence shall end with compressor trains in the pressurised mode ready for start. With the pressing of the second button, the system shall be completely depressurised and after completion of all the sequential steps, 'ventilated shut down' shall be displayed on the panels.

The unit shall be brought safely to a shutdown/ventilated shutdown in the event of activation of the emergency push button or in the event of a malfunction as part of the GTC protection and sequence control system. Detailed sequence block diagrams and logic diagrams for start-up / shutdown etc. shall be approved by the Purchaser.

8.2 The complete compressor-gas turbine train shall be capable of remote starting / stopping from Unit/Compressor control panel installed in the Main Control Room (MCR). However, Start clearance from the field will be provided. Monitoring & Control of the Compressor station shall be performed at two levels viz. Station PLC and Unit Control Panel (UCP)/Common facility panel (FCP). For Details refer Instrumentation Specifications.

8.3 Emergency shutdown of the compressor train shall be possible from Unit/Compressor control panel, Master control center as well as from local gauge board on the GTC skid regardless of mode selection.

8.4 Monitoring and control of the compressor station are envisaged to be performed as under.

System	Control and Monitoring from
Gas Turbine Compressor (GTC) Train, Fuel Gas Conditioning Skid, indication and alarms etc	1. Unit/Compressor control panel/PLC 2. Master Control Center/Station PLC (only key parameters)
Station Flow Computers/Repeat Signals to and from GTC Train PLC	1. Purchaser's Common Facility Panel/PLC for common facilities 2. Purchaser's Master Control Center/Station PLC (only key parameters)

Note: Refer Instrumentation System Configuration Schematic Nos. B240-910-16-52-SK-0001 Rev. 0 and

B240-910-16-51-SK-0002 Rev. 0 attached elsewhere.

9.0 SPECIAL REQUIREMENTS

9.1 COMPRESSOR

9.1.1 The Centrifugal compressor and associated equipment shall conform to API Std. 617, 7th edition together with EIL Standard specification no. 6-42-0005 Rev. 2 and other specifications as listed in the List of Attachments forming part of MR.

9.1.2 The compressor shall be selected so as to fully meet the requirements specified in data sheets (i.e. Process data sheets and Equipment datasheets) and specifications as well as referred codes and standards forming part of the inquiry document.

9.1.3 Compressor shall be driven by Gas Turbine (GT) through a Gear Unit (as applicable).

9.2 DRY GAS SHAFT SEALING SYSTEM

9.2.1 Compressor shall be equipped with dry gas shaft sealing system. All dry gas seal piping between auxiliary skids and compressor shall be included in Vendor's scope.

The Proposed Dry- Gas Seals shall be bi-directional, interchangeable between drive end and non-drive end and of Tandem & cartridge type design. The Seal faces lift-off speed shall always be below than compressor-train minimum operating speed suggested by vendor.

The dry gas seal modules shall be on separate skid from the lube oil console comprising of all the necessary instruments like pressure reducing valves, pressure & temperature and differential pressure instruments etc.

9.2.2 Seal gas skid shall be compact, easily operatable/maintainable and designed to ensure that there is no condensate ingress in dry gas seals.

9.2.3 The dry gas seal and seal gas system shall be designed for the supply / return / mechanical design conditions of the proposed seal gases OR casing MAWP, whichever is greater.

9.2.4 The primary sealing medium shall be same as the gas handled by the compressor during normal running of compressor. Conditioning of seal gas to suit dry gas seal requirement shall be done by the vendor within dry gas seal skid.

9.2.5 The secondary sealing medium shall be nitrogen. During start-up / Emergency, external seal gas as Nitrogen from Nitrogen Header shall be made available by the Purchaser at the battery limit for further distribution by Vendor to the primary seals. The provision for change over from normal to emergency seal gas supply is in Vendor's scope. Vendor is advised to review the supply conditions of Nitrogen from Nitrogen Header from "Site & Utility data" and shall indicate their limitations, if any. Vendor shall also furnish the quantity of N2 required during first start-up, subsequent start-up (without requiring depressurisation of compressor) & emergency. N2 bottle bank with a load cell (suitable for area classification), suitable for compressor start-up shall be supplied by the vendor.

9.2.6 Instrument air as separation gas shall be provided between Secondary seal and Compressor Bearing to prevent flow of lube oil to seal area.

9.2.7 The Dry Gas Seals & Sealing system shall be designed for settle-out pressure attained after the Compressor trip. Vendor shall supply Seal system complete with all necessary pressure regulators, Control valve, Pressure safety valve, electric heaters, Pressure gauges, piping from Purchaser's battery limit to Compressor Seals along with fittings, other instruments, and controls, stainless steel piping, Coalescing filters and Steel bodied transfer valves with Stainless Steel trim/internals. If required based on Seal Gas Conditions, Stainless Steel piping shall be insulated and heat traced by the Vendor to prevent any condensation.

9.2.8 During emergency/stand-still settle-out conditions, if the min. pressure of plant nitrogen (as mentioned in site and utility data) is not sufficient for buffer/primary and barrier/secondary seals sealing of dry gas seal (based on settle-out conditions), Bidder shall provide Seal Gas Boosting System (as required) and associated axillaries along with necessary instrumentation

& logics, as part of dry gas seal skid (&) Nitrogen Bottle Bank (as recommend by bidder) with auto-change-over valve(s) and associated axillaries along with necessary instrumentation & logics.

9.2.9 Coalescing filters: If required based on Seal Gas Conditions, Coalescing filters shall be equipped with stainless steel housing & shall have filtration efficiency of 98% on liquids (i.e. 1 micron or greater) & solids (i.e. 3 microns or greater). The collapse pressure of the filter elements shall be minimum 50 psi (3.5 kg/cm² g) differential. Filters shall be twin filters each with an overdesign margin of 20%. The seal vents shall be routed to flare or safe disposal.

9.2.10.. QC for Dry Gas Seal:

The offered model of Dry Gas Seal shall be field proven and similar in terms of specified process gas service, shaft diameters, speeds, sealing pressures and configuration as compared to at least TWO UNITS designed, manufactured, tested and supplied and at least ONE of these units shall have completed at least one year of satisfactory operation at site as on bid due date of main equipment. Bidder shall furnish past supply experience list of the seal manufacturer for the offered model of seal and justify meeting accepting criteria, during detailed engineering stage.

9.2.11.. QC for Dry Gas Seal Skid:

The offered dry gas seal skid and panel shall be field proven and similar to the specified operating parameters as compared to at least TWO UNITS designed, manufactured, tested and supplied by the proposed manufacturer and at-least ONE of these units shall have completed at-least one year of satisfactory operation at site as on the bid due date of main equipment.

9.2.12.. Bidder shall indicate process gas & Nitrogen consumption requirements during normal, stand-still/settle-out & start-up conditions.

9.2.13.. Vendor shall indicate the guaranteed seal leakage rate in compressor data sheet.

9.2.14.. Operating and spare seals shall have the following shop tests:

- (a). Cleanliness (No discoloration or hard particles found on 20 mesh screen after module blown for 5 minutes with 100 psig (7.0 kg/cm² g) dry filtered gas.
- (b). Gas Leak at a pressure equal to settling out pressure with a mol weight gas equal or less than the seal gas
- (c). Functional run for minimum of one hour at operating pressure and speed. Following the test, the seal elements shall be examined for wear and general conditions.
- (d). Other tests as per Annexure 1D of API 617.

9.2.15.. The design & drawings of dry gas seal skid and panel shall be vetted by the dry gas seal manufacturer to ensure the trouble free operation.

9.2.16.. Dry Gas seal shall preferably be of one of the makes as listed in the vendor list attached in the this document.

9.3 ANTI-SURGE CONTROL SYSTEM

9.3.1 Anti-surge control system furnished for the compressor shall include all Instruments viz. (Flow, Pressure, Temperature, Speed) Transmitters, Indicators, control valve, surge controller with accessories as required for completeness of the surge control loop. The design/engineering, testing, supply and supervision of erection and commissioning of the complete system shall be in bidder's scope of supply. Details of the proposed system shall be furnished by the bidder along with the bid.

9.3.2 The surge controller shall be installed at a location as indicated in the Instrument Specifications/P&IDs.

9.3.3 Bidder shall be totally responsible for any coordination with controller supplier in realising the

anti-surge control system for safe and reliable operation of the compressors.

- 9.3.4 Instrumentation specifications and process P&ID's as enclosed with the inquiry documents shall be referred for further requirements.

9.4 COMPRESSOR SUCTION STRAINERS

- 9.4.1 Bidder shall provide a suitable permanent strainer "T" type strainer at gas inlet with spool piece arrangement to facilitate removal for each of the stages as per P&ID. Suction pressure indicated in the data sheet is at the Suction flange of the Compressor. A pressure drop of 0.1 Kg/cm² has been considered across the strainer, to arrive at the compressor suction pressure. In case the pressure drop is more than the above value, Vendor to indicate the pressure drop and re-calculate the value of suction pressure at compressor flange. The revised value of suction pressure shall be indicated on compressor data sheet & shall be the basis of sizing/selection of the compressor. Strainer shall be mechanically suitable to withstand a pressure drop of 5 kg/cm². The open area shall be at-least 150%.
- 9.4.2 Bidder to indicate the mesh size and the pressure drop across the strainer. A Differential pressure indicator with high differential pressure alarm & shutdown shall be provided for differential pressure across the suction strainer.
- 9.4.3 Vendor shall provide a temporary strainer, which shall be housed in the same spool piece as provided for the permanent strainer for each of the Compressor stages as per P&ID. The temporary strainer in each case shall be used for commissioning of the compressor after which the same shall be removed and permanent "T" type strainer installed.
- 9.4.4 This strainer shall be installed as indicated in the enclosed P&ID. Strainers shall be of full line size.
- 9.4.5 All strainer materials shall confirm to Strainer Datasheet attached with the Bid Document. Vendor to furnish the details for the strainer.
- 9.4.6 Piping specifications as attached elsewhere in tender may also be referred.

9.5 CASING DRAINS

- 9.5.1 All casing drains of the compressor shall be manifolded by the Vendor and terminated at the skid edge with double isolation valves. Drains shall be connected by the vendor to purchaser's nearest OWS point(s).

9.6 GEAR UNIT

- 9.6.1 The Gear unit shall conform to API Std. 613, 5th edition 2003.

9.6.2 QUALIFYING CRITERIA (QC) FOR GEAR UNIT

The gear box shall be from a regular and established manufacturer of API 613 gear unit having requisite design, manufacturing and testing facilities.

The Gear-Unit model offered shall meet the following minimum service and manufacturing experience requirement:

Gear Box model offered shall be identical or validly similar in terms of Power rating, Pinion speeds, Gear ratio, Mechanical Design, Materials as compared to at least ONE UNIT designed, manufactured, tested and supplied from the proposed manufacturing plant in the last Fifteen years and shall have operated for one year at site as on the bid due date.

Note: Provenness of the offered Gear-unit w.r.t. the qualification criteria shall not be reviewed during bid-evaluation stage. The same shall be reviewed during post-order stage upon placement of order. Duly filled in experience record proforma shall be submitted post-order to establish provenness of the offered Gear Unit model. However, if it is found during post-order stage that the offered gear-unit does not satisfy the QC

as above, then bidder shall provide alternate make/model of gear-unit (meeting the QC as above) without any time/cost implication to the purchaser and without any increase in the "Guaranteed BKW".

9.7 GAS TURBINE

9.7.1 The Gas Turbine and associated equipment shall conform to API Std. 616, 5th edition together with EIL Standard specification no. 6-43-0041 Rev. 2 and other specifications as listed in the List of Attachments forming part of inquiry document.

9.7.2 The gas turbine shall be either of heavy-industrial, light-industrial or aero-derivative type and Single/Multiple Shaft design. All the components including gas generator to be supplied with gas turbine and as spares shall be newly manufactured against this order. This shall be indicated from the manufacturing serial number.

9.7.3 The Vendor shall furnish detailed time schedule of inspection/overhaul of various components. The design life of major components shall also be indicated. This information shall be indicated in the proposal.

9.7.4 Gas Turbine starting system:

(a). Gas Turbine driver can be with a gas starting (expansion turbine) system & the pipeline gas (start-up gas) as available shall be used for the purpose. The gas starter gas (gas based start motor) should be provided with speed monitoring system to measure the speed of the starter during startup & after the starter drop out to ensure the safety of starting system & clutch mechanism.

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Alternatively, the Gas Turbine starting system can be of soft starter based electric type i.e. VFD fed electric Motor Starter (Clutched) subject to the condition that the electric motor starting system shall be suitable for starting at full load with 750 kVA (Prime Rated Power) rating emergency DG set (in purchaser's scope) with GTC and all its auxiliaries (i.e. Air-cooled LO coolers, auxiliary motors etc.) on full load. The electric starting system shall be complete with all associated accessories, instrumentation & controls. **A categorical confirmation w.r.t. the above shall be provided in the bid.**

(b). Complete Gas starting system includes the equipment required for making the gas suitable for expander, interconnecting SS piping along with companion flanges from source to expander & vendor pipes shall be supplied by SPRV (Applicable PMS shall be referred for flanges and gaskets etc.) are included in bidder's scope.

(c). Starting Gas used for starting the gas turbine shall be measured by installing a meter in starting gas line for the Gas turbine. Bidder to supply the metering system with flow computer suitable for compressibility correction as per AGA 8 detailed method.

(d). Bidder shall refer the battery-limit conditions of start-up seal gas in Process Datasheet and Compressor datasheet. Any boosting system (if required) to boost the starting gas pressure shall be included by bidder in his scope.

9.7.5 Air inlet system:

(a). The air intake system shall be complete with silencer, plenum chamber, filter, filter housing, Pre-fabricated air inlet ducting, Expansion joints, flanged connections and transition pieces etc. as required along with necessary instruments and controls. The air intake shall be from safe area (16 m from nearest leakage source). **All parts coming into contact with inlet air shall be of Stainless Steel construction (SS) construction. The filter housing shall be of SS.**

(b). The air inlet system shall be equipped with a differential pressure transmitter and indicator in mm of water. There will be provision of an alarm in case of increase of pressure drop across filter. At still higher pressure drop, turbine shall shutdown by 2 out of 3 voting logic.

- (c). The Air Intake System shall be suitable for the operating conditions specified by the Gas Turbine Manufacturer.
- (d). Detailed fabrication, installation drawings & bill of materials for structural supports, access/ maintenance platforms, ladders for the Inlet Air filters & Inlet Air Ducting shall be submitted for Purchaser's review/approval during detailed engineering.
- (e). Design of inlet ducting shall be made in such a way that it requires minimum time and effort to remove when the Gas Turbine has to be maintained/overhauled.
- (f). Air filters shall be latest state of the art design such as synthetic type in place of conventional Cellulose type so as to ensure enhanced life. Air filtration capacity shall have an overdesign margin of 20% over capacity.
Filters shall be sourced from reputed manufacturers. Complete details of filter along with filter manufacturer's catalogues along with list of references shall be reviewed & approved by Purchaser during detailed engineering stage.
- (g). The inlet air filter shall meet the mandatory requirements of the Gas Generator (GG)/Gas Turbine (GT) and Vendor in all respects.
- (h). Inlet air filter shall be provided with a stainless steel weather hood/louvers and heavy mesh wire insect / bird screen.
- (i). The inlet air filter element shall be replaceable while the unit is in operation. Vendor shall furnish complete details of filter cleaning / replacement procedure and the expected time duration between each such operation and the expected life of filter elements (expected filter element change out period). The filters shall be provided with DPI, alarm & shutdown for high differential pressure.

9.7.6 Exhaust system and Emission control:

- (a). The exhaust shall be routed to atmosphere through exhaust stack/chimney. SPM emission at GT exhaust shall be limited to 150 mg/Nm³ & 100 ppm NO_x v/v @ 15 % Oxygen. Emission monitoring ports shall be provided in GT exhaust for monitoring exhaust emission. These ports shall be in an area with steady flow. The GT Vendor to note that water /steam system is not acceptable for reducing the emission levels.
- (b). The exhaust system for the Gas turbine shall include but not limited to:
 - Exhaust collector
 - Exhaust silencer
 - Transition Pieces
 - Exhaust duct
 - Expansion joints
 - Exhaust stack/chimney (minimum 30 m height)
 - Instrumentation and controls as required
 - Necessary insulation for personnel protection. Surface temperature of cladding shall not exceed 60°C at any point of time.
 - Supports
- (c). The exhaust stack/chimney shall be of self supporting type complete with suitable ladder/staircase for maintenance of the same as per the specifications attached elsewhere. The stack//chimney shall be provided with connections/ tappings for measuring emission levels with emission-measuring equipments for on line emission measurement equipment (Purchaser's supply) etc.
- (d). The exhaust system shall be suitably located relative to the air inlet, ventilation inlet/exhaust and after cooling air, so that no recirculation of exhaust gas to inlet air filters, coolers is possible.
- (e). The exhaust stack shall be suitably insulated and jacketed so as to minimise heat

contribution to other units and to provide personnel protection. Exhaust system shall be adequately supported.

- (f). The exhaust shall be fitted with suitable silencer capable of reducing overall train noise levels to below the permissible noise level limit as specified in this specification.
- (g). Provision shall be made for preventing the accumulation of monsoon rainwater in the exhaust system when the unit is not running. The purchaser shall approve the details of this provision.
- (h). Design of exhaust ducting shall be made in such a way that it required minimum time and effort to remove when the GT has to be maintained/ overhauled.

9.7.7 Fuel Gas System

- (a). The Fuel gas system shall be as per Clause 5.8 of EIL Standard 6-43-0041 Rev. 2 attached elsewhere in the inquiry document. In addition to what is specified in the EIL standard Specification as above Vendor shall also include all Instrumentation and valves , auto vent valve downstream of Shutdown valve (SDV) etc as indicated in Piping and Instrumentation diagrams (P&ID) forming part of the inquiry document.
- (b). Bidder shall obtain the detailed fuel gas specs from the GT manufacturer and it shall be the responsibility to engineer, design, manufacture, tests the Fuel gas conditioning system to meet the specific fuel gas requirements from the available pipeline gas offered by Purchaser for GT fuel. Vendor shall also take into account the possibility of cold starting of the unit during winter.
- (c). All fuel gas piping downstream of the fine filters shall be stainless steel 304.
- (d). In case of tripping of compressor train (normal or emergency); gas supply to individual turbine compressor train shall be cut-off by SDV. Suitable arrangement for auto-venting of fuel gas downstream of SDV in such an event shall be provided.
- (e). Fuel gas supply from conditioning skid to each train shall be provided with a PCV. Gas turbine fuel gas control / governing (complete with instrumentation, piping and valves etc.) shall be GT Vendor's standard proven system and shall satisfy the established safety means for such systems.
- (f). Fuel Gas Conditioning skid shall be so designed that Proper maintenance space is provided around & within the Fuel Gas conditioning skid to take care of the bundle pulling arrangement for Fuel Gas Heater, filters etc. The local gauge board etc should be located in such a manner so that accessibility/visibility is maintained. Gas conditioning skid shall be sourced from one of the vendors as listed in Annexure-A of this job specification. Alternatively the same can be supplied from OEM certified suppliers subject to availability of reference list for the intended application.
- (g). Skid shall be complete with the following:
 - Instrumentation, valves and controls as required.
 - Fuel gas piping between "fuel gas conditioning skid" and the Gas Turbine shall be in Vendor's scope along with any Insulation/heat tracing as required.
 - Relief valves/thermal safety valves with block and bypass shall be provided as required. Discharge of all such PSV/PRV/ TSV's shall be manifolded and terminated at skid edge with isolation valves.
 - All condensate drains shall be manifolded and terminated at skid edge with isolation valves. Drains shall be connected to purchaser's nearest OWS point(s)

All vents shall be terminated at safe location.

9.7.8 Gas Turbine Washing System

The turbine shall be equipped with offline cleaning system along with crank/soak washing facility with all accessories, as required for internal turbine cleaning. Turbine shall have control for manual cranking and run up without firing. Vendor shall indicate recommended

periods between cleaning under specified site and operation conditions. Liquid tank, piping and fitting etc. required for above purpose shall be of stainless steel. Instrument air and not gas generator air shall be used for pressurisation of liquid tank, if required.

The Gas Turbine Washing/Cleaning System shall be portable trolley mounted complete with reservoir, driver, interconnecting flexible hose piping (10 m each at each port), hose-storage-wheel, valves, motor cable of approximately 30 m length & plug to suit the area classification & necessary instrumentation & controls.

9.7.9 Gas Turbine Enclosure

- (a). Weather proof sound attenuating enclosure shall be provided for the Gas turbine which shall meet all the requirements as per Clause no. 5.7.5 of EIL Std. Specification no. 6-43-0041 Rev. attached in the inquiry document. Additionally, the following requirements shall also be complied with.
- (b). The enclosure must be quickly detachable and equipped with lifting lugs for easy removal. Enclosure shall be constructed of easily handled sections to facilitate maintenance of and removal of the gas generator and power turbine. Access door(s) shall be provided for inspection, repair and maintenance of the turbine and its system. Turbine enclosure shall also have glass window with seal tight metallic covers. The enclosures shall be suitable for operation under conditions as specified and shall be rigid enough to withstand all static and dynamic loads.
- (c). The enclosure shall be constructed with fire resistant materials. All enclosures shall be free of any depression or crevices where water or dust might collect.
- (d). Provision shall be made for removal of rainwater, which might collect inside ventilation exhaust duct. Ventilation air intake and exhaust shall be provided with silencers having stainless steel splitters.
- (e). All instrument & electrical items, which are energised before start of pressurisation or remain energised after loss of pressurisation, shall be suitable for area classification as specified in Instrumentation and electrical specs attached elsewhere in the MR.
- (f). The enclosure shall be provided with fire detection system including thermal detectors, flame detectors etc., gas detection system and fire suppression system using CO2 as per the specifications enclosed elsewhere in the MR.
- (g). Detailed fabrication, installation drawings & bill of materials for structural supports, access/maintenance platforms, ladders for of the ventilation Fans & Ventilation Air Ducting shall be submitted during detailed engineering for the Purchaser's review.

9.8 LUBE OIL SYSTEM

9.8.1 General

- (a). The lube oil system shall conform to API standard 614, 4th edition and attached data sheets and other specifications as listed in the List of Attachments forming part of inquiry document. Console type common lube oil system shall be supplied for Compressor, Gear Unit & Gas Turbine Driver.
- (b). Gas Generator (GG) lube oil (LO) system may be independent if so recommended by the gas generator manufacturer. In such case GG LO system shall be as per GG manufacturer's standard. GG LO system shall comply with all the mandatory requirements of GG manufacturer.
- (c). Vendor shall design the lube oil consoles from the point of view of easy accessibility, 500 mm free space around and maintainability of the major pieces of equipments such as coolers, pumps, drivers, control valves, filters etc. Vendor to ensure easy personal movement and no criss crossing of piping in the consoles. Vendor shall not consider his standard congested consoles but shall design the layout in spread out manner. The layout shall be furnished for review and approval by the purchaser during detailed

engineering.

- (d). The LO system shall be complete and include oil reservoir, lube oil pumps (main & auxiliary), Emergency Oil Pump (EOP), hydraulic oil pumps (main & auxiliary oil pumps), an overhead emergency lube oil run-down tank suitably sized so as to ensure supply of lube oil to compressor train for complete coast down time and cool off (separate accumulators shall be provided for pump change over), twin filters, air-cooled oil cooler, and all necessary valves, fittings, gauges etc. as required by purchaser's specifications.
- (e). The material of construction of lube oil reservoir, lube oil supply and return piping, valve internals etc. shall be of Series 300 Stainless Steel.
- (f). Oil mist eliminator shall be provided in all lube oil vent lines to minimize the loss of lube oil due to vaporization. All the oil mist eliminator shall be mounted at suitable height by the Vendor.
- (g). All inter-connecting lube oil piping from oil console to various consumption points in the equipment, including fittings, valves, instruments and supports shall be included in the Vendor's scope of supply. Lube oil piping between compressor, oil console and lube oil run down tank shall also be in Vendor's scope of supply. Vendor shall engineer the system and furnish detailed P&IDs as well as the piping drawings for the interconnecting piping for purchaser's review/ approval during detail engineering stage.
- (h). Reservoirs, pumps, coolers, filters and control valves shall be provided in an assembled console. Console shall have a steel baseplate with rim and drip lip for drainage.
- (i). Matching companion flanges, gaskets, fasteners etc at all terminating points requiring Owner's interface (Applicable PMS shall be referred for flanges and gaskets etc.) and All Stainless Steel supply & return piping/tubing between LO console & compressor /GT are included in Vendor's scope.
- (j). Supply of First fill of lubricants for the machines is not included in the Vendor's scope of supply. However, the Vendor, in his proposal, shall indicate the Grade of Oil and the quantities required for flushing oil and for first fill of Lubricant for each machine forming part of the Compressor package.

9.8.2 Drivers for Lube oil Pumps

Following Driving arrangement is envisaged for LO pumps.

Main Lube oil Pump	:	driven by Electric (AC) Motor
Standby Lube oil Pump	:	driven by Electric (AC) Motor (Emergency AC feeder)
Emergency Oil Pump	:	driven by Electric (DC) Motor (DC battery bank)

For voltage and frequency levels electrical specifications may please be referred.

9.8.3 Oil Coolers

- (a). Oil coolers shall be Air-Cooled and shall be supplied and manufactured according to the requirements API standard 614, 4th edition.
- (b). The cooler tubes shall be series 300 stainless steel. The header boxes shall be made of hardened stainless steel plate. The header plug material shall be selected to prevent galling.
- (c). The oil cooler shall be equipped with temperature-controlled bypass valves and sized for a minimum temperature approach of 10 deg.C to the maximum ambient air temperature.
- (d). Oil cooler should be provided with adequate number of fans with 100% spare capacity. Cooling area shall be 200 % of the required surface area.
- (e). Electronic vibration switches shall be provided for each fan and shall alarm on high

vibration.

- (f). Each cooler shall be designed for 110 % of cooling capacity. ASME Code stamp is required on all coolers.
- (g). Cooler fans shall be electric motor driven directly (V Belt drives are not acceptable). Flexible metallic couplings shall be used for coupling motor & fan.
- (h). Equipment furnished for Air-cooled exchangers shall include, but not limited to:
 - Coolers with fans and guards, electrical motor drivers.
 - Vibration cutout switches.
 - Pneumatically-actuated, opposed-action type louvers with Positioners for automatic control of oil temperature (controlled by temperature control system).
 - Access platform and ladders.
- (i). Size and thickness of tubes, maximum number of fins per inch shall be as per relevant applicable functional specification and API code.
- (j). Motors shall be in accordance with functional specification of electrical motors, suitable for area classification.

Provisions shall be made in the Cooler design to facilitate ease of cleaning of the cooler.

9.8.4 Filling/Emptying out Pump

One portable trolley mounted pump with necessary hose piping, valves, connections etc. shall be provided by Vendor for emptying out / filling the main oil reservoir. Pump capacity shall be 3 m³/hr (minimum) and it shall be electric motor driven, with a flexible motor cable of 30 m length and plug to suit the area classifications and motor rating. Ten metres of hose piping shall be provided both at inlet and outlet along with hose storage wheel by the Vendor.

9.8.5 Oil Purifier Unit

The Vendor shall supply one portable trolley mounted oil purifier unit common for all compressor-turbine packages. The capacity of oil purifier shall be sufficient for total oil treatment in approximately 12 hours. It shall be provided with a flexible cable of 30 m length and plug to suit the area classification and motor rating. Ten metres of hose piping shall be provided both at inlet and outlet of the oil purifier unit along with hose storage wheel.

9.9 Couplings

- (a). The coupling shall conform to API-671, 3rd Edition, October 1998 with a service factor of 1.75. While selecting the coupling, it shall be ensured that the allowable shaft stresses of the Compressor train are not exceeded under any circumstances including any offset condition or conditions of maximum torque.
- (b). In case of Compressor train having a gear-unit, the the coupling service factor shall not exceed the gear-box service factor.
- (c). Coupling shall be non-lubricated flexible metallic element type.
- (d). Coupling hubs and spacers shall be dynamically balanced at coupling manufacturer's works as one unit and all components shall be properly match marked.

9.10 Common Skid and Base-Plate

- (a). Gas Turbine Compressor (GTC) train shall be mounted on a common skid/base-plate designed to support the compressor, Gear unit and gas turbine. The skid/base-plate shall be suitable for 4/6 point lift. Non-skid decking shall be provided on the skid/base-plate by Vendor.
- (b). In case for transportation reasons from port/Manufacturing works to site, splitting of this skid is required, the same shall be done by the Vendor. Splitting shall be done only with purchaser's prior approval. In case where splitting is essentially required, the skid/base-plate shall be designed so as to make a common skid/base-plate by bolting and dowelling at site and the complete skid/base-plate shall also be suitable for 4/6

point lift.

- (c). Vendor shall provide suitable spreader bars/spreader frames for transportation of common skid/base-plate or independent skids/base-plates.
- (d). Auxilliary Skids (e.g. Fuel Gas Conditioning Skid, Buffer Gas Skid etc.) shall be so designed that Proper maintenance space is provided around & within the skids for maintenance purpose of individual skid components. Local gauge board etc should be located in such a manner so that accessibility/visibility is maintained. All maintenance aspects of various skid components shall be reviewed by Purchaser and complied by vendor.

9.11 Piping (Refer piping specification also)

Piping for lube oil and internal seal gas piping shall conform to API 614. Other piping requiring Purchaser's interface shall conform to enclosed specifications.

All piping, fittings, valves etc. specified in Vendor's scope of supply shall conform to the technical requirements specified in the relevant codes and standards. However all interfaces shall conform to purchaser's requirements specified in the P&ID's and respective Piping Material Specification (PMS) & piping specs enclosed with the inquiry document.

9.12 Pressure Vessels

All pressure vessels, tanks required for lube oil system, buffer gas supply system, fuel gas system & starter gas system etc. shall be in accordance with the relevant API standards namely API Std. 617, API Std. 616, API Std. 614 & ASME Section VIII Div I.

9.13 Electricals

All electrical and lighting systems for the package shall be as per the electrical specification and data sheets as per list of attachments forming part of the inquiry document and other codes/Standards referred therein.

9.14 Instrumentation and Controls

The Vendor shall supply the necessary instrumentation and control system as described in Equipment and Instrument Data Sheets and Specifications, Process P&IDs and other specified instrumentation standards forming part of the inquiry document and other codes/Standards referred therein.

10.0 INSPECTION AND TESTING

10.1 General

- (a). Inspection and test requirement have been detailed out in data sheets and/or specifications for various equipments.
- (b). All tests which are marked as witness tests may be witnessed by Owner's and/or Consultant's Inspector.
- (c). Vendor shall submit detailed Test Procedure for approval of the Purchaser at least four months in advance of the actual date of conducting each test.
- (d). Complete details of all tests and inspection requirements must be consolidated by the Vendor in a single document entitled "Inspection and Test Schedule for Compressor Package".
- (e). For all witness tests, Vendor shall give at least one month's notice and shall reconfirm the date of testing at least one week before the date of test.
- (f). The following tests besides being witnessed by Owner's/Consultant's Inspector may also be witnessed by Owner's/Consultant's equipment specialists. Vendor shall inform the Purchaser the scheduled test dates 6 weeks in advance and reconfirm the firm date of testing 1 week in advance.
 - (i). Mechanical Run Test for Compressor with Main Rotor as per API Std. 617 & EIL Standard Spec. 6-42-0005 at Compressor manufacturer's works.

- (ii). Mechanical Run Test for Compressor with Spare Rotor as per API Std. 617 & EIL Standard Spec. 6-42-0005 at Compressor manufacturer's works.
- (iii). Performance Test for Compressor (with main rotor) as per Type 2 ASME Code PTC-10 at Compressor Manufacturer's works.
- (iv). Mechanical run test for the Gas Turbine with main rotor (Industrial type GT) / Gas generator (Aero-derivative type GT) as per API Std. 616, PTC 22 & EIL Standard Spec. 6-43-0041 at Gas Turbine Manufacturer's works.
- (v). **Mechanical run test for the Gas Turbine with spare rotor (Industrial type GT) / Gas generator (Aero-derivative type GT) as per API Std. 616, PTC 22 & EIL Standard Spec. 6-43-0041 at Gas Turbine Manufacturer's works.**
- (vi). Performance Test for Gas Turbine main rotor (Industrial type GT) / Gas generator (Aero-derivative type GT) as per API Std. 616 and EIL Standard Spec. 6-43-0041 at Gas Turbine Manufacturer's works.

10.2 Field trial run test:

- 10.2.1.. The GTC package shall also be subjected to **"Field trial run test"** for 72 hours of continuous operation. The duration of 72 hours shall be on sustained basis i.e. process interruptions shall be allowed to cumulate, however machine related interruptions shall not be counted. During the field trials safe and satisfactory operation of the GTC package shall be established. **Bidder shall include the expenses for the field trial run test/performance acceptance test in his basic scope. No per diem rates shall be payable for the same.**
- 10.2.2.. The field trial run test shall be done with available media and load to ensure safe, smooth, reliable operation, mechanical integrity and sound level of the complete package.
- 10.2.3.. Modifications/additions/changes as required to resolve/correct any fault in the package, detected during field trial run test shall be in vendor's scope without any time/cost implications to the purchaser.
- 10.2.4.. If any additional equipments/instruments are necessary in addition to those in vendor's scope of supply for the purpose of testing & measurement, vendor shall bring them to site duly calibrated and shall take them back after successful completion. All utility and safety systems shall be operating during the test.

10.3 Performance Guarantee test (PGTR) at site:

- 10.3.1.. The GTC package shall also be subjected to **"Performance Guarantee test run (PGTR) at site"** inline with the requirements as per EIL Std. specification no. 7-76-0103 Rev. 1 attached elsewhere in the inquiry document. Bidder shall be informed regarding the site readiness for PGTR post commissioning. Bidder shall accordingly arrive at site with required manpower, tools, instruments etc. on the notified dates (mutually agreed with purchaser) to make necessary arrangement for carrying out PGTR at site.
- 10.3.2.. The PGTR shall be done with the process gas (as per Process datasheets) and at full load for 04 (four) hours duration to establish satisfactory performance (in terms of performance guarantee parameters, pressure and temperature etc. as per inquiry document).
Note: The duration of 04 (four) hours shall be on sustained basis i.e. process interruptions shall be allowed to cumulate, however machine related interruptions shall not be counted.
- 10.3.3.. Modifications/additions/changes as required to resolve/correct any fault in the package, detected during PGTR shall be in vendor's scope without any time/cost implications to the purchaser.
- 10.3.4.. If any additional equipments/instruments are necessary in addition to those in vendor's scope of supply for the purpose of testing & measurement, vendor shall bring them to site duly calibrated and shall take them back after successful completion. All utility and safety systems

shall be operating during the test.

- 10.3.5..** The cost for the "Performance guarantee test at site" shall be quoted as Lumpsum optional cost in the unpriced price schedule and purchaser shall exercise the option during order placement, if deemed necessary.

10.4 Sound Level Test

- (a). Sound pressure level of the complete unit operating at site at full load shall not exceed 85 dBA at any point when measured at 1 m. from the skid in any direction.
- (b). Sound level measurement for information purposes shall be done during no load complete unit test.
- (c). In case specified noise level limit is not met at site, the Vendor shall suggest and implement necessary modifications in the system to reduce the noise level to the specified noise level.

11.0 PARTICIPATION OF PURCHASER'S ENGINEERS DURING ASSEMBLY AND OTHER IMPORTANT ACTIVITIES:

Purchaser may depute his engineers at the Compressor/Gas turbine manufacturer's shop during the time of rotors assembly, balancing of rotor, main assembly of compressors and such other important activities which may be required to be performed during maintenance of the machines and the associated system. The Purchaser's engineers deputed in the Compressor/Gas turbine manufacturer's shop shall participate in the assembly operation and other activities and shall maintain record of all the final data like tolerances, clearances etc. Vendor shall have to provide all such data and records to the Purchaser's engineers and shall have to clarify all such data. Vendor shall submit along with the bid a list of activities in which such participation shall be useful for future maintenance work, along with the time period of each activities and the schedule when these activities are likely to be performed.

12.0 TRAINING

Vendor shall make arrangements for training of 15 persons x 02 weeks = 30 man weeks for the purchaser's operating and maintenance personnel at his/his sub Vendors works to familiarize them with all aspects of operation and maintenance of mechanical, electrical, instrumentation & controls (inclusive of Compressor/Gear Box/Gas Turbine/ Anti-Surge Controller etc.) of these packages.

13.0 SPARE PARTS / SPECIAL TOOLS

13.1 Mandatory Spare Parts

Bidder shall include all the mandatory spare parts as specified in "List of Mandatory Spares" Doc. No. B240-910-80-42-SL-5010 Rev. A as attached in the inquiry document.

13.2 Commissioning Spares

Bidder shall include in his proposal, sufficient spares required for commissioning of the GTC package as per his experience/recommendation & furnish a list for the same. If however, any additional spare is consumed over and above the quoted commissioning spares, during commissioning, the same shall be provided free of cost, by the Vendor. Any leftover spares after commissioning shall be handed over to the owner.

13.3 Special Tools / Tackles

- (a). Special tools and tackles required, if any, for erection, site assembly & maintenance of each equipment of the compressor package as recommended by the equipment manufacturer shall be included in the bidder's proposal.
- (b). The following special tools & tackles shall be supplied by the Vendor. If any specific item in the list below is not applicable, then the same shall be justified with suitable technical justification by the bidder.
 - Necessary power tools required for all bolts greater than 32 mm diameter.
 - One set of Hydraulic tightening devices, as required shall be supplied along with low

- pressure and high-pressure pumps.
- One set alignment tools including fast align laser alignment tool for alignment purpose.
- Industrial digital video scope.
- Torque Wrenches/Bolt Tensioners.
- Coupling removal tools
- Special tools for dismantling/assembly of GT
- Special tools for dismantling/assembly of Compressor
- Rotor lifting tools
- Seals mounting tools.
- Bearing tools
- Transportation stand / container for the Gas generator for transporting the Gas Generator to the work of OEM for overhaul / major repair.

All special lifting tools/tackles including spreader bar etc. shall also be included in the bidder's scope of supply.

13.4 RECOMMENDED SPARES FOR TWO YEAR NORMAL OPERATION

Bidder shall include in his proposal, his recommended spares for 2 years normal operation (Mechanical, Electrical and Instrumentation) over and above the mandatory spares, for compressor package (Quote only) including compressor, driver, lube oil and seal gas, electrical, instrumentations etc. together with, part no., name of the parts, cost and recommended quantity of spare against the GTC train. Prices shall be firm for two years from the date of order.

14.0 SUPERVISION DURING ERECTION AND COMMISSIONING

14.1 The GTC package vendor shall provide his services for supervision during erection and commissioning of the Compressor packages. Electrical & Instrumentation engineers (as required) shall also be present along with vendor's erection and commissioning engineers. Site supervision of 60 mandays for the GTC package have been envisaged. As such, supervisory cost of 60 mandays for the GTC package shall be considered for the purpose of commercial comparison (which the vendor may decide between days for Indian/Foreign supervisors and also discipline wise, if required, but total of 60 mandays as indicated above). In case separate rates for different supervisors are to be quoted, then number of man-days of each supervisor must be quoted.

14.2 The above cost for Supervision of Erection and Commissioning shall be considered for commercial comparison purpose only. However, the actual man days consumed at site during supervision of erection & commissioning shall be considered for actual payment. Hence, the cost of supervisory charges shall be quoted accordingly.

15.0 EQUIPMENT LAYOUT

- (a). The main equipment i.e. Compressor, Gear Unit & Gas Turbine train is envisaged to be installed on foundations (at a certain height above grade level). Lube oil console is also envisaged to be located at the Grade level below the main equipment.
- (b). The proposed Equipment Layout (Drawing No. B240-910-83-41-11901 Rev. A) enclosed with the inquiry document indicates tentative Equipment layout alongwith the space available for the complete GTC package. Vendor shall ensure that the proposed equipment package is accommodated within the space allocated in the above mentioned layout drawing The main and auxiliary equipments shall be so arranged within this area such that enough space is available around each equipment for ease of operation and routine maintenance.

NOTE: Space given in the layout cannot be further increased and Bidder has to give his acceptability to overall space during proposal stage itself. Any upward change in the area requirement at a later date shall not be allowed.

- (c). Bidder in his proposal shall include suggested detailed equipment layout indicating main equipment as well as auxiliary equipment various consoles, local panels/local gauge board etc. along with their dimensions and levels at which the same are to be placed.
- (d). Bidder shall also indicate weights of equipment, maintenance space required, crane capacity (recommended) and crane hook approach from the grade level etc. The data/information shall be adequate for designing of compressor house (shelter).
- (e). General Arrangement Drawing (GAD)/ Equipment Layout of all equipment located inside compressor house as well as around the compressor house including main equipment, auxiliaries, and routing of piping etc. *(based on the indicative layout drawing provided in the inquiry)* shall be provided by the bidder along with the proposal.

16.0 VENDOR DATA AND DRAWING

16.1 General

- (a). Vendor Drawings and Data shall be furnished in conformity with the Vendor Data Requirements Forms attached with inquiry document.
- (b). Vendor shall furnish all the information at the time of bidding as specified in the relevant Vendor Data Requirement (VDR) forms and in this job specs.
- (c). The Vendor Data Requirement after placement of Letter/Fax of Intent is indicated in the Vendor Data Requirement Forms for the respective equipment, including the number of weeks within which this data is to be provided. Vendor shall confirm that all data as required shall be furnished by him and shall indicate the Vendor's promised date in the columns provided.
- (d). After the placement of Letter/Fax of Intent, a conference (kick off meeting will be held at such date and at such place, as may be mutually agreed upon between the Vendor and the purchaser. The intent of this conference shall be to discuss/clarify the various requirements and finalize the modus operandi.
- (e). Vendor shall furnish the Drawings/Documents for purchaser's review/approval as per the Vendor Data Requirement (as specified in the specifications/Vendor data requirement forms). The review comments for major and critical drawings (such as system P&ID's General Arrangement Drawings, Foundation Drawings, Performance characteristics, Frequency analysis reports etc.) shall be discussed across the table at such date and place as may be mutually agreed between the Purchaser and the Vendor.
- (f). Vendor shall also provide the operation and maintenance manuals as part of final documentation. The operation and maintenance must include Performance curves & characteristic curves for various operating conditions, Performance footprints at the time of shop testing. The operation and maintenance manual must clearly mention the schedule of all the overhauls along with detailed procedure for carrying out the same.

17.0 SUB-VENDOR LIST

17.1 Refer Annexure-A for vendor list for Dry Gas Seal and Dry Gas Seal skid.

18.0 EQUIPMENT STORAGE

18.1 GTC package shall be packed for an outside storage period of 12 months.

18.2 The following shall be ensured before despatch of the GTC Package:

- (a) All the openings shall be plugged & in sealed condition during dispatch.
- (b) Instruments like gauges, probes, oiler etc shall be removed from the main equipment and dispatched separately to avoid the damage of these components during transportation handling and erection.
- (c) In addition to normal packing the equipment skids shall be separately covered with transparent polythene cover with opening for piping.

19.0 TRANSPORTATION OF THE PACKAGE

- 19.1 For transportation of the packages to the project site, number of pieces and size and weight limitations shall be mutually discussed between the purchaser and the Vendor.
- 19.2 Spare rotors shall be separately shipped with vertical storage box with suitable preservative measures.

ANNEXURE-A

GENERAL NOTES

- 1.0 BIDDER shall necessarily procure all the material / equipment forming permanent part of the unit / plant from OWNER / EIL approved vendors only. This shall include sub-ordered items / components also. The "Approved Vendors" shall be item specific.
- 2.0 OWNER / EIL approved vendor list for the various items is enclosed in this section.
- 3.0 BIDDER may procure material from any of OWNER / EIL approved vendors. However, current validity, holiday status and range of approval as per EIL enlistment letter, workload, stability and solvency need to be verified by the BIDDER with vendor before placement of order. BIDDER is also required to ensure that equipment qualification criteria, specified elsewhere in the bid document, are also simultaneously met.
- 4.0 Vendors on OWNER / EIL holiday list shall not be considered for ordering. BIDDER shall comply with this requirement without any time or cost implication to the OWNER. If a vendor is put on OWNER / EIL's holiday list subsequent to BIDDER placing an order, it shall be BIDDER's responsibility to ensure quality work and timely supply from the vendor.
- 5.0 For items not covered in the above list, the BIDDER shall approach OWNER / EIL for that list or the vendors list shall be approved by OWNER / EIL prior to placement or order by BIDDER. BIDDER shall list down the proposed suppliers / vendors for such items and submit the same for OWNER / EIL's review / approval along with necessary documents / credentials. "Approval status" documents / credentials to be furnished by the vendors in such cases shall solely be the responsibility of the BIDDER. OWNER / EIL's decision on above shall be final and non-negotiable. Acceptance or non-acceptance of a particular proposed vendor due to any reasons whatsoever shall not be a cause of schedule and cost implication.
- 6.0 BIDDER shall make an independent assessment of capability of all the vendors for timely deliveries of material / equipment. Any delays in deliveries by vendor(s) shall not be a cause of schedule and cost implication.
- 7.0 At any stage of the project, if it comes to the notice of OWNER / EIL that BIDDER has procured material / equipment, intentionally or unintentionally whatsoever, from an unapproved vendor and / or items not falling in approved range of vendor(s), the same shall be rejected forthwith and BIDDER shall be liable to replace such material / plant / machinery without any schedule and cost implication to the OWNER.
- 8.0 List of vendors appearing anywhere else in the contract document in case of duplication of the items at two or more places shall not be considered by BIDDER and shall be superseded by the vendor list enclosed herewith. And if in this vendor list also, items seems to be duplicated / repeated then BIDDER shall get clarified the issue by OWNER / EIL before proceeding ahead for procurement activity.

- 9.0 It is understood that should the name of vendor be changed due to change in their company or corporate shareholding. OWNER may accept such vendors under its new name with prior approval.

Any such approval shall however, not absolve the BIDDER from any of his obligations under the contract; neither shall any such approval signify nominations or instruction to use such a vendor. All approved vendors are deemed to have been freely chosen by the BIDDER at his own risk.

SL. NO.	DESCRIPTION	REMARKS
1.0	LUBE-OIL PUMPS-CENTRIFUGAL HORIZONTAL (SPECIAL PURPOSE PROCESS)	
1.1	Arai Pump Manufacturing Company Ltd.	
1.2	Clyde Union Ltd.	
1.3	DMW Corporation [Mishima]	
1.4	Ebara Corporation [Japan]	
1.5	Flowserve Corporation [Japan]	
1.6	Flowserve India Controls Pvt. Ltd.	
1.7	Flowserve (Thompsons Kelly & Lewis Pty Ltd.)	
1.8	Goulds Pumps Inc.	
1.9	Goulds Pumps Co. Ltd.	
1.10	Hyosung Goodsprings Inc.	
1.11	ITT Corporation India Pvt. Ltd. [Vadodara]	
1.12	Kirloskar Ebara Pumps Ltd. [Sangli]	
1.13	KSB Limited [Pune]	
1.14	KSB Pumps Ltd. (Poona) [Satara]	
1.15	Ruhrpumpen GmbH [Germany]	

SL. NO.	DESCRIPTION	REMARKS
1.16	Ruhrpumpen India Pvt. Ltd.	
1.17	Shin Nippon Machinery Co. Ltd.	
1.18	Sulzer Pumps (US) Inc.	
1.19	Sulzer Pumpen Deutschland GmbH [Bruchsal, Germany]	
1.20	Sulzer Pumps India Pvt. Ltd.	
1.21	Weir Minerals Netherlands BV	
2.0	LUBE-OIL PUMPS-ROTARY GEAR	
2.1	Allweiler India Private Limited	
2.2	DEL PD Pumps & Gears Pvt. Ltd.	
2.3	Flowserve Corporation	
2.4	MAAG Pumps Systems AG [Zurich]	
2.5	Shimadzu Corporation	
2.6	Viking Pump INC [USA]	
2.7	Witte Pumps & Technology GMBH	
3.0	LUBE-OIL PUMPS-ROTARY SCREW	
3.1	Alekton Engg. Industries Pvt. Ltd.	
3.2	Allweiler India Private Limited	
3.3	Flowserve Corporation	
3.4	Netzsch Technologies India Pvt. Ltd.	
3.5	Plenty Mirrless Pumps [England]	

SL. NO.	DESCRIPTION	REMARKS
3.6	Pompe Vergani SPA	
3.7	Robbins & Myers Inc	
3.8	ROTO Pumps Ltd.	
3.9	Seepex GMBH (Bottrop)	
3.10	UT Pumps & Systems Pvt. Ltd. (Borneman)	
3.11	Warren Pumps INC.	
4.0	MECHANICAL SEALS (for Lube-Oil Pumps)	
4.1	AESSEAL PLC [ROTHERHAM]	
4.2	Chetra Dichtungstechnik AG	
4.3	Eagle Burgmann India Pvt. Ltd.	
4.4	Flowserve Sanmar Limited (Chennai)	
4.5	John Crane Sealing Systems India Pvt. Ltd.	
4.6	Leak Proof Engg (I) Pvt. Ltd. (Banaskantha-Gujarat)	
5.0	DRY GAS SEAL (REFER QC)	
5.1	Eagle Burgmann	
5.2	Flowserve	
5.3	John Crane	
6.0	DRY GAS SEAL SKID (REFER QC)	
6.1	Eagle Burgmann	
6.2	Flowserve	

SL. NO.	DESCRIPTION	REMARKS
6.3	John Crane	
7.0	GAS CONDITIONING SKID	
7.1	Grand Prix Engineering Pvt. Ltd. [Faridabad]	
7.2	Multitex Filtration Engineers Ltd. [Noida UP]	
7.3	Nirmal Industrial Control Pvt. Ltd. [Thane]	
7.4	Premabargo Italiana SRL	

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