SPECIFICATION FOR DRY GAS SEAL SKIDS FOR CENTRIFUGAL COMPRESSORS

1. SCOPE

This specification covers the minimum requirements of design, detail engineering, fabrication and supply of completely assembled Gas Seal Control System (with impulse piping, tubing and wiring) for a Centrifugal Gas Compressor consisting of (a) Seal Gas Filter Skid & (b) Seal Gas Control Skid compatible with Dry gas seals. The detail of the different operating cases, Gas composition, ambient conditions and design parameters of the different lines, etc are furnished in the project specific DGS specification which is a part of this enquiry.

2. BRIEF DESCRIPTION OF SEAL GAS FILTER SKID AND SEAL GAS CONTROL SKID FOR CENTRIFUGAL COMPRESSOR:

2.1 The Vendors minimum Scope of Supply and Work shall be as indicated below

a) Seal Gas P&I Diagram as per Variant Table-4 of this specification

b) Latest edition of API 614.

c) List of Instruments, make & model as per Table-1 of this specification

2.2 The scope of supply shall include the following for each compressor:

1) Seal Gas Filter Skid
2) Seal Gas Control Skid
3) Mating flanges with gaskets, bolts and nuts at terminal points
4) Spare filter cartridges – 05 sets (Each set consists of number of cartridges required for one Filter Bowl).
5) Loose supplied items like
   a. Interconnection pipes and fittings between both assemblies.
   b. Loose cable glands.
   c. Foundation bolts and accessories
   d. Instruments not mounted on the skids, etc.
   e. Any other item in Vendor's scope but not assembled on the skids

2.3 The function of the system is: -

- To supply and monitor process gas/ Nitrogen/ other gas, as applicable for primary injection to dry gas seals.
- To supply and monitor Nitrogen/ start up gas for purging
- To supply and monitor Inert gas (Nitrogen) for Secondary seals
- To supply and monitor Inert gas (Nitrogen)/ Instrument Air for barrier seals
- To monitor primary gas leakage and initiate Alarms/Shutdown in response to variation in leakage.

2.4 The project specific P&I diagram shall be provided after the placement of the order during the detailed engineering. The availability of the gas for start up in primary injection line and barrier seal shall be finalized as per P&I diagram.

2.5 The total design and selection of the equipment of Seal gas filter skid and seal gas control skid is the responsibility of the Vendor. The ranges and set values of the Instruments are to be furnished by Seal Gas Control Skid & Seal gas filter skid Vendor for BHEL/Customer's review during detailed engineering after the placement of the order.

2.6 The primary seal gas line within filter skid shall be steam traced and insulated. All Piping, Valves and fittings forming a part of steam tracing shall be IBR certified. The steam parameters shall be provided during detailed engineering.

3.0 General arrangement of the skid Assemblies

3.1 Gas Seal Control System shall be designed as two Package Units: - a) Seal Gas control skid and b) Seal Gas filter skid. Each skid shall be stand-alone type and shall be formed out of suitable structural steel.

A common skid shall be supplied in place of individual skids at a) and b) above , whenever indicated in the enquiry.

3.2 Equipments, Instruments, Regulators, Shut off ball valves, Modulating valves, Isolating valves, In-line check valves, Piping/Tubing with fittings, etc. shall be mounted and assembled on the respective skid.

3.3 All the materials in contact with primary seal gas inlet and vent shall be of SS 316L or Equivalent forging/casting materials and suitable for the gas composition specified in Dry Gas Seal specification. Also ,they shall comply with NACE-MR-01-75 latest edition

3.4 All the materials in secondary seal inlet and vent lines, barrier seal inlet and vent lines shall be of SS316 or Equivalent forging/casting materials.

3.5 Vendor to ensure that the Primary seal leakage to flare header lines along with the instruments shall be designed for the design parameters of seal gas lines up to NRV.

3.6 Vendor to provide the condensing pot as per design code ASME VIII div I as required along with control system instrumentation for automatic draining as part of scope of supply, for variants as per Table-4. Also, vendor to check the requirement and indicate in their offer for other variants in case of the following instances.

a) The gas passes through various elements in the system and shall be mixed with Hydrocarbons, which may become condensed on cooling. The vendor to provide suitable arrangement, if required to keep dryness in the gas in all operating conditions and removal of condensate as required for seals. Vendor to provide DEW point curve for our review along with the offer.

3.7 Whenever, the condensate pot is provided, the level transmitter shall be provided by selecting either of the following options which shall be selected after the placement of the order.

a) Guided wave radar type instrument shall be used for level measurement up to 1219 mm. For all level measurement above 1219 mm diaphragm seal type differential

pressure transmitter shall be used. The Guided wave radar type level transmitter shall be with flange size and rating suitable for the design pressure of the system.

b) The level transmitter using remote diaphragm sealed DP transmitter shall be with 3" flange size and rating suitable for the design pressure of the system. The suitable flushing rings along with drain & vent valves shall be provided.

3.8 Whenever, the condensate pot is provided, the following shall be provided

a) A solenoid valve operated drain control valve with proximity type limit switches designed for the condensate/oil flow envisaged for the project.

b) A level transmitter specified in 3.7 above.

c) A level gauge for local indication.

3.9 The Vendor shall note that the appearance engineering is one of the most important aspects. The whole Rack shall be very compact and shall give an aesthetically good look as this equipment is mounted on the operating floor of the compressor.

3.10 The Vendor shall take care of good accessibility for operation and maintenance of all parts. The Instruments and Components disposition /location on the rack and Piping/Tubing layout are paramount important aspect.

3.11 External paint shall be with the thickness 80-150 microns and internal paint shall be with the thickness 40-60 microns. The project specific painting specification, if applicable shall be provided during detailed engineering; vendor to carry out the same without any commercial implication.

3.12 The Skids shall be provided with lifting lugs for a 4-point lift.

3.13 Foundation holes shall be oval in shape to help in installation.

4.0 Seal Gas Duplex Filter

4.1 The Duplex gas Filter shall be as per design code ASME VIII div I, consisting of two filter bowls mounted in parallel with a change over valve. Each filter bowl is 100 % capacity. Clean Process gas is supplied to primary seal through a Duplex Filter with required filtration grade for liquids and solids as required for DGS.

4.2 The collapsible pressure for the cartridge is min. 10 kg/cm2 (g) differential.

4.3 The Gas Pressure to Primary Seal is maintained 0.5 kg/cm2 (g) more than Operating Gas by means of differential pressure controller and control valve.

4.4 While finalising the capacity (Flow) of Duplex Filter assembly, the maximum leakage through the labyrinth into the compressor and the primary seal leakage indicated in DGS specification shall be taken into account along with required margins.

4.5 The changeover valve is used for switching over from one filter bowl during operation so that one filter open to operating gas flow and other closed off for changing filter elements. There shall not be any reduction of flow during switching over operation. Arrows shall be provided on filter assembly to indicate the filter in operation. The change over valve shall be of Trans flow type. Double stage change over valve is preferred.

4.6 The filters shall be provided with drain and vent connections with valves.

4.7 Filtration grade

Solids: Beta 75(98.7% efficient) on 2 microns or greater
Liquids : Beta 75(98.7% efficient) on 1 microns or greater

5.0 Piping

5.1 The Pipe sizes and terminal points shall be as per the Seal Gas P&ID indicated in variant table-4.

5.2 The exact pipe size and terminal points shall be finalised as per the project specific P&I diagram provided during detailed Engineering after the placement of order.

5.3 Vendor shall supply the companion flanges, gaskets, O-rings, Stud nuts, etc. for all flanged end connections.

5.4 All piping and other items shall be as described below

Item	**For rating upto #300**	**For rating upto #600**	**For rating # 1500**
Pipe Schedule	Schedule 80 S	Schedule 80 S	Schedule 160 S
Flanges & 2" Valves	# 300 RF	# 600 RTJ	# 1500 RTJ
Fittings & Valves upto 1½"	SW # 3000 rating	SW # 3000 rating	BW # Sch 160
Fittings for 2"	BW # Sch 80	BW # Sch 80	BW # Sch 160
SS Piping/ Tubing for instruments and control valve	½" piping (schedule 80S) / 12.7x2.1 mm thk Tubing for primary seal inlet and vent lines (Please refer Table 4 and Material code for requirement of Piping / Tubing against this enquiry)		¾" piping (schedule 160S) for primary seal inlet and vent lines
	12.7mm x 2.1mm thk for Secondary & Barrier seal lines		
	6mm x 1mm thk for pneumatic line for control valve		

5.5 Materials shall be as described below

Item	Seal gas inlet & vent upto flare	Sec.seal inlet & vent	Barrier seal inlet & vent
Pipes and tubes	SS 316L	SS 316	SS316
Flanges & Valves	SS 316L	SS 316	SS316
Fittings	SS 316L	SS 316	SS316
Manifolds	SS 316L	SS 316	SS316
Filters	SS 316L	SS 316	SS316

PMI to be done for all materials, fittings & weld materials.

5.6 The dimension of all fittings shall be as per ASME/ANSI standard.

5.7 In general, the following type of valves shall be provided.

a) For piping root valves Globe valves shall be used.

b) For isolation, gate valves shall be used

c) For equalisation and bypass, globe valves shall be used

d) For instrument air, Ball valves shall be used

e) For throttling in secondary and barrier seal lines, needle/globe valves shall be used.

5.8 All Butt-welded joints shall be TIG welded and the welds shall be 100% radio graphed.

5.9 Vent/ Drain/ Any header shall be bigger in size than the individual lines connected to it.

5.10 Supports shall be provided for all items inclusive of pipelines/ tubing/instruments.

5.11 All lines shall be cleaned in order to remove all dust, rust, slag, and all other foreign particles from internal and external parts.

5.12 All the vent/ drain holes, if any shall be plugged with threaded plugs/caps.

5.13 All the instruments shall be provided with individual root isolating valves. The double isolation valves shall be provided for all high-pressure (pressures more than 40 ata) isolation, inclusive for vent & drains.

5.14 Design pressure of all piping, valves, fittings, instruments, filters shall be as described below

Item	For #300 rating	For #600 rating	For #1500 rating
Primary seal inlet and vent lines	35 Kg/sq.cm(g)	84 Kg/sq.cm(g)	210 Kg/sq.cm(g)
Secondary & Barrier seal lines	20 Kg/sq.cm(g)	20 Kg/sq.cm(g)	20 Kg/sq.cm(g)

5.15 The items used for Seal gas inlet & vent upto flare, the following shall be strictly followed

a) All austenitic stainless steel grades shall be solution annealed after welding.

b) Ferrite No. Test: For all austenitic stainless steels, the weld deposit shall be checked for ferrite content. A Ferrite No. (FN) not less than 3% and not more than 10% is required to avoid sigma phase embrittlement during heat treatment. FN shall be determined by Ferrite scope prior to post weld heat treatment.

c) All girth welded joints (longitudinal and circumferential) shall be 100% radiographed in accordance with UW-51 of ASME Section VIII, Div-1 and ASME Section V.

d) VALVES:

i) All valve castings shall be of radiographic quality.

ii) All cast valve flanges & bodies with flange rating of Class 1500 shall be examined in accordance with paragraphs 7.2 through 7.5 of Appendix-7 of ASME SEC-VIII, DIV.1, regardless of casting quality factor.

iii) Body / bonnet / cover joints & stuffing box of all valves shall have low emission and shall be helium leak tested as per ASME Sec.V, Subsection A, Article 10 (Detector Probe Technique), Appendix IV at a minimum of 25% of the allowable (rated) cold working pressure. Sampling for helium leak Test shall be one valve

selected at random for each item of the material requisition. The failure of helium leak test shall call for testing of remaining valves of that item at vendor's cost. The valve shall show no leakage. No leakage is defined as a total leakage rate of less than 0.0001 ml/s of helium. Test Duration shall be 12 Minutes

iv) Casting and test bar shall be heat treated together. Valve casting shall be in solution heat treated and pickled condition.

v) Critical body and bonnet casing section typically defined by ASME B16.34 shall be radiographed and shall meet ASTM E446 (upto 2" thick) Category A,B & CA Level 2, Category CB, OC & CD Level 3, Category D,B & F Level 0. For wall thickness 2" to 4.5" comparable plates of ASTM E186 shall be used. ASTM E94 and ASTM E142 shall be used for recommended practice & controlling quality of radiography as guide. The entire surface of all castings shall be dye-penetrant inspected after pickling.

vi) Repair welds shall be 100% radiographed and evaluated in accordance with paragraph 344.5 of ASME B31.3 with a minimum casting quality factor of 0.95. Dye Penetration test shall be as per ASTM E165 Procedure B-2, Interpretation as per Appendix-8 of ASME-VIII Div.1.

6.0 Instrumentation

6.1 The detailed technical specifications of Instruments, Filter Regulators, Valves, Junction Boxes and other equipment shall be furnished by the vendor.

6.2 All instruments & junction boxes shall be weather proof to IP-65 and shall be certified suitable for use in intrinsic safe circuit and explosion proof for area classification IEC Zone-1, Gr. IIA, IIB and IIC, T3 certified by a statutory body.

6.3 All Instruments shall have internal terminal blocks of anti-vibration type for cable termination suitable for terminating a minimum of 1.5sq.mm size cable conductors. Flying Leads are not acceptable.

6.4 All the instruments shall have Proven Track Record of 8000 hours of successful uninterrupted operation.

6.5 All the instruments and quantity shall be as specified in Table-1.The project specific requirements shall be finalised after the order placement. All the instruments shall be of Smart type and compatible to Hart communication until and unless specified otherwise.

6.6 In some specific projects, the transmitters connected to DCS shall be of Foundation field bus type. The instruments and their accessories like field bus cables, connectors, junction boxes, etc shall be supplied compatible for FF Bus.(FNICO/FISCO)

6.7 Vendor to confirm compliance for the sub-vendors indicated as per Table-1. For the items, which are not covered in the list or vendors are not indicated, vendor has to take prior approval before procurement without any cost/ delivery implications. Vendor to confirm compliance for the same.

6.8 Vendor shall confirm that the bill of material furnished along with offer is only indicative and the final BOM, which shall be furnished during detailed Engineering (after order

placement) for the approval of BHEL. The additional items, if any required for complying BHEL specification at later stage or good engineering practice or for the satisfactory working of the seals shall be supplied by vendor without any price/delivery implications.

6.9 The body of the control valves shall be as per Piping Material Specification and as a minimum trim shall be with stelliting.

6.10 The vendor shall furnish the following test certificates for the instruments

a) Calibration/ test certificates
b) Material test certificates
c) Sub-vendor conformity certificates.
d) Third part statutory certificates

6.11 Vendor shall submit necessary statutory body certificates for the instruments & Junction Boxes, cable glands, etc from the following statutory authorities

a) BIS (Bureau of Indian Standards)
b) CIMFR, Dhanbad
c) Petroleum and Explosives Safety Organization (PESO), Nagpur India (earlier CCOE)

Please note that the above are mandatory for all flame proof instruments of Indian origin.

6.12 Vendor shall submit necessary statutory body certificates for the instruments & Junction Boxes, cable glands, etc from Petroleum and Explosives Safety Organization (PESO), Nagpur India (earlier CCOE) in addition to the certificates from the country of origin for all flame proof items of foreign origin.

6.13 All the Device Description (DD) and common file format (CFF) files for all HART and FF instruments shall be supplied in CD/DVD for configuration.

6.14 The earth connections of all electrical components shall be brought to common bar for further connection to earth pit at site.

6.15 Electrical Junction Box shall be with LM-6 body, 2Nos of Outlet Connections of 1 ½ " NPT at bottom and 12nos of Inlets of size 1/2 " NPT. All inlets and outlets shall be complete with double compression cable glands. Blanking plugs shall be provided for all spare inlets/outlets. Material of cable gland shall be Nickel plated Brass material with PVC hood. Cable glands, JB's and blanking plug shall be suitable for area Classification IEC Zone 1,Gas IIA and , IIB and IIC "EExd" type Cable OD for outlet gland shall be furnished during detailed engineering. Telephone sockets and plugs shall be provided in JB. External paint shade Light Blue Shade 101 as per IS 5.

6.16 Signal cable shall be as follows:

6.16.1 Single pair 7 stranded/ 0.53 mm dia (1.5 mm2) annealed tinned copper conductors of electrolytic grade copper, PVC insulated.

6.16.2 FRLS type, armoured and of 1100V grade and shall meet insulation resistance, voltage and spark test requirements as per BS 5308 part-2.

6.16.3 Conductors as per BS6360

6.16.4 Pr. Insulation: Fire retardant (FR) shall be as per standard IEC 60332.Shall have mica insulation and shall be as per IEC-331 CAT –A type. Primary

insulation and inner jacket of polyethylene with maximum capacitance of 80 pf/m.

6.16.5 Conductor DC resistance at 20° C : ≤ 12.3 ohms / km ; Inductance : ≤ 0.9 μ H /Km between conductors at 1000 HZ; Capacitance ≤0.06 μ F/ Km between conductors at 1000 Hz; Insulation resistance 100 Mohmns / Km.

6.16.6 Color coding: Core insulation: Black & Blue; Inner Jacket: Black; Outer Jacket: Light blue for intrinsically safe application and black for others.

6.17 Spur cable between FF instruments and FF JB shall be Type A as per IEC61158 part 2.

7.0 Instrument Installation Standards

7.1 The Pressure & DP Gauges shall be grouped as per operational requirement and mounted on the Gauge Board in the front side of the Skids.

7.2 All the instruments mounted on the skids shall be installed as per hook up diagrams (to be furnished during the detailed engineering). Based on these, Vendor shall develop & submit a tag number wise installation Standard (hook up) directory for all the instruments supplied/ mounted in the skids based on the above diagrams for BHEL/Customer approval.

7.3 The tubing for Control valves (from air filter regulator, I/P converter and control valve) shall be of stainless steel tubing and the same is in vendor's scope.

7.4 Integral manifolds shall be used only, if the same is acceptable by the customer. The same shall be confirmed after order placement, during detailed engineering.

7.5 If hook up is specified as "piping" in the variant table-4, the piping hookup with welded joints shall be considered for primary seal gas inlet and vent lines. Installation of impulse lines shall be as per piping class.

7.6 Tubing for impulse line to instruments shall be made of SS 316L (for primary seal gas inlet and vent) or SS316 (for secondary seal inlet and vent, barrier seal inlet and vent) tube with double compression fittings of "Swagelok"/"Parker" make and of material SS 316L(for primary seal gas inlet and vent) or SS316(for secondary seal inlet and vent, barrier seal inlet and vent).

7.7 Instead of union; flange to be used in all impulse pipes and tubes irrespective of class.

7.8 For pipe class 600# and above, the impulse piping shall be as per pipe class. In these cases no integral type manifold shall be used. 2-valve or 3-valve manifold shall be fabricated with gate valve and pipe. Equalization with globe valve only. Closed coupled installation shall be considered for high viscous services or hydrocarbons containing water for flow/pressure transmitter. The size (NB) of impulse pipe shall be ¾" for corrosive/congealing and high pressure services to avoid frequent chocking.

7.9 For pipe class below 600#, the impulse piping shall be as per pipe class. However small portion of tubing from impulse line to transmitter shall be made of tube with double compression fittings of "Swagelok"/"Parker" make. In those cases the tube material shall be suitable for that process fluid condition. In these cases the transmitter with integral manifold shall be used.

7.10 Bypass line with isolation valves must be provided for inline instruments like Rotameters, Integral orifice, Control/On-Off valves.

7.11 For impulse line with viscous / congealing services a tee off with blind flange shall be provided for cleaning purpose near to first isolation valve.

7.12 All the transmitters shall have horizontal impulse entry to have easy interchangeability.

7.13 The double valves (2 valves in series) shall be provided for all high-pressure (pressures more than 40 ata) isolation ,vent & drain application.

8.0 Electrical Installation

8.1 Junction boxes shall be weather proof to IP-65 and shall be certified suitable for use in intrinsic safe circuit and explosion proof for area classification IEC Zone-1, Gr. IIA, IIB and IIC, T3 certified by a statutory body, as specified in cause no 6.12.

8.2 Separate Junction box shall be provided for the following signals and grouping of instruments shall be carried out accordingly.

a) Analog Signals for DCS
b) Analog Signals for PLC
c) Field Bus Signals
d) Proximity signals
e) Digital signals
f) Solenoid valves
g) Intrinsic/Explosion proof signals

8.3 Field bus junction boxes (FNICO/ FISCO/HPT)

a) Junction boxes shall be provided with wiring/ termination blocks.
b) Each Fieldbus junction box shall contain wiring terminal blocks for two Fieldbus segments. Wiring / termination block for each segment shall have four spur connections. However vendor shall use only three spur connections and one shall be kept as spare for future connection.
c) In each Fieldbus segment, only one close loop can be connected (if applicable), remaining spur connection in the segment can be used for open loop.
d) Wiring/ termination blocks shall have built-in short circuit protectors.
e) Vendor shall provide field terminator for each segment inside Fieldbus junction box.
f) The junction boxes shall have metallic enclosure.

8.4 Tag plates shall be provided for all the Equipment, instruments & cables. Cable tags shall be provided for both ends.

8.5 Identification ferrules and lugs for termination shall be provided at junction box end and instrument end.

8.6 All the Electrical Instruments shall be neatly concealed wired and terminated in a local junction box requiring only connection to purchaser's wiring. The cable connecting the instrument to junction box shall be armoured.

8.7 Stainless Steel perforated Cable Trays shall be used for cable laying. The edges of cable trays shall be covered suitably using rubber sleeve.

8.8 The JB grouping and terminal allocation shall be as per BHEL cable schedule (provided during detailed engineering)

9.0 The supplier shall furnish the following Documents

9.1 Along with offer

a) Compliance for BHEL specification and its Annexures
b) Signed and stamped Filled up check-list (Table-2).
c) Price Schedule as per table-5.
d) Proven Track Record as indicated in Clause no 10.0.
e) Dew Point Curve.

9.2 Within 2 weeks of Placement of Order/ LOI

a) Vendor shall visit BHEL office within one week of receipt of PO / LOI to collect the project specific information for engineering their drawings / documents
b) Vendor shall submit following in 10 sets for approval for the documents as mentioned below within 2 weeks of Placement of PO /LOI
   i. General Arrangement drawing of Gas Seal Control System Skids giving overall dimensions. It shall show location /disposition of various equipments/Instruments on the Rack and location of customer termination connection.
   ii. Bill of Material of all the equipments, instruments, components etc. The Bill of Material should clearly show the make and model of each component, which are subjected to BHEL/CUSTOMER approval.
   iii. Instruments Data sheets as per ISA format.
   iv. Filled in dry gas seal system data sheet as per API format.
   v. Quality assurance plan.
   vi. Spares list

9.3 Final Documentation

Vendor shall furnish (17 sets of hard copies for a) to c) below + 2 DVD's for all documents mentioned below)

a) Documents mentioned 9.2 above.
b) Terminal wiring details of Junction Box.
c) Instruction, Service and Maintenance manual
d) Test and Inspection reports : 3 copies
e) Guarantee Certificates : 3 copies
f) Photographs for all views : 2 sets(In DVD, the digital photos shall be provided).

10.0 Acceptance Criteria

10.1 The offered Dry Gas Seal system skids (Control system and filter) shall be proven and validly similar to the specified operating parameters, process gas service, pressures and configuration as compared to at least TWO UNITS designed, manufactured, tested and supplied from the proposed manufacturing plant and at least one of these units shall have been successfully operated in the field for at least 8000 hours of continuous operation without any major overhaul as on the date of issue of enquiry.

10.2 Vendor shall furnish complete reference list / details (Proven track record) along with the offer. These details shall include Plant name, year of commissioning, number of operating hours completed and name of contact person(s) etc. for the skids similar to one being offered.

11.0 Inspection and Tests

All the equipments shall be subject to inspection and witness tests by BHEL/CUSTOMER/CONSULTANT. The schedule of quality checks shall be furnished by the vendor in the quality plan which is subject to the approval of customer/consultant/ BHEL. The minimum shall be as indicated in clause 12.0 below and Table-3 Quality Plan.

12.0 Material tests for filter and Changeover Valve for Duplex Filter (as a minimum)

	Type of Check and Test	Certificate Designation	Type of Inspection
12.1	Chemical Analysis	Mills Certificates	Verification of test report certificates by Lloyds
12.2	Mechanical Tests	Certified check by manufacturer	- do -
12.3	Non destructive Tests (as per manufacturer's standard)	- do -	- do -
12.4	Hydrostatic Test (Filter Housing and valve body)	Witness	Lloyds
12.5	Degree of filtration (filter element)	Certificate from manufacturer	Verification of test report certificates by Lloyds

13.0 Marking and Shipping

13.1 Name plates

The Individual components shall be provided with Nameplates giving important details like make, model etc. Each component shall be provided with stainless steel Tag plates duly punching Tag Nos. as applicable on it.

13.2 Preparation for Shipment

a) Equipment shall be suitably prepared for shipment. The preparation shall make the equipment suitable for 6 months of outdoor storage from the date of shipment.

b) Each assembly shall be marked with details like, drawing no, job number, PO No. etc. at a convenient location.

c) Exterior carbon Steel surfaces shall be given at least two coats of Epoxy paint.

d) Flanges openings shall be provided with metal closures.

e) Pipe union openings shall be suitably closed with Swagelok (or Parker) fittings.

f) Lifting Points and lifting lugs shall be clearly identified.

g) All Loose supplied items like interconnection pipe and fittings between both assemblies, loose cable glands, spare filter cartridges, foundation bolts, etc., which are in Vendor's scope shall be listed out separately in the packing list.

h) Adequate amount of silica gel or equivalent shall be provided in the box before despatch for the removal of moisture till installation.

i) All safety instructions for storage and handling shall be indicated on external surface of the box.

14.0 Guarantee

The Gas Seal Control System Skids and each component of the unit shall be guaranteed for 18 months of trouble free performance from the date of shipment or 12 months from the date of commissioning whichever is earlier

15.0 Bids

Technical bids and Price bids are to be submitted in separate sealed covers. Un-priced copy of the price bid shall be furnished along with Technical bid.

16.0 Services:

Vendor shall provide services of their engineers for commissioning of Gas Seal Systems at site for 7 working days

17.0 Training:

Vendor shall at no extra cost to the purchaser, undertake to train 4 engineers selected by the purchaser for a period of 5 working days at BHEL Hyderabad or Vendors works or site

18.0 SPECIAL NOTES

18.1 Vendor should bring out in his offer clause wise deviations if any, with respect to proposed supply along with price adder for withdrawing the deviation to comply with specification. Failure to highlight the same will be construed as acceptance on the part of the vendor to meet the requirement of this specification totally.

18.2 Vendor shall provide the relevant technical information and supporting documents whenever asked for by the customer/ consultant.

18.3 Vendor to clearly bring out any additional requirements which are essential for proper functioning of the dry gas seal system. This shall be included in the offer.

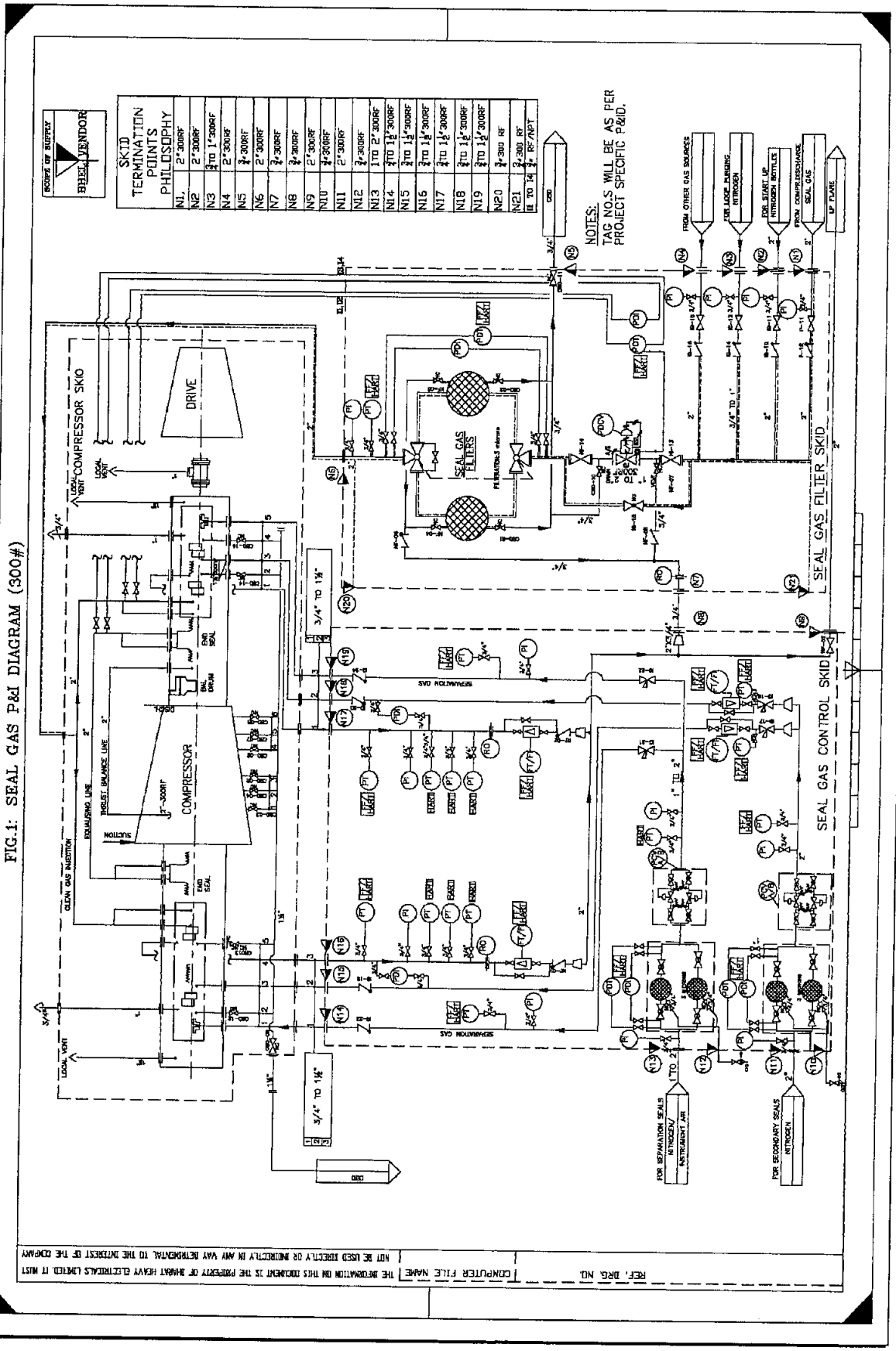
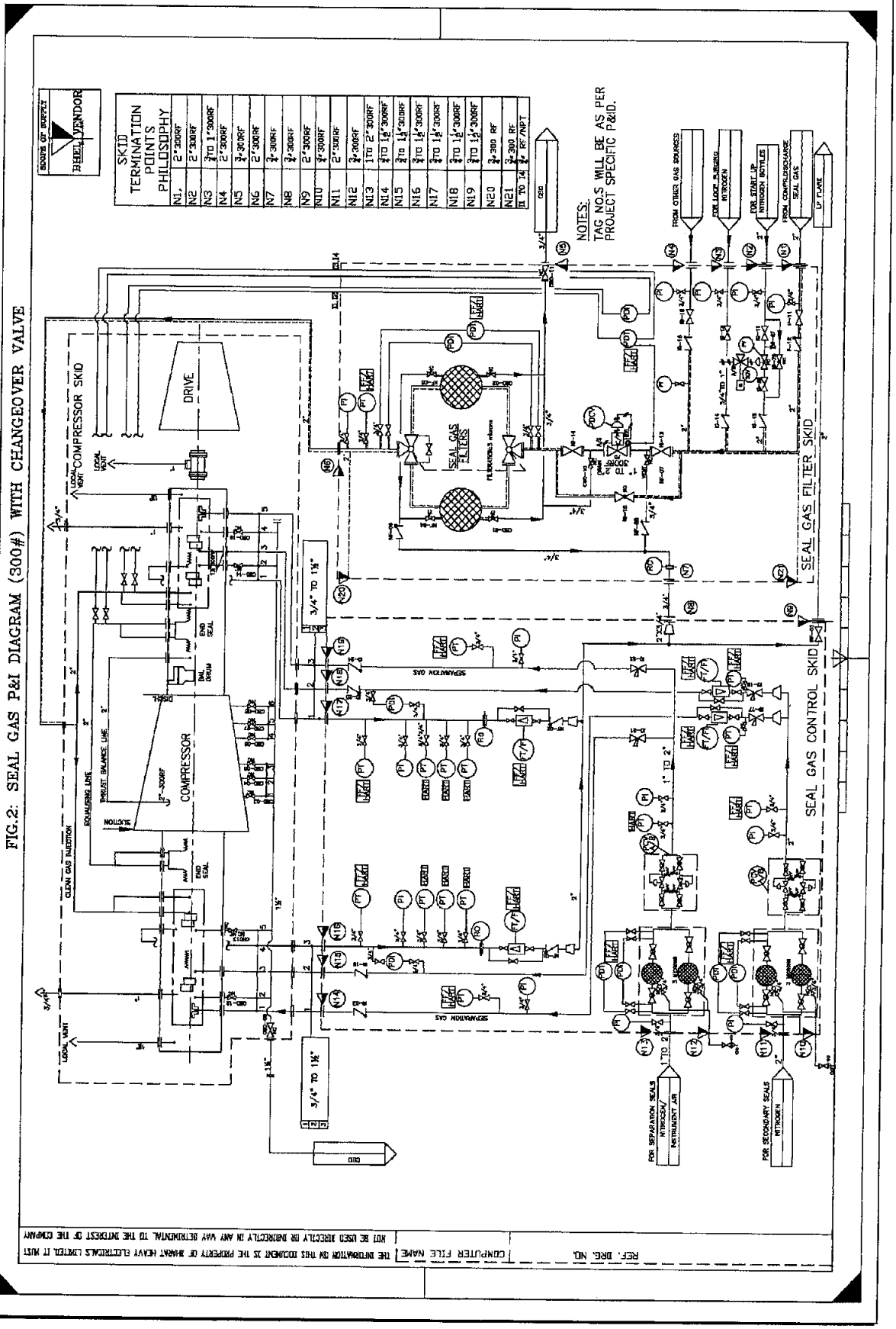


FIG.1: SEAL GAS P&I DIAGRAM (300#)

Ref. Doc.	COMP. FILE NAME
	TC55450.DOC

FIG.2: SEAL GAS P&I DIAGRAM (300#) WITH CHANGEOVER VALVE



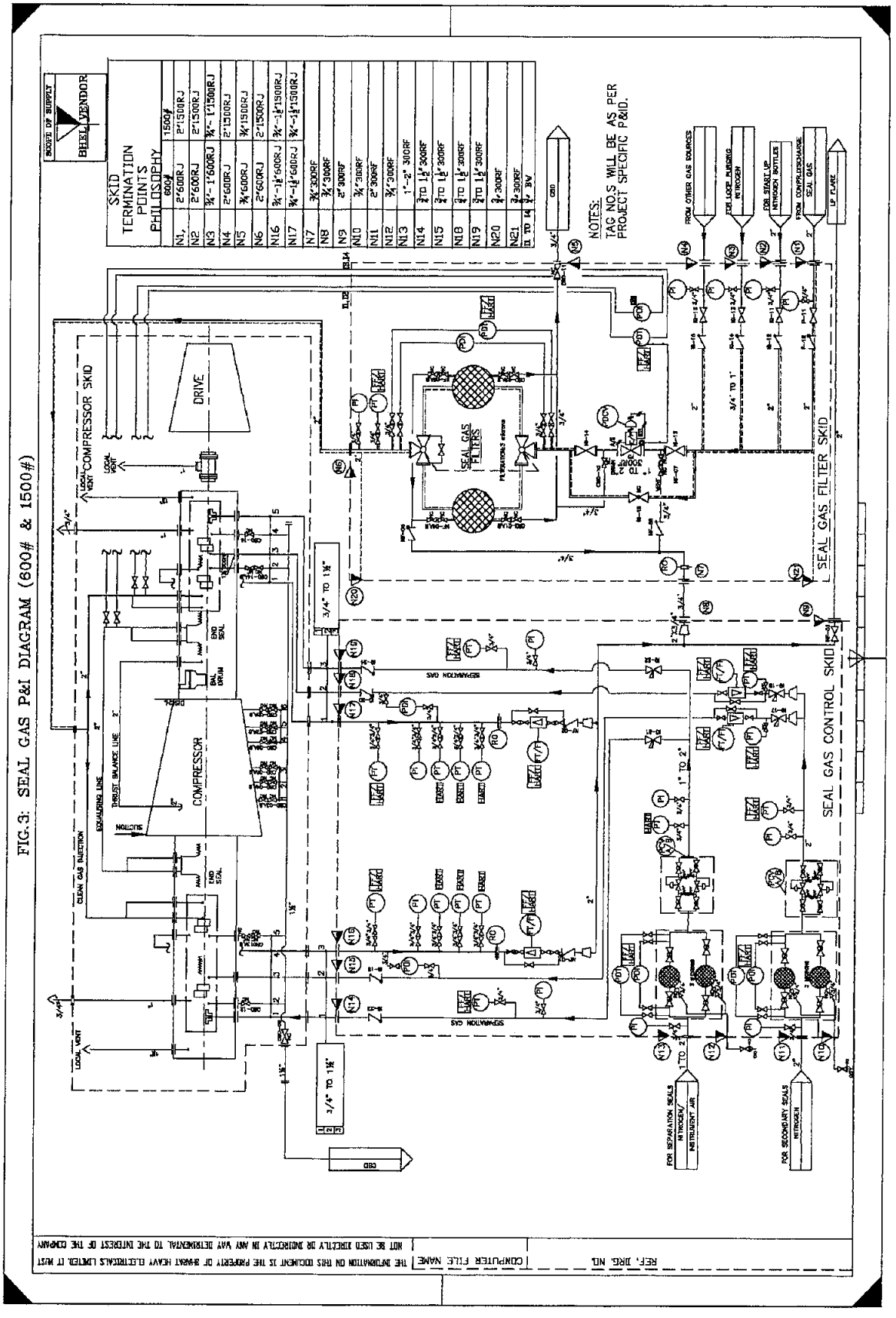
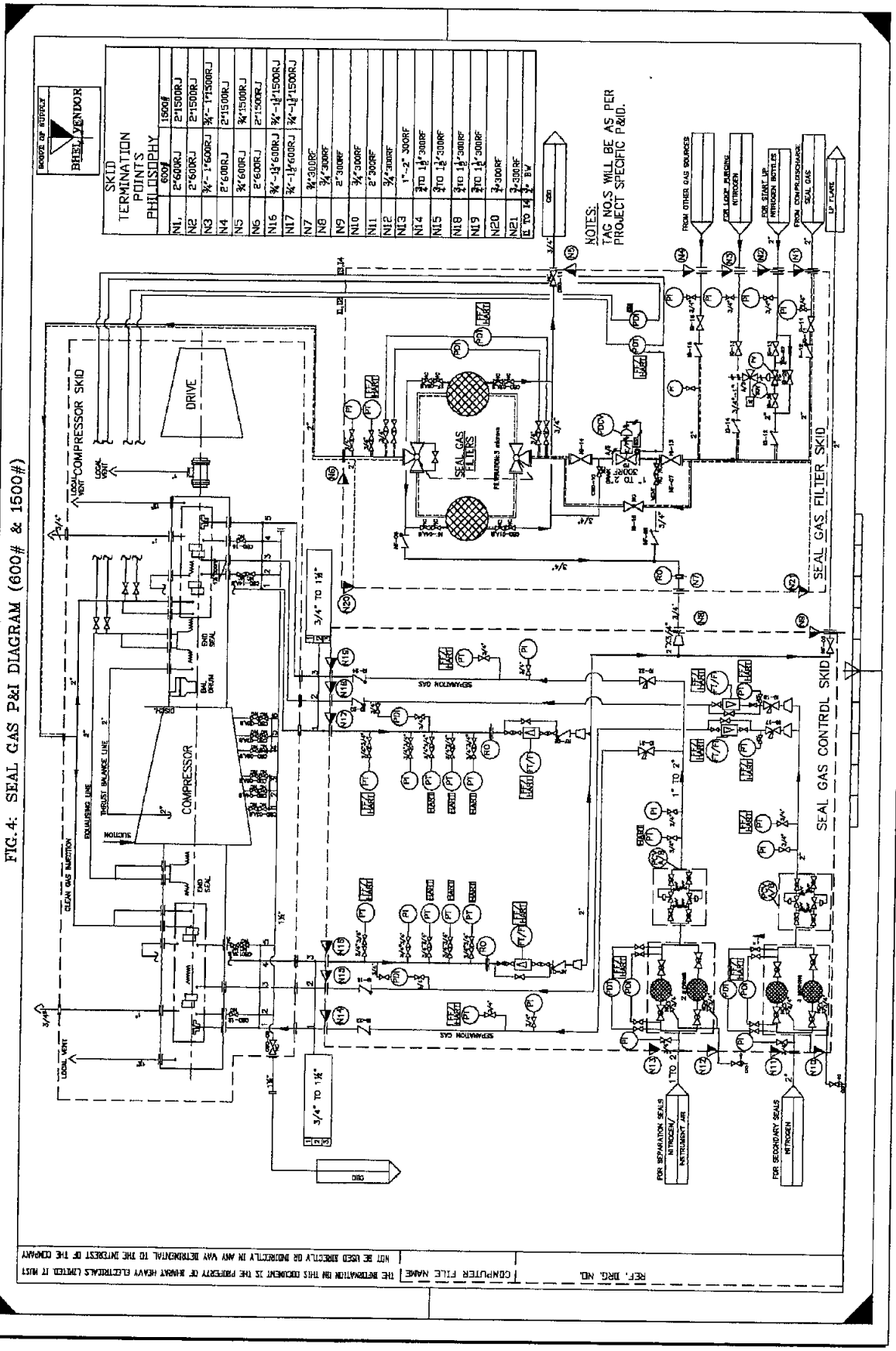


FIG.3: SEAL GAS P&I DIAGRAM (600# & 1500#)

FIG. 4: SEAL GAS P&I DIAGRAM (600# & 1500#)



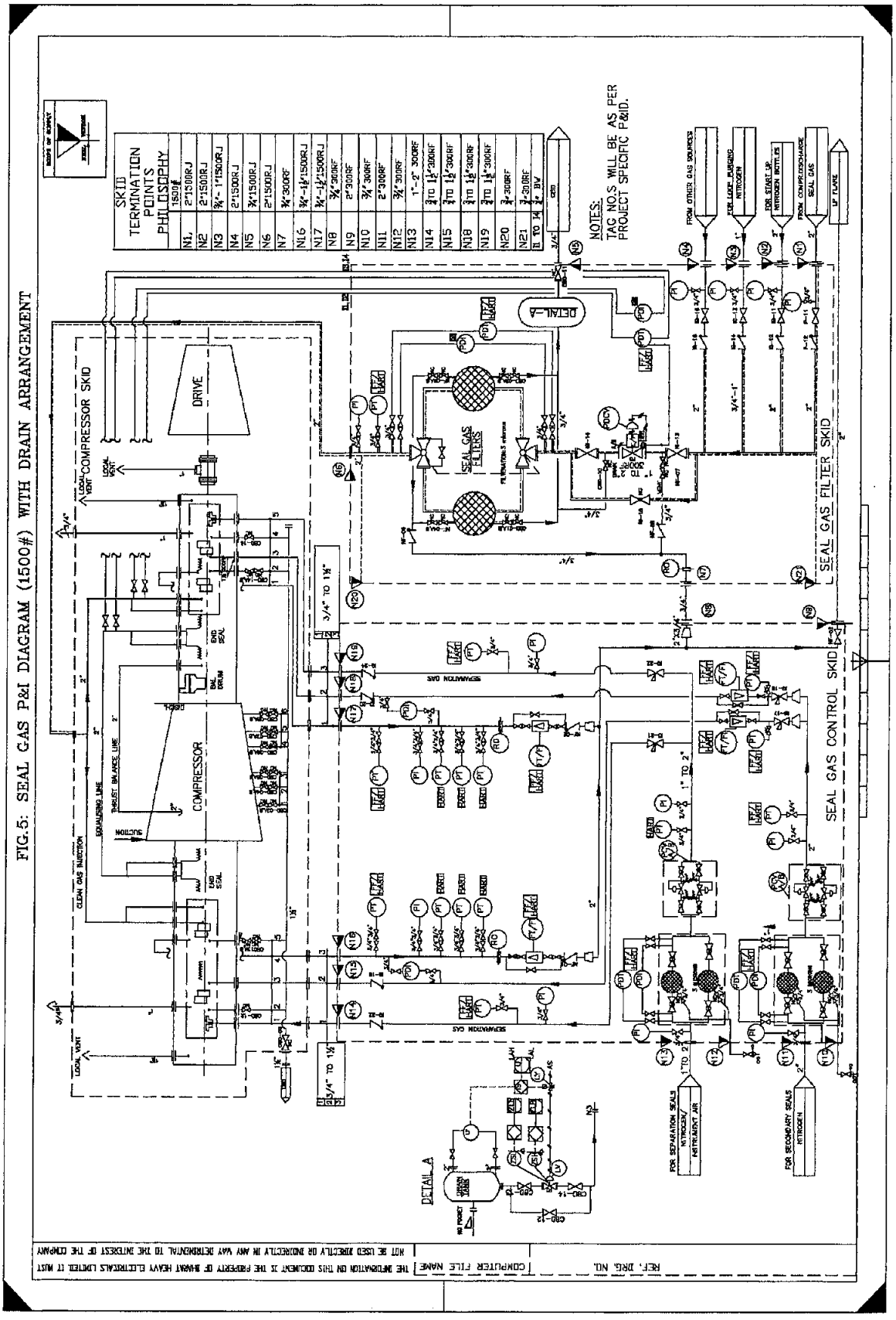


FIG.5: SEAL GAS P&I DIAGRAM (1500#) WITH DRAIN ARRANGEMENT

Table 1 : Technical Specifications of Instruments and other components

(* Vendor to furnish Information along with offer)

SL. No.	Instrument	Qty Note (2)	Minimum Specification	Vendor	Model
1	Differential Pressure Gauges	6 nos.	Differential Pressure Indicator IP65; Range : * Dial Size : 150mm Pr.Conn. : 1/4"PT-F Static Pr. : 210 kg/cm2(g)	Switzer	109-V-E-2-6-0-S
2	Pressure Gauges	16 nos	Pressure gauge IP65; Accuracy: ± 1% of full scale Range : * Dial Size : 150mm Pr. Connections: 1/2"NPT-M Case and Bezel : All SS Construction Wetted parts : * Gold plating for diaphragm seal type in seal gas line Solid front type for seal gas line Over range protection: SS316	GIC/ WIKA/ WAREE	
3	Differential Pressure Transmitters	6 nos	Smart (Hart Protocol/ FF) Transmitters Range : * intrinsic safe & explosion proof IEC Zone 1,Gas IIA, B & C Min Load: 600 ohms All SS construction Pr. Connections: 1/2"NPT-F	Emerson	HART model: 3051CD 3A 27A1 J B4 KD L4 M5 Q4 QT T1 DF D1 TR FF model: 3051CD 3F 27 A1 J A01 B4 IE(or IA) L4 M6 Q4 T1 DF
			Accuracy: 0.075% of span Min. Static Pr.: 210 kg/cm2(g) LCD indicator In built lightning & surge protection Integral Manifold: SS 316L 3-way valve for DP and 2-way valve for pressure (Below 600# only. For 600# and above integral manifold not to be used)	YIL	HART model: EJX 110A EH S4 GU 2 CEB/ V1U/A /D4/A1 FF model: EJX 110A FH S4 GU 2 CDB/ D4/ A / A1/ FF1 & FS15 / LC1

			shall be included in the model number by the vendor		
			SIL certified(for HART)		
4	Pressure Transmitters	21 nos (for fig. 2 & 4) 17 nos (for fig. 1, 3 & 5)	Smart (Hart Protocol/ FF) Transmitters	Emerson	HART model: 3051CG X A 27A1 J B4 KD L4 M5 Q4 QT T1 DF D1 TR Note : X is as per range
			Range : *		
			Others same as sl.no. 3		FF(FNICO/FISCO) model: 3051CG X F 27A1 J A01 B4 IE(or IA) L4 M6 Q4 T1 DF Note : X is as per range
				YIL	HART model: EJX XXX A E X S4 GU 2 CEB/ V1U/A /D4/A1 Note : X is as per range
					FF model: EJX XXX A F X S4 GU 2 CDB/ D4/ A / A1/ FF1 & FS15 / LC1 Note : XXX is as per range
5	Smart Positioner for DP control valve (sl.no 15)	1 no	Smart(Hart Protocol/ FF) Positioner with dual certification (Explosion proof and Intrinsic safe) and metallic housing "Valve's operating signatures" in the form of hard copy and also CD along with each control valve to be supplied with smart positioner.	Metso	HART model: ND 930 X H X1 T Note : X as per requirement
					FF model: ND 930 X F X1 T Note : X as per requirement
6	Flow Meters	4 nos	Metal Tube Variable Area flow meter (with 2 electrical entries with 1 blind plug), 2 wire	Krohne	H250/RR/X/MX/EG/ESK/ EEx Note : X as per requirement
			SMART (HART protocol /FF)		
			Range : *		
			intrinsic safe & explosion proof IEC Zone 1,Gas IIA, B & C		
7	Guided wave radar LT for drain pot	1no.	Smart (Hart Protocol/ FF) Transmitters	Emerson or E&H or Magnetrol or Krohne	
			Pr.conn: Flanged		
8	Diaphram seal type LT for drain pot	1 nos	Smart (Hart Protocol/ FF) Transmitters	Emerson	HART model: 3051CD 2A 22 A1 J S2 B4 KD L4 M5 Q4 QT T1 DF D1 TR + 1199 WDF XX A FFW 76 DA A 9 H U + 1199 MDF XX A FFW 76 DA A 9 H U Note : XX as per requirement

			Range : * Others same as sl.no. 3		FF model: 3051CD 2F 22 A1 J A01 B4 IE(or IA) L4 M6 Q4 T1 DF + 1199 WDF XX A FFW 76 DA A 9 H U + 1199 MDF XX A FFW 76 DA A 9 H U Note : XX as per requirement
			Pr. Connections: 3" Flanged Flush flange with spacer ring minimum SS316 with Flushing / Filling Connection (1/2"size)	YIL	Equivalent models for HART and FF
9	Magnetic level gauge for drain pot	1no.	Body matl.: SS 316L Pr.conn: 1" Flanged The maximum visible range of a single gauge shall not exceed 1470 mm Ball check valve (offset design) required.	Levcon or Chemtrols or Technomatic or Krohne	
10	Drain valve for drain pot	1no.	Smart/FF positioner as per sl.no 6 Others as per sl.no 15		
11	Change over valve in startup gas	1no.	On-off ball valve ANSI / FCI 70.2 Minimum class VI. the body as well as the actuator shall meet the testing requirements as per API 617 latest revision. Actuator: Pneumatic cylinder with spring return scotch yoke type SS, Universal type, IS or Exp.proof (as per project reqt.), Voltage (as per project reqt.) Solenoid valve : Make: Norgren or ASCO Proximity type IS SIL certified limit switches	Flowserve or IL, palghat or Koso, palghat or Tyco	
12	---	5 nos	Electrical Junction Box with LM-6 body	Baliga lighting or FCG flame proof control gears Or FCG Power Industries Or Flameproof Equipments P Limited	
13		2 nos	FF JB		FF JB Loose supply by BHEL.

					Vendor to make provision for mounting the same.
14	Duplex filter	1 nos	- Each filter 100% capacity with change over valve - Startup diff. Pr. : * - Max. Pr. For change over : * - Filter vessel : SS 316L - Change over valve : SS 316L	Forain Italy or Indfil, Germany	
15	Pneumatically operated control valve for DP control valve	1 nos	Material of body : SS 316 L Material of Trim : * Suitable for use in IEC Zone 1,Gas IIA, and IIB & IIC area. ANSI / FCI 70.2 Minimum class IV. Noise level shall not exceed 85db. Source treatment for noise shall be by using special trims like anti-noise trims, in case noise exceeds the allowable level. Bellow seal for corrosive & toxic gases like H2S, H2 etc. Actuator: Pneumatic diaphragm/ cylinder with spring return scotch yoke type	Fisher-Sanmar or IL, Palghat	
16	Duplex Filter regulator	2 nos.	As per system requirement		
17	In line check valves		As per system requirement		
18	Needle valves		As per system requirement		
19	Instrument root & Isolation valves		As per system requirement		
20	Tubes, Tube fittings and manifolds		As per system requirement	Swagelok / Parker Hannifin corp.	
21	Instrument cable	As reqd	Single pair 1.5 mm2.		
22	Spur Cable for FF instr.	As reqd	Type A as per IEC 61158-2	Belden	

Note:-

(1) All instrument makes shall be as per this list. Any item not covered in this list shall be from a reputed manufacturer unless otherwise specified in this specification elsewhere. The vendor shall furnish the proposed sub-vendors' list for all the items mentioned in above table & for the instrument impulse line materials for the approval of BHEL/customer along with the offer.

(2) If the quantity indicated above is more than the numbers required as per project specific P&I diagram, the additional quantity shall be supplied loose.

Table 2 : Check List
(TO BE FILLED BY THE VENDOR AND SUBMITTED ALONG WITH THE OFFER WITH OUT WHICH OFFER WILL NOT BE CONSIDERED)

Cl.no	Description	Vendor's Confirmation (Yes/No)
2.1	Compliance to clause no 2.1.	
3.3,3.4, 5.1,5.4 & 5.5	Compliance of materials and sizes to clause no 3.3, 3.4, 5.1, 5.4 & 5.5.	
3.6(b)	The DEW point curve enclosed along with the offer.	
6.7	Compliance for the sub-vendors list indicated as per Table-1. For the items, which are not covered in the list or vendors not indicated, vendor has to take prior approval before procurement without any cost/ delivery implications. Vendor to confirm compliance for the same.	
6.8	Vendor shall confirm that the bill of material furnished along with offer is only indicative and the final BOM, which shall be furnished during detailed Engineering (after order placement) for the approval of BHEL. The additional items, if any required at later stage for complying BHEL specification or good engineering practice or for the satisfactory working of the seals shall be supplied by vendor without any price/delivery implications.	
9.1(a)	Compliance for BHEL specification and its Annexure	
9.1(c)	Price Schedule as per table-5 enclosed. Also, signed filled copy of Price schedule (without prices) enclosed with technical offer	
9.1(d)	Proven Track Record as indicated in Clause no 10.0 enclosed.	
9.1(f)	Recommended spares parts list enclosed.	
18.1	Vendor should bring out in his offer clause wise deviations if any, with respect to proposed supply along with price adder for withdrawing the deviation to comply with specification. Failure to highlight the same will be construed as acceptance on the part of the vendor to meet the requirement of this specification totally.	
18.3	Any additional requirements which are essential for proper functioning of the dry gas seal system included in the offer.	

Vendor's Signature

Vendor's Company seal

Table – 3 : Quality Plan

Sl. No.	Description	Type of check Quantum of check 100%	Ref. Documents	Type of Inspection	Agency
1	Assembly of Skids	- Location of equipment - Correctness of flow Schematics - Overall dimensions	- Approved GA drg. of Skids	Physical check	BHEL/ CUSTOMER
2	Welding (if applicable)	Type	Manufacturing drawings.	-Review of Radiograph certificate -Welding efficiency of 1	--Do--
3	Duplex Filter	- Material Certification - Hydrostatic test - Degree of filtration- Type Test	-BHEL/ CUSTOMER Specification - Approved drg./docts.	Verification of test report certificate	--Do--
4	Control Valves	- Calibration test certificate -Seat leakage test certificate -100% radiography test certificate (two shall be taken from each area to be tested) -magnetic particle test certificate -hardening test certificate -charpy test -confirmity test certificate -Material Certification - Explosion proof/ Intrinsic safe certification - Hydrostatic test - Control valve functional test	--DO--	- Verification - Review of Certificates	--Do--
5	Valves	- Material Certification - Hydrostatic test - Control valve functional test	--DO--	- Verification - Review of Certificates	--Do--
6	Pressure Gauges, Diff. Pr. Gauges,	- Make, Model - Materials Certification	--DO--	--Do--	--Do--

	Diff. Pr. Transmitters, I/P converters, DP Switch, Pr. Switches, Junction Box, Flow meters	- Calibration certification - Explosion proof/ Intrinsic safe certification			
7	Filter regulators, Valves	- Make, Model	--Do--	--Do--	--Do--
8	Piping/Tubing	- Materials Certification	--Do--	- Review of Mills certificates	
9	Pipe fittings and swagelok type fittings	- Materials Certification	--Do--	-Verifica-tion - Review of Certificates	--Do--
10	Instrument Hook-ups	- Material Certificate	--Do--	Review of certificates	--Do--
11	Line cleaning	Compliance	--Do--	Verification	--Do--
12	Hydraulic Testing of Piping	- Leakage	-Do--	Witness	--Do--
13	HP test with Helium or Nitrogen as per API 614	- Leakage	--Do--	Witness	--Do--
14	Air Leak test for the Hydraulic tested lines	- Leakage	--Do--	Witness	--Do--
15	Name Plates	- Correctness	--Do--	Physical check	--Do--
16	Painting - Pre-Treatment, Chemical Cleaning, Degreasing De-rusting and Phosphating - Two coats of Primer and Two coats of final Paint	- Thoroughness - Thoroughness	No Rust Finish	Physical check Physical check	Supplier BHEL/CUSTOMER
17	Wiring	- Continuity	Wiring diagram	Verification	--Do--

Table – 4: Variant Table

VAR NO.	DESCRIPTION	MATERIAL CODE	REMARKS
1	FILTER SKID- IOCL BARODA WGC	TC9755450017	
2	CONTROL SKID- IOCL BARODA WGC	TC9755450025	
3	FILTER SKID- BPCL-NET GAS-LP	TC9755450033	
4	CONTROL SKID- BPCL-NET GAS-LP	TC9755450041	
5	FILTER SKID- IOCL BARODA VGO	TC9755450050	
6	CONTROL SKID- IOCL BARODA VGO	TC9755450068	
7	NOT USED	NOT USED	
8	CONTROL SKID- BPCL NET GAS-HP	TC9755450084	
9	FILTER SKID- BPCL-CCR(MOTOR)	TC9755450092	
10	CONTROL SKID- BPCL-CCR(MOTOR)	TC9755450106	
11	FILTER SKID- IOCL VADODARA NHT	TC9755450114	
12	CONTROL SKID- IOCL VADODARA NHT	TC9755450122	
13	FILTER SKID- CPCL DHDT	TC9755450130	
14	CONTROL SKID- CPCL DHDT	TC9755450149	
15	FILTER SKID- GGSR-HPCL MITTAL	TC9755450157	
16	CONTROL SKID- GGSR-HPCL MITTAL	TC9755450165	
17	FILTER SKID- HMEL CCR	TC9755450173	
18	CONTROL SKID- HMEL CCR	TC9755450181	
19	FILTER SKID- HMEL DHDT	TC9755450190	
20	CONTROL SKID- HMEL DHDT	TC9755450203	
21	FILTER SKID- HMEL DCU	TC9755450211	
22	CONTROL SKID- HMEL DCU	TC9755450220	
23	FILTER SKID- ONGC TRIPURA	TC9755450238	
24	CONTROL SKID- ONGC TRIPURA	TC9755450246	
25	FILTER SKID- BRPL	TC9755450254	
26	CONTROL SKID- BRPL	TC9755450262	
27	FILTER SKID- MRPL DCU	TC9755450270	
28	CONTROL SKID- MRPL DCU	TC9755450289	
29	FILTER SKID- MRPL DHDT	TC9755450297	
30	CONTROL SKID- MRPL DHDT	TC9755450300	
31	FILTER SKID- GSFC-HP-2BCL 507	TC9755450319	As per CCI-MCA-1001-27
32	CONTROL SKID- GSFC-HP-2BCL 507	TC9755450327	As per CCI-MCA-1001-27
33	FILTER SKID- GSFC-BCL 407A	TC9755450335	As per CCI-MCA-1001-27
34	CONTROL SKID- GSFC-BCL 407A	TC9755450343	As per CCI-MCA-1001-27
35	FILTER SKID- GSFC-LP-2BCL 407A	TC9755450351	As per CCI-MCA-1001-27
36	CONTROL SKID- GSFC-LP-2BCL 407A	TC9755450360	As per CCI-MCA-1001-27

37	FILTER SKID- MRPL CHTU	TC9755450378	Item Same as M.code: TC9755450904
38	CONTROL SKID- MRPL CHTU	TC9755450386	Item Same as M.code: TC9755450912
39	FILTER SKID- MRPL PFCCU	TC9755450394	As per CCI-MCN-1001-27
40	CONTROL SKID- MRPL PFCCU	TC9755450408	As per CCI-MCN-1001-27
41	SGS SKID- TABRIZ	TC9755450416	As per CCI-CA217-27
42	SGS SKID- SPARES- TABRIZ	TC9755450424	As per CCI-CA217-27
43			
44			
45			
46			
47			
48			
49			
50			

Table – 4: Variant Table

Var No	Description	Requirements	Material code	Reference P&ID
51	Seal gas Filter Skid	Rating: #300 Insts Hookup: Tubing DCS Insts: HART Protocol	TC9755450513	Fig.1
52	Seal gas Control Skid		TC9755450521	Fig.1
53	Spares for Seal gas filter skid and control skid		TC9755450530	Fig.1
54	Seal gas Filter Skid	Rating: #300 Insts Hookup: Piping DCS Insts: HART Protocol	TC9755450548	Fig.1
55	Seal gas Control Skid		TC9755450556	Fig.1
56	Spares for Seal gas filter skid and control skid		TC9755450564	Fig.1
57	Seal gas Filter Skid	Rating: #300 Insts Hookup: Tubing DCS Insts: HART Protocol Startup Gas: With Changeover valve	TC9755450572	Fig.2
58	Seal gas Control Skid		TC9755450580	Fig.2
59	Spares for Seal gas filter skid and control skid		TC9755450599	Fig.2
60	Seal gas Filter Skid	Rating #300 Insts Hookup Piping DCS Insts HART Protocol Startup Gas: With Changeover valve	TC9755450602	Fig.2
61	Seal gas Control Skid		TC9755450610	Fig.2
62	Spares for Seal gas filter skid and control skid		TC9755450629	Fig.2
63	Seal gas Filter Skid	Rating #300 Insts Hookup Tubing DCS Insts FF Instruments	TC9755450637	Fig.1
64	Seal gas Control Skid		TC9755450645	Fig.1
65	Spares for Seal gas filter skid and control skid		TC9755450653	Fig.1
66	Seal gas Filter Skid	Rating #300 Insts Hookup Piping DCS Insts FF Instruments	TC9755450661	Fig.1
67	Seal gas Control Skid		TC9755450670	Fig.1
68	Spares for Seal gas filter skid and control skid		TC9755450688	Fig.1
69	Seal gas Filter Skid	Rating #300 Insts Hookup Tubing DCS Insts FF	TC9755450696	Fig.2
70	Seal gas Control Skid		TC9755450700	Fig.2

			Instruments		
71	Spares for Seal gas filter skid and control skid	Startup Gas	With Change over valve	TC9755450718	Fig.2
72	Seal gas Filter Skid	Rating Insts Hookup	#300 Piping	TC9755450726	Fig.2
73	Seal gas Control Skid	DCS Insts	FF Instruments	TC9755450734	Fig.2
74	Spares for Seal gas filter skid and control skid	Startup Gas:	With Changeover valve	TC9755450742	Fig.2
75	Seal gas Filter Skid	Rating Insts Hookup	#600 Piping/Tubing	TC9755450750	Fig.3
76	Seal gas Control Skid	DCS Insts	HART Protocol	TC9755450769	Fig.3
77	Spares for Seal gas filter skid and control skid			TC9755450777	Fig.3
78	Seal gas Filter Skid	Rating Insts Hookup	#600 Piping/Tubing	TC9755450785	Fig.3
79	Seal gas Control Skid	DCS Insts	FF Instruments	TC9755450793	Fig.3
80	Spares for Seal gas filter skid and control skid			TC9755450807	Fig.3
81	Seal gas Filter Skid	Rating Insts Hookup	#600 Piping/Tubing	TC9755450815	Fig.4
82	Seal gas Control Skid	DCS Insts	HART Protocol	TC9755450823	Fig.4
83	Spares for Seal gas filter skid and control skid	Startup Gas:	With Changeover valve	TC9755450831	Fig.4
84	Seal gas Filter Skid	Rating Insts Hookup	#600 Piping/Tubing	TC9755450840	Fig.4
85	Seal gas Control Skid	DCS Insts	FF Instruments	TC9755450858	Fig.4
86	Spares for Seal gas filter skid and control skid	Startup Gas:	With Changeover valve	TC9755450866	Fig.4
87	Seal gas Filter Skid	Rating Insts Hookup	#1500 Piping	TC9755450874	Fig.3
88	Seal gas Control Skid	DCS Insts	HART Protocol	TC9755450882	Fig.3
89	Spares for Seal gas filter skid and control skid			TC9755450890	Fig.3

90	Seal gas Filter Skid	Rating	#1500	TC9755450904	Fig.3
91	Seal gas Control Skid	Insts Hookup	Piping	TC9755450912	Fig.3
92	Spares for Seal gas filter skid and control skid	DCS Insts	FF Instruments	TC9755450920	Fig.3
93	Seal gas Filter Skid	Rating	#1500	TC9755450939	Fig.5
94	Seal gas Control Skid	Insts Hookup	Piping	TC9755450947	Fig.5
95	Spares for Seal gas filter skid and control skid	DCS Insts Drain pot	HART Protocol System	TC9755450955	Fig.5
96	Seal gas Filter Skid	Rating	#1500	TC9755450963	Fig.5
97	Seal gas Control Skid	Insts Hookup	Piping	TC9755450971	Fig.5
98	Spares for Seal gas filter skid and control skid	DCS Insts Drain Pot	FF Instruments system	TC9755450980	Fig.5

Table-5

PRICE SCHEDULE

SEAL GAS CONTROL SYSTEM

Enquiry ref. no. Date:
Offer ref no. Date:

Sl no.	DESCRIPTION	Qty	PRICE
01	Seal Gas Control system consists of the following	1 set	
	a) Seal Gas Filter Skid		
	b) Seal Gas control skid		
	c) Filter cartridges – 5 sets		
	d) Matting flanges & accessories for all terminal points– 1 set		
	e) Loose supplied items		
02	Seal Gas Control system Spares as per following	1 set	
	a) Pressure Gauges, Differential Pressure Gauges, level gauges-10% or min 1 no. each type.	The word "TYPE" means the make, model no, range, size/length, rating, material as applicable	
	b) Transmitters (both Fieldbus and SMART) for Pressure, Level, Variable area Flow & Differential Pressure-10% or min.1 no each type.		
	c) Control valve spares-10% or min 1 no. each type of the following: i. Proximity type limit switches. ii. Airfilter Regulator. iii. Solenoid valve. iv. Bonnet Gasket/Special Gasket. v. Gland packing. vi. Stem seal o-rings/Piston o-ring. vii. SMART/Fieldbus positioner. viii. Trim set. ix. Diaphragm, actuator assembly		
	d) Manifolds- 3.way and 5 way, isolation valves, instrument valves, tube fittings, check valves, filter regulators -10% or min.1 no each type.		
03	Optional offer for addition of each of the following instrument inclusive of root valves, piping, & installation materials etc.		
	a) Pressure Transmitter	1 set	
	b) DP Transmitter	1 set	
	c) Pressure Gauge	1 set	
	d) DP Gauge	1 set	
	e) Smart Positioner as per sl.no 5 of table-1	1 set	
	f) Solenoid valve.	1 set	
	g) Variable area Flow transmitter.	1 set	
04	Additional price to with draw the deviations to following clauses:		

Note:

(1) The individual prices for the spares and optional items against sl nos 02 and 03 above are valid for one year to order as and when the requirement arises.
(2) Any additional requirements which are essential for proper functioning of the dry gas seal system but not indicated in specification are included in the offer.

Vendor's signature & seal

Rev. No.	Date	Revision Details	Revised	Approved
00	03.03.2008	New Standard	--	AK
01	02.05.2009	Insulation requirement added	RAM	AK
02	13.12.2009	Generally revised and variants added	VJK	VVS