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Instruction to bidders:

1) Bidders are advised to contact BHEL for essential technical queries in writing within one week of issue of Enquiry. Offers with incomplete information will not be considered for evaluation, and are likely to be rejected without any further correspondence with the Bidder.
2) Unsolicited requests from bidders for alterations to their already submitted offer will not be permitted. These would not be taken cognizance, and offers will be evaluated without taking into account such requests/correspondence.
3) Any technical features over & above BHEL enquiry specification requirements proposed by Bidder will not be given preference for the purpose of evaluation.
4) Bidders shall comply BHEL specifications in total. Incomplete offers will be rejected. In case feasible deviations are proposed by the bidder and subsequently withdrawn, no commercial implications can be claimed by the bidder.
5) The make of Bidder bought out items shall be as per vendor list. In case Bidder proposes alternate make / model of bought out item due to non-availability of statutory certification etc., the same shall not be binding on BHEL. Such changes shall be explicitly listed in deviation list with applicable price (for removal of the said deviation, if applicable) explicitly indicated (with specific item no) in the PRICED price schedule.
6) In the event of any conflict between these specifications, data sheets, related standards, codes etc. the bidder shall refer the matter to the purchaser for clarifications and only after obtaining the same shall proceed with the manufacture / procurement of the items in question.
7) Bidder shall submit duly filled deviation format enclosed with this specification along with technical offer, otherwise, it will be presumed that there are no deviations from this specification. Offer without this deviation list will not be evaluated & shall be rejected. If, there are no deviations, bidder shall submit signed copy of deviation format, mentioning "No Deviations".
8) Changes if any made by BHEL during technical evaluation on the specification requirements or Bill of material, bidder is requested by the purchase to submit impact price (amount to be reduced or increased to the original offered price) for those changed items only, other items for which there are no technical changes, unit rates shall be maintained as it is.
9) **In case of any technical query, bidders may contact the following BHEL engineer:**
   Name: Ramniwas Sangwa
   Designation: Deputy Manager
   Deptt: TC Engineering
   Phone: +91 40 2318 3548
   Email: ramsangwa@bhel.in

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TECHNICAL ADDENDUM FOR DRY GAS SEAL SKID
Project: Assam Petrochemicals Limited, Namrup Natural Gas & Syn Gas Compressor

1 GENERAL

This specification is applicable for the variants mentioned in the table below and is an addendum to TC55450-R03 (Specification for Dry Gas Seal Skids for Centrifugal Compressors). Vendor shall explicitly bring out any conflict between this specification and its attachments with TC55450-R03.

2 VARIANT TABLE

Project	Description	Material Code	Remarks
APL Namrup Natural Gas Compressor	Filter Skid	TC9765387040	The filter skid shall be provided with seal gas inlet change over valve and primary seal gas condensate pot with level transmitter and drain on-off valve.
	Control Skid	TC9765387059	
	Seal Gas Skid Spares as per price schedule	TC9765387067	
APL Namrup Synthesis Gas Compressor	Filter Skid	TC9765387075	The filter skid shall be provided with seal gas inlet change over valve and primary seal gas condensate pot with level transmitter and drain on-off valve.
	Control Skid	TC9765387083	
	Seal Gas Skid Spares as per price schedule	TC9765387091	

3 DESIGN

3.1 The project specific requirements shall as per the following attachments:

Sl. No.	Description	Document No.
a	Seal Gas P&ID	Annexure-1. For reference only. Condensate pot / Inlet On-Off valve is not indicated, however it is required.
b	TC55450-R03	Annexure-2.
c	Additional Vendor List	Annexure-3.
d	Thermowell & TC Drawing	Annexure-4.
e	EIL specification for IGC	Annexure-5.

3.2 Vendor shall include automatic change-over arrangement (On-Off valve) from normal to emergency / start up seal gas supply along with all the necessary instrumentation and controls required during start-up & emergencies.

3.3 Valve positioner shall be supplied along with valve diagnostic software / valve signature in USB. This software shall be integrated with customer control system for advance control valve diagnostics like seat ring condition, gland packing condition, actuator leakage etc.

3.4 The primary seal gas supply lines along with all inline equipment & instruments shall be min 2”. The gas velocity shall be limited to 30 m/s.

3.5 Vendors to note that the seal gas skid assembly may be changed to a single skid if accepted by end user, however the same shall be informed only during detail engineering only. No price or delivery implication will be accepted on account of this.

Rev. No.	Revisions	Prepared	Checked	Approved	Date
01	Updated & Issued for APL	PG	RAM	PSVS	08.05.2018
00	Issued	RAM	RAM	PSVS	26.07.2017

Ref. Doc

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3.6 Vendor to refer DGS specification for all operating & design parameters.

4 PROJECT SPECIFIC REQUIREMENT

4.1 For all other requirements, formats etc. refer Dry Gas Seal Skid specification TC55450-R03 along with the following project specific requirements.

Clause No	Existing	To be replaced with
2.1-a	Seal Gas P&I Diagram as per Variant Table-4 of this specification	Annexure-1
2.1-c	List of Instruments, make & model as per Table-1 of this specification	As per this addendum.
5.1	The Pipe sizes and terminal points shall be as per the Seal Gas P&ID indicated in variant table-4.	Refer 3.4 above. BHEL shall provide 2" connection or higher if required for primary seal gas.
5.4	Flange connection	All flanges shall be WN RF / RJ.
5.5	PMI & IGC	PMI & IGC is applicable for all instrumentation, piping items.
6.5	All the instruments and quantity shall be as specified in Table-1.	As per this addendum.
7	Instrument installation	The instrument installation shall be piping standard.
6.6, 8.3	Foundation Fieldbus	Not Applicable
9	Documentation	Vendor to include documents listed in this specification.
Fig-1 to 5	Typical P&ID	Annexure-1
Table-1	List of Instruments, make & model	As per this addendum.
Table-4	List of variants	As per this addendum.
Table-5	Price Schedule	As per this addendum.
-	Cleanliness Test	No discoloration or hard articles found on 20 mesh screen after module blown for 5 minutes with 7 kg/cm2g dry filtered gas.

5 SEAL GAS SKID DIMENSIONS & PIPING ORIENTATION

5.1 All the seal gas piping nozzles shall be terminated on top of the skids except drains.

5.2 Every effort shall be done to minimize the skid footprint. Efforts shall be made to minimize the skid size to 2000 mm x 1500 mm (Filter Skid) & 1500 mm x 1000 mm (Control Skid).

5.3 Vendor shall further try to reduce the above indicated dimensions based on its 3-D modeling of the skids.

6 DOCUMENTATION

6.1 The following documents as a minimum shall be supplied by the vendor. The number of hard copies & CD/DVD/USB shall be as per TC55450-R03.

a) As-built GA drawings.
b) As-built Instrument datasheets including instrument vendor datasheets, GA drawings & sizing calculations.
c) Spares list.
d) Packing list.
e) Material test certificates.
f) Filter degree of filtration test certificate.
g) Explosion protection certificates for all electronic instruments.

h) Terminal wiring details of Junction Box.
i) Skid Photographs.
j) Instruction, Service and Maintenance manual.
k) Guarantee Certificates.

6.2 Three sets hard copies & one number CD/DVD/USB of the above documents shall be submitted to BHEL prior to dispatch of the skids.

7 LIST OF INSTRUMENTS: NATURAL GAS COMPRESSOR

SL. No.	Instrument	Qty Note (2)	Minimum Specification	Vendor	Model
1	Differential Pressure Gauges	6	Differential Pressure Gauge IP66; panel mount Range: as required Dial Size: 150mm Pr.Conn. : ¼" NPTF Static Pr. : 210 kg/cm2(g)	Switzer, GIC, Wika	Switzer 109-V-E-2-6-0-S or eqv.
2	Pressure Gauges	16	Pressure gauge IP67; panel mount Accuracy: ±1% of full scale Range: as required Dial Size: 150mm Pr.Conn.: ½" NPTM Case & Bezel: All SS Construction Wetted parts: * Solid front type for seal gas line. Liquid filled / with pulsation dampner. Over range protection: SS316	GIC, Wika, Waree	
3	Differential Pressure Transmitter	8	Smart-HART Range: as required with Intrinsic safe Ex-ia & flameproof Ex-d certified for IEC Zone-1, Gas IIA, B & C Min Load: 600 ohms All SS construction Pr.Conn.: ½" NPTF Accuracy: 0.075% of span Static Pr.: 210kg/cm2(g) Integral LCD indicator In built lightning & surge protection Integral Manifold: SS 316L 3-way valve for DP and 2-way valve for pressure SIL certified	Emerson	HART: 3051CD 3A 07 A1 J H2 B7 K8 L4 M4 Q4 QT D4 T1 DF D1 HR5
				Yokogawa	HART: EJA 110A E H S4 GU 2 CEB KU22 A D4 A1 M11
4	Pressure Transmitter	18		Emerson	HART: 3051CG * A 07 A1 J H2 B7 K8 L4 M4 Q4 QT D4 T1 DF D1 HR5 Note : * is as per range
				Yokogawa	HART: EJA 430A E * S4 GU 2 CEB KU22 A D4 A1 DG6 M11 Note : * is as per range
5	SMART positioner	For PDCV & On-Off valve partia	Positioner with Intrinsic safe Ex-ia & flameproof Ex-d certified for IEC Zone1, Gas IIA, B & C and metallic housing. 'Valve operating signature' in the form of hard copy and	Metso, Fisher, Dresser, Flowserve & Samson	HART: Metso ND930 * HXT or eqv. Note : * is as per requirement

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SL. No.	Instrument	Qty Note (2)	Minimum Specification	Vendor	Model
		1 stroke test	CD’		
6	Flow Meter	4	Internal magnetic float or Rota meter design or an integral orifice and differential-pressure (DP) cell SMART-HART protocol Range: as required All other requirements same as PT / DPT. Pr.conn: Flanged		The exact flow device type shall be provided during detail engineering and shall not have any delivery or commercial implication.
7	Junction Box	6	Flameproof Ex-d certified for IEC Zone 1, Gas IIA, B, C weather proof IP65, Die cast aluminum LM-6 body with nickel plated brass double compression glands & plugs. The terminals for JBs connected to Intrinsic safe instruments shall be light blue and for ex-proof instrument, shall be grey / blue colour.	Baliga lighting, FCG flame proof control gears, FCG Power Industries, Flameproof Equipments.	
8	Duplex filter (Coalescing type) with change over transfer valve	1 set*	With change over valve Startup diff. Pr.: * Max. Pr. For change over: * Filter vessel: SS316L Change over valve: SS 316L	Forain-Italy, Indfil-Germany, Boll & Kirch-Germany, Hydac-Germany.	Filter sizing shall be as per API614.
9	Pneumatic DP control valve	01 nos.	Material of body: SS316 L Material of Trim: * 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	Note-6.	
10	Duplex filter regulator with SS housing and changeover transfer valve	02 sets	As per system requirement	Norgren, Parker, Boll & Kirch, Hydac, Pall	Shall be provided with three way ball valves

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SL. No.	Instrument	Qty Note (2)	Minimum Specification	Vendor	Model
11	In line check valves	As reqd	As per system requirement	Audco, BDK, ATIPL, DFT	
12	Needle valves	As reqd	As per system requirement	Audco, BDK, ATIPL, DFT	
13	Instrument root & Isolation valves	As reqd	As per system requirement	Audco, BDK, ATIPL, DFT	
14	Tubes, Tube fittings and manifolds	As reqd	As per system requirement	Swagelok, Parker Hannifin corp.	
15	Cable: SMART Instruments	As reqd	Single pair 1.5 mm2.	Note-6	
16	Change over valve in startup gas & Condensate Drain valve	2no.	Full bore, On-off ball valve ANSI / FCI 70.2 Minimum class VI TSO. 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 SOV: 110 VAC SS body, Ex-d IIC, SIL 3 certified, Universal type, class H insulation. Proximity type IS SIL certified limit switches, P&F make	NOTE-6	
17	Temperature Gauges	03 nos.	Bi-metallic thermometer, every angle IP67, direct mount Accuracy: ±1% of full scale Range: as per requirement Dial Size: 150mm Inst Conn: ½” NPTM bottom. Case & Bezel: All SS Construction Solid front type for gas line	Note-6	
18	Temperature Gauge thermowell	03 nos	Instrument connection: ½” NPTF Pr. Connections: 1-½” flanged. Rating as per skid rating All SS316 Construction. NACE certification Bore dia: suitable for TG	Note-6	Refer EIL drawing 7-52-0035

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SL. No.	Instrument	Qty Note (2)	Minimum Specification	Vendor	Model
19	Canopy for all transmitters, positioners & junction boxes	As reqd			
20	LT for condensate Pot	1 no		Note-6	Emerson 3300 series or eqv.

Notes:-

1. All instrument makes shall be as per this list.
2. Any item not covered in this list shall be from a reputed manufacturer unless otherwise specified in this specification elsewhere.
3. For the items, which are not covered in the list or vendors not indicated, vendor shall procure the same from their standard sub-vendors.
4. If the quantity indicated above is more than the numbers required as per project specific P&I diagram, the additional quantity with ranges same as used within skid & shall be supplied loose.
5. All the items of the same type of instrument shall be of same make.
6. Additional Vendor List as attached.
7. In case the above listed quantity is les than that required by the vendor as per vendor proposed P&ID, these additional instruments shall be considered by vendor.

8 LIST OF INSTRUMENTS: SYNTHESIS GAS COMPRESSOR

SL. No.	Instrument	Qty Note (2)	Minimum Specification	Vendor	Model
21	Differential Pressure Gauges	9	Differential Pressure Gauge IP66; panel mount Range: as required Dial Size: 150mm Pr.Conn. : ¼" NPTF Static Pr. : 210 kg/cm2(g)	Switzer, GIC, Wika	Switzer 109-V-E-2-6-0-S or eqv.
22	Pressure Gauges	30	Pressure gauge IP67; panel mount Accuracy: ±1% of full scale Range: as required Dial Size: 150mm Pr.Conn.: ½" NPTM Case & Bezel: All SS Construction Wetted parts: * Solid front type for seal gas line. Liquid filled / with pulsation dampner. Over range protection: SS316	GIC, Wika, Waree	
23	Differential Pressure Transmitter	12	Smart-HART Range: as required with Intrinsic safe Ex-ia & flameproof Ex-d certified for	Emerson	HART: 3051CD 3A 07 A1 J H2 B7 K8 L4 M4 Q4 QT D4 T1 DF D1 HR5

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SL. No.	Instrument	Qty Note (2)	Minimum Specification	Vendor	Model
			IEC Zone-1, Gas IIA, B & C Min Load: 600 ohms All SS construction Pr.Conn.: ½" NPTF Accuracy: 0.075% of span Static Pr.: 210kg/cm2(g) Integral LCD indicator In built lightning & surge protection Integral Manifold: SS 316L 3-way valve for DP and 2-way valve for pressure SIL certified	Yokogawa	HART: EJA 110A E H S4 GU 2 CEB KU22 A D4 A1 M11
24	Pressure Transmitter	35		Emerson	HART: 3051CG * A 07 A1 J H2 B7 K8 L4 M4 Q4 QT D4 T1 DF D1 HR5 Note : * is as per range
				Yokogawa	HART: EJA 430A E * S4 GU 2 CEB KU22 A D4 A1 DG6 M11 Note : * is as per range
25	SMART positioner	For PDCV & On-Off valve partial stroke test	Positioner with Intrinsic safe Ex-ia & flameproof Ex-d certified for IEC Zone1, Gas IIA, B & C and metallic housing. 'Valve operating signature' in the form of hard copy and CD'	Metso, Fisher, Dresser, Flowserve & Samson	HART: Metso ND930 * HXT or eqv. Note : * is as per requirement
26	Flow Meter	10	Internal magnetic float or Rota meter design or an integral orifice and differential-pressure (DP) cell SMART-HART protocol Range: as required All other requirements same as PT / DPT. Pr.conn: Flanged		The exact flow device type shall be provided during detail engineering and shall not have any delivery or commercial implication.
27	Junction Box	8	Flameproof Ex-d certified for IEC Zone 1, Gas IIA, B, C weather proof IP65, Die cast aluminum LM-6 body with nickel plated brass double compression glands & plugs. The terminals for JBs connected to Intrinsic safe instruments shall be light blue and for ex-proof instrument, shall be grey / blue colour.	Baliga lighting, FCG flame proof control gears, FCG Power Industries, Flameproof Equipments.	
28	Duplex filter (Coalescing type) with change over transfer valve	1 set / 2 set	With change over valve Startup diff. Pr.: * Max. Pr. For change over: * Filter vessel: SS316L Change over valve: SS 316L	Forain-Italy, Indfil-Germany, Boll & Kirch-Germany, Hydac-Germany.	Filter sizing shall be as per API614. Vendor to provide TWO separate Primary seal gas Duplex filters in case of possibility of seal gas condensation in any operating scenario.
29	Pneumatic DP	02	Material of body: SS316 L	Note-6.	

SL. No.	Instrument	Qty Note (2)	Minimum Specification	Vendor	Model
	control valve	nos.	Material of Trim: *		
			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		
30	Duplex filter regulator with SS housing and changeover transfer valve	04 sets	As per system requirement	Norgren, Parker, Boll & Kirch, Hydac, Pall	Shall be provided with three way ball valves
31	In line check valves	As reqd	As per system requirement	Audco, BDK, ATIPL, DFT	
32	Needle valves	As reqd	As per system requirement	Audco, BDK, ATIPL, DFT	
33	Instrument root & Isolation valves	As reqd	As per system requirement	Audco, BDK, ATIPL, DFT	
34	Tubes, Tube fittings and manifolds	As reqd	As per system requirement	Swagelok, Parker Hannifin corp.	
35	Cable: SMART Instruments	As reqd	Single pair 1.5 mm2.	Note-6	
36	Change over valve in startup gas & Condensate Drain valve	2no.	Full bore, On-off ball valve	NOTE-6	
			ANSI / FCI 70.2 Minimum class VI TSO.		
			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		
			SOV: 110 VAC SS body, Ex-d IIC, SIL 3 certified, Universal type, class H insulation.		

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SL. No.	Instrument	Qty Note (2)	Minimum Specification	Vendor	Model
			Proximity type IS SIL certified limit switches, P&F make		
37	Temperature Gauges	05 nos.	Bi-metallic thermometer, every angle IP67, direct mount Accuracy: ±1% of full scale Range: as per requirement Dial Size: 150mm Inst Conn: ½" NPTM bottom. Case & Bezel: All SS Construction Solid front type for gas line	Note-6	
38	Temperature Gauge thermowell	05 nos	Instrument connection: ½" NPTF Pr. Connections: 1-½" flanged. Rating as per skid rating All SS316 Construction. NACE certification Bore dia: suitable for TG	Note-6	Refer EIL drawing 7-52-0035
39	Canopy for all transmitters, positioners & junction boxes	As reqd			
40	LT for condensate Pot	1 no		Note-6	Emerson 3300 series or eqv.

Notes:-

1. All instrument makes shall be as per this list.
2. Any item not covered in this list shall be from a reputed manufacturer unless otherwise specified in this specification elsewhere.
3. For the items, which are not covered in the list or vendors not indicated, vendor shall procure the same from their standard sub-vendors.
4. If the quantity indicated above is more than the numbers required as per project specific P&I diagram, the additional quantity with ranges same as used within skid & shall be supplied loose.
5. All the items of the same type of instrument shall be of same make.
6. Additional Vendor List as attached.
7. In case the above listed quantity is les than that required by the vendor as per vendor proposed P&ID, these additional instruments shall be considered by vendor.

9 **DEVIATION FORMAT:**

Bidder shall submit duly filled deviation format (as given below) along with technical offer, otherwise, it will be presumed that there are no deviations from this specification. Offer without this deviation list will not be evaluated & shall be considered for rejection. If, there are no deviations, bidder shall submit signed copy of this format, mentioning "No Deviations".

Sl. No.	Clause No. of Spec	Deviation	Reason for deviation	Deviation category	
				Product/design	Optimization

				limitation	
1					
2					

10 **CHECKLIST:**

(TO BE FILLED BY THE VENDOR AND SUBMITTED ALONG WITH THE OFFER WITHOUT WHICH OFFER WILL NOT BE CONSIDERED)

Sl. No.	Requirement	Vendor Confirmation YES / NO
a.	Compliance to BHEL specification and its annexures.	
b.	Deviation (if any) included in offer with reason.	
c.	Price implication for deviation removal is indicated in Priced offer in case of any deviation.	
d.	Skid GA & BOM (with make/model) attached with technical offer.	
e.	Signed and stamped copy of BHEL specification attached with technical offer.	
f.	Spares BOM (with make/model) attached with technical offer.	
g.	Price schedule attached with technical offer with 'QUOTED' marked against each item.	
h.	PTR attached with technical offer.	

11 **SPARES REQUIREMENT:**

SL NO	SPARE ITEM DESCRIPTION / SPARE PHILOSOPHY	QTY
a	Seal gas filter element with gaskets / O-rings (1 set is equal to 100% filter replacement for complete skids): 5 Set.	1 set
b	Local Gauges: DP, Pressure, flow, temperature, level etc.-10% or min 01 no. each type with all accessories	
c	Transmitters: DP, Pressure, Level, Flow etc.-10% or min.1 no. each type with all accessories	
d	Control valve & On-Off Valve, Pressure Regulating Valve (self Actuated) spares: 10 % or minimum 1 no of each type and size. i. Trim consisting of seat, seat ring/ seal ring, plug with stem, cage (wherever applicable), packing material. ii. Positioners (Smart) with links of each type and make. iii. Actuator Diaphragm. iv. Solenoid valve. v. Proximity switch. vi. Air filter regulators of each type and size. vii. Bonnet Gaskets/ gland packing's, piston O-rings, bearing & liner. viii. Any special accessories provided along with the control valve like boosters, position transmitters (wherever applicable), etc.	
e	Instrument valves, manifolds & fittings: i. Fittings, lugs, nipples, sockets, blinds, unions: 10% or min. 2 no each type. ii. ½", ¾", 1", 1-½", 2" (etc.) valves (ball, Globe, Gate, Needle, NRV etc.) : 10% or min. 1 no each type. iii. 2 valve & 3 valve manifolds, isolation valves, instrument valves, tube fittings, check valves, filter, regulator, orifice plates etc.: 10% or min. 1 no each type.	

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12 **PRICE SCHEDULE: NATURAL GAS COMPRESSOR**

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

Sl no.	DESCRIPTION	Qty	PRICE
1.	**Seal Gas Control system consists of the following:**		
a	Seal Gas Filter Skid MCA1044: TC9765387040	1 set	
b	Seal Gas Control Skid MCA1044: TC9765387059	1 set	
c	Seal Gas Skid Spares MCA1044: TC9765387067 (as per spares philosophy listed above)	1 set	
2.	**Additional price to withdraw the deviations to following clauses: <Vendor To Indicate Clause Nos>**		
3.	**Optional offer for addition of each of the following instrument inclusive of root valves, piping & installation materials etc.**	**Optional price for each item**	
a	Filter cartridges / elements with gaskets / o-rings (100%)	1 set	
b	Pressure Transmitter	1 unit	
c	DP Transmitter	1 unit	
d	Pressure Gauge	1 unit	
e	Differential Pressure Gauge	1 unit	
f	Smart Positioner	1 unit	
g	Solenoid valve	1 unit	
h	Flow transmitter	1 unit	
i	Level transmitter	1 unit	
j	On-Off Valve	1 unit	
4.	**Pre-Commissioning, Commissioning Supervision**		
a	Per diem for Commissioning activities for seal gas skid at site inclusive of Travel, boarding, lodging, and local conveyance.	Per diem	
5.	**Total Price for Evaluation {1+2}**		

Notes:

i. The word 'TYPE' means the Make, Model no., Type, Range, Size/ Length, Rating, Material as applicable.
ii. The individual prices for the spares and optional items above are valid for one year to order as and when the requirement arises.
iii. 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

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13 **PRICE SCHEDULE: SYNTHESIS GAS COMPRESSOR**

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

Sl no.	DESCRIPTION	Qty	PRICE
1.	**Seal Gas Control system consists of the following:**		
a	Seal Gas Filter Skid MCA1045: TC9765387075	1 set	
b	Seal Gas Control Skid MCA1045: TC9765387083	2 set	
c	Seal Gas Skid Spares MCA1045: TC9765387091 (as per spares philosophy listed above)	1 set	
2.	**Additional price to withdraw the deviations to following clauses: <Vendor To Indicate Clause Nos>**		
3.	**Optional offer for addition of each of the following instrument inclusive of root valves, piping & installation materials etc.**	**Optional price for each item**	
a	Filter cartridges / elements with gaskets / o-rings (100%)	1 set	
b	Pressure Transmitter	1 unit	
c	DP Transmitter	1 unit	
d	Pressure Gauge	1 unit	
e	Differential Pressure Gauge	1 unit	
f	Smart Positioner	1 unit	
g	Solenoid valve	1 unit	
h	Flow transmitter	1 unit	
i	Level transmitter	1 unit	
j	On-Off Valve	1 unit	
4.	**Pre-Commissioning, Commissioning Supervision**		
a	Per diem for Commissioning activities for seal gas skid at site inclusive of Travel, boarding, lodging, and local conveyance.	Per diem	
5.	**Total Price for Evaluation {1+2}**		

Notes:

iv. The word 'TYPE' means the Make, Model no., Type, Range, Size/ Length, Rating, Material as applicable.

v. The individual prices for the spares and optional items above are valid for one year to order as and when the requirement arises.

vi. 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

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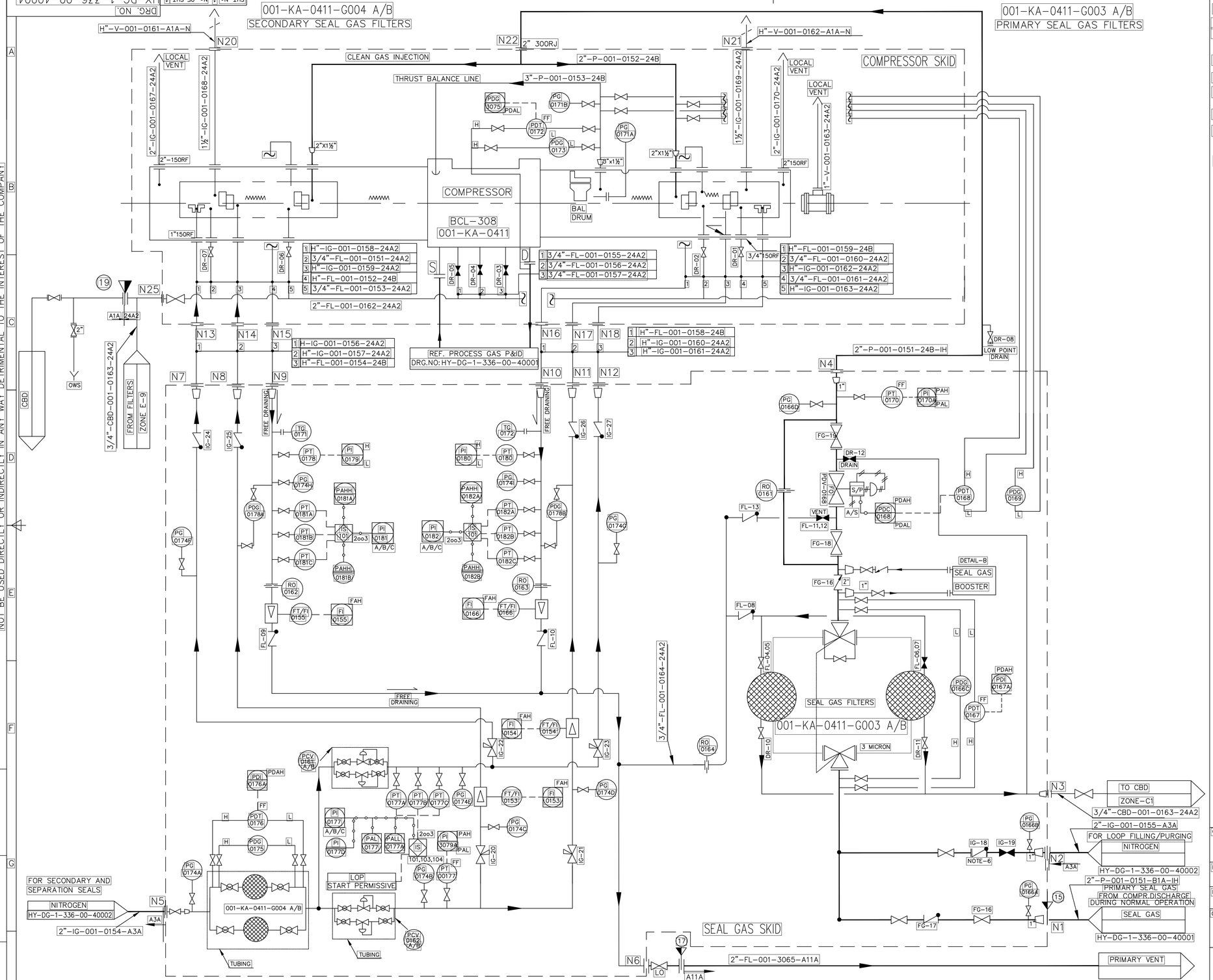


REFERENCE DRAWINGS:

1) LUBE OIL P&I DIAGRAM : HY-DG-0-336-00-40002
2) PROCESS GAS P&I DIAGRAM: HY-DG-1-336-00-40001

NOTES:

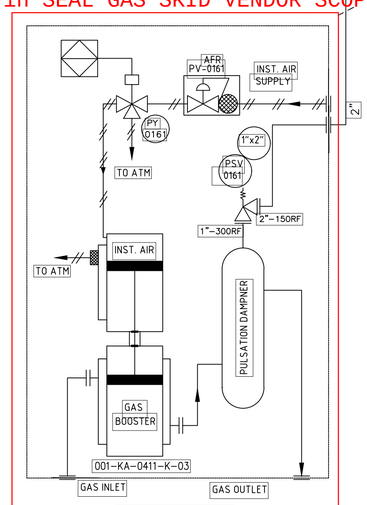
1) THERE SHOULD BE NO POCKETS OR DEAD LEGS IN CLEAN GAS SUPPLY LINE.
2) FOR INTERLOCK TABLE, REFER PROCESS GAS P&I DIAGRAM : HY-DG-1-336-00-40001
3) ALL INSTRUMENT TAG NUMBERS SHALL BE PREFIXED WITH UNIT NO. '001'.
4. ALL THE PRESSURE GAUGES SHALL HAVE A PROCESS CONNECTION OF 3/4" SW GATE VALVE. THE TEMPERATURE GAUGES SHALL HAVE A PROCESS CONNECTION OF 1½" 300# RF.
5) SEAL GAS PIPING MATERIAL WITHIN THE SEAL GAS FILTER & CONTROL SKIDS SHALL BE SS304/SS316/SS321 AS PER VENDOR.

LEGEND:

VENT TO ATM AT SAFE LOCATION

INTERNAL SCOPE OF SUPPLY	SCOPE OF SUPPLY
PACKAGES I.C PPG.	EIL BHEL

NOT in SEAL GAS SKID VENDOR SCOPE



SEAL GAS BOOSTER SKID

STATUS : FOR APPROVAL

CUSTOMER: ASSAM PETROCHEMICALS LTD. NAMRUP, ASSAM

PROJECT: 500 TPD METHANOL AND 200 TPD FORMALINE PLANT

PRODUCT: NATURAL GAS COMPRESSOR (FOR METHANOL PLANT) 001-KA-0411

CONSULTANT : ENGINEERS INDIA LTD, 1, BHIKAJI CAMA PLACE, NEW DELHI – 110 066

EIL JOB NO.: 001

BHARAT HEAVY ELECTRICALS LTD. HYDERABAD

	NAME	SIGN.	DATE	NO.OF VAR.
DRN.	DEEPAK	SD/-	24.03.18	
CHD.	DEEPAK	SD/-	24.03.18	NA
APPD.	MURALIDHAR		24.03.18	

DEPT.	UNTOL DIMS.	SCALE	WEIGHT (KG)	REF. TO ASSY. DRG.	ITEM NO.	NO.OF ITEMS
TC ENGG.	GR. C/N/F	NTS	NA	NA	NA	NA
CODE 415						

TITLE: SEAL GAS P&I DIAGRAM

CARD CODE: HY-DG-1-336-00-40004 REV. 00

SHT. No 01 NO. OF SHT. 01

ALTERED	REV.	DATE	ALTERED	REV.	DATE	ALTERED	REV.	DATE	ALTERED	REV.	DATE	ALTERED	REV.	DATE	ALTERED	REV.	DATE	ALTERED
CHD/APPD	ZONE		CHD/APPD	ZONE		CHD/APPD			CHD/APPD			CHD/APPD			CHD/APPD			CHD/APPD

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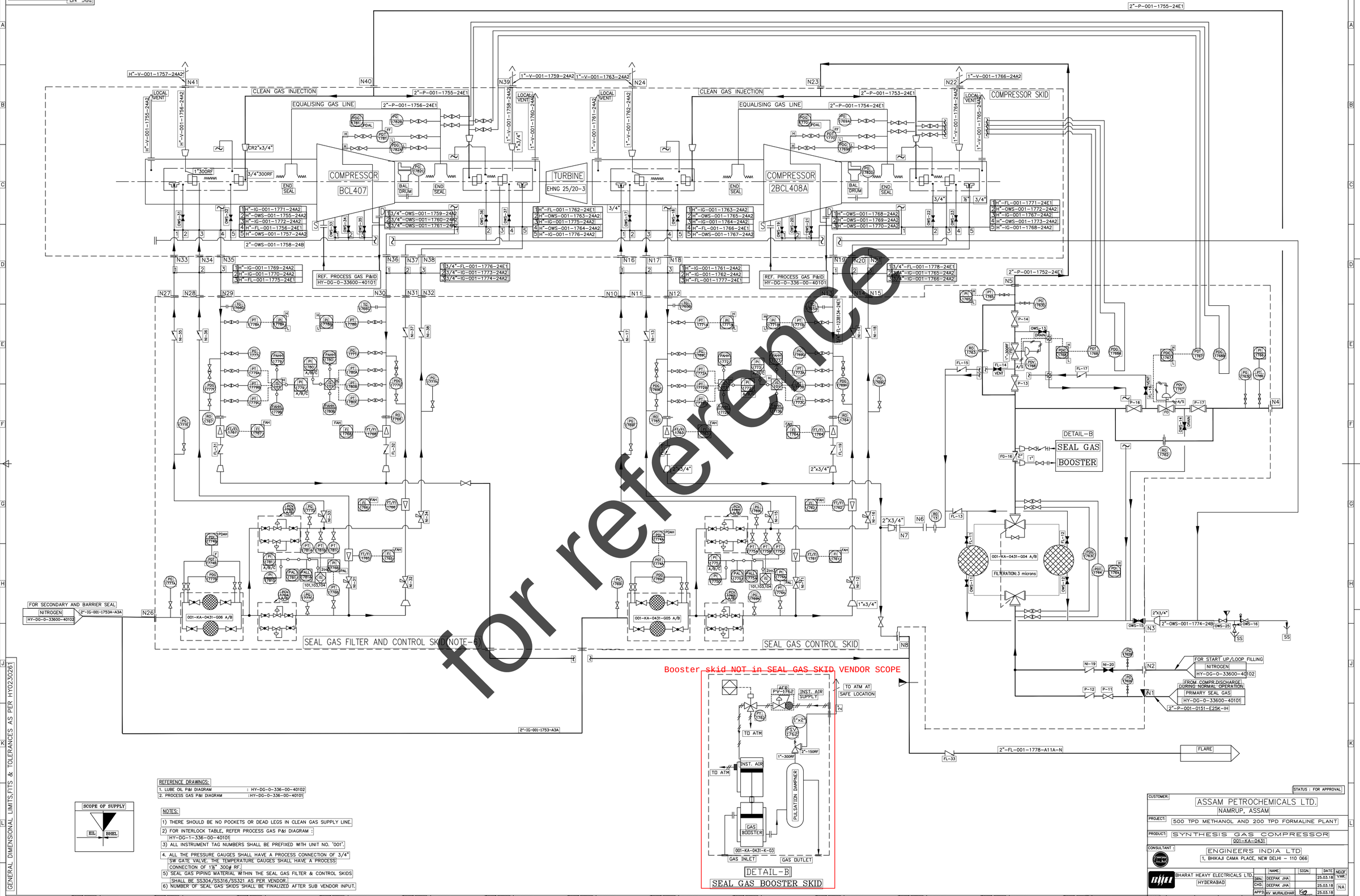
COMPUTER FILE NAME | REF. DRG. NO. | SIGN. AND DATE | INVENTORY NO

FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN mm)

DRG. NO. 0-336-00-40104 SH. 1 OF 1



for reference

SCOPE OF SUPPLY

EIL BHEL

REFERENCE DRAWINGS:

1. LUBE OIL P&I DIAGRAM : HY-DG-0-336-00-40102
2. PROCESS GAS P&I DIAGRAM : HY-DG-0-336-00-40101

NOTES:

1) THERE SHOULD BE NO POCKETS OR DEAD LEGS IN CLEAN GAS SUPPLY LINE.
2) FOR INTERLOCK TABLE, REFER PROCESS GAS P&I DIAGRAM : HY-DG-1-336-00-40101
3) ALL INSTRUMENT TAG NUMBERS SHALL BE PREFIXED WITH UNIT NO. '001'.
4. ALL THE PRESSURE GAUGES SHALL HAVE A PROCESS CONNECTION OF 3/4" SW GATE VALVE. THE TEMPERATURE GAUGES SHALL HAVE A PROCESS CONNECTION OF 1½" 300# RF.
5) SEAL GAS PIPING MATERIAL WITHIN THE SEAL GAS FILTER & CONTROL SKIDS SHALL BE SS304/SS316/SS321 AS PER VENDOR.
6) NUMBER OF SEAL GAS SKIDS SHALL BE FINALIZED AFTER SUB VENDOR INPUT.

REV.	DATE	ALTERED	CHD/APPD	ZONE

STATUS : FOR APPROVAL

CUSTOMER: ASSAM PETROCHEMICALS LTD. NAMRUP, ASSAM

PROJECT: 500 TPD METHANOL AND 200 TPD FORMALINE PLANT

PRODUCT: SYNTHESIS GAS COMPRESSOR 001-KA-0431

CONSULTANT : ENGINEERS INDIA LTD 1, BHIKAJI CAMA PLACE, NEW DELHI - 110 066

BHARAT HEAVY ELECTRICALS LTD. HYDERABAD

	NAME	SIGN.	DATE	NO.OF VAR.
DRN.	DEEPAK JHA		25.03.18	
CHD.	DEEPAK JHA		25.03.18	NA
APPD.	KV MURALIDHAR		25.03.18	

DEPT. SYS.ENGG.	UNTOL. DIMS. OR CONF.	SCALE	WEIGHT (KG)	REF. TO ASSY. DRG.	ITEM NO.	NO.OF ITEMS
CODE: 1415		NTS	NA	NA	NA	NA

TITLE: SEAL GAS P&I DIAGRAM

DRAWING NO. HY-DG-0-336-00-40104 REV. 00

SHT. No. 1 NO. OF SHT. 1

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GENERAL DIMENSIONAL LIMITS,FITS & TOLERANCES AS PER HY0230261

COMPUTER FILE NAME | SIGN. AND DATE | REF. DRG. NO | INVENTORY NO

Annexure-2

Form No. RTD-E 106

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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:
   i. Interconnection pipes and fittings between both assemblies.
   ii. Loose cable glands.
   iii. Foundation bolts and accessories
   iv. Instruments not mounted on the skids, etc.
   v. 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. 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~~

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~~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. Seal Gas Duplex Filter (Coalescing)

4.1 The Duplex gas Filter shall be coalescing type 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.

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4.7 Filtration grade:

a) Solids: Beta 75(98.7% efficient) on 2 microns or greater.

b) Liquids : Beta 75(98.7% efficient) on 1 microns or greater.

5. 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 #900 & # 1500**
Pipe Schedule	Schedule 80 S	Schedule 80 S	Schedule 160 S
Flanges & 2" Valves	# 300 RF	# 600 RTJ	**#900RTJ &** #1500RTJ **as applicable**
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. PMI to be done for all materials, fittings & weld materials.

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

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.

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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 valves shall be provided for all high-pressure (pressures more than 40 ata) isolation, equalization, vent & drains.

5.14 Design pressure **at 170° C** of all piping, valves, fittings, instruments, filters shall be as described below

Item	For #300 rating	For #600 rating	**For rating #900 & # 1500**
Primary seal inlet and vent lines	**30** Kg/cm^2(g)	**60** Kg/cm^2 (g)	**90 Kg/cm^2 (g) for #900 & 152 Kg/cm^2(g) for #1500**
Secondary & Barrier seal lines	20 Kg/cm^2 (g)	20 Kg/cm^2 (g)	20 Kg/sq.cm(g)

5.15 Hydro test pressures for seal gas filter skid and seal gas control skid shall be carried out with water after the instrument dismounting and isolation of tubing line. After the test the piping should be blown with air. The hydraulic pressure is as follows:

Item	**For #300 rating**	**For #600 rating**	**For rating #900 & # 1500**
Primary seal inlet and vent lines	**60 Kg/sq.cm(g)**	**120 Kg/sq.cm(g)**	**180 Kg/cm^2 (g) for #900& 300 Kg/cm^2(g) for #1500**
Secondary & Barrier seal lines	**30 Kg/sq.cm(g)**	**30 Kg/sq.cm(g)**	**30 Kg/sq.cm(g)**

5.16 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. 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.

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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. 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.

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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 **as indicated in variants of table-4**, 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 procure from their standard sub-vendors

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 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 1½" NPT at bottom and 12nos of Inlets of size ½" 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.

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Cable glands, JB's and blanking plug shall be suitable for area Classification IEC Zone 1, Gas IIA, 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 M ohm / 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 part2.

7. 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 if hook up is envisaged as tubing. Integral manifolds shall be used in piping hook-ups for 300#.

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.

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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.

7.14 The instruments shall not be mounted directly on its hook-up. The instruments shall first be mounted on gauge board / 2"pipe and then the hook-up shall be connected.

8. 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.~~

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~~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 All components (instruments, valves, cable glands, junction box etc.) shall be identified by means of a plate placed on the structure with stainless material tearing rivets. All instruments shall have a second stainless steel plate fixed to the instrument body by means of a steel wire. The junction boxes shall be equipped with a second plate fixed to its cover by means of an oil-proof adhesive (Loctite or similar). ALL THE PLATES SHALL BE MANUFACTURED AND ENGRAVED ACCORDING TO PROJECT SPECIFIC P&ID.

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

8.7 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.

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

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

8.10 Junction boxes will be installed on the side plates of the panel; the distance between the bottom of these junction boxes and the ground must be at least 800 mm and 500 mm in case of adjacent boxes.

8.11 Seal gas gauge board shall be equipped with n°2 earthing bosses.

8.12 Inside each panel a SS bar measuring 16 mm^2, rectangular-sectioned shall be included for the connection of ground cables coming from the instruments or other.

9. 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. 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. 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.

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12. 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. 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.

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14. 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. 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. Services:

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

17. 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. 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.

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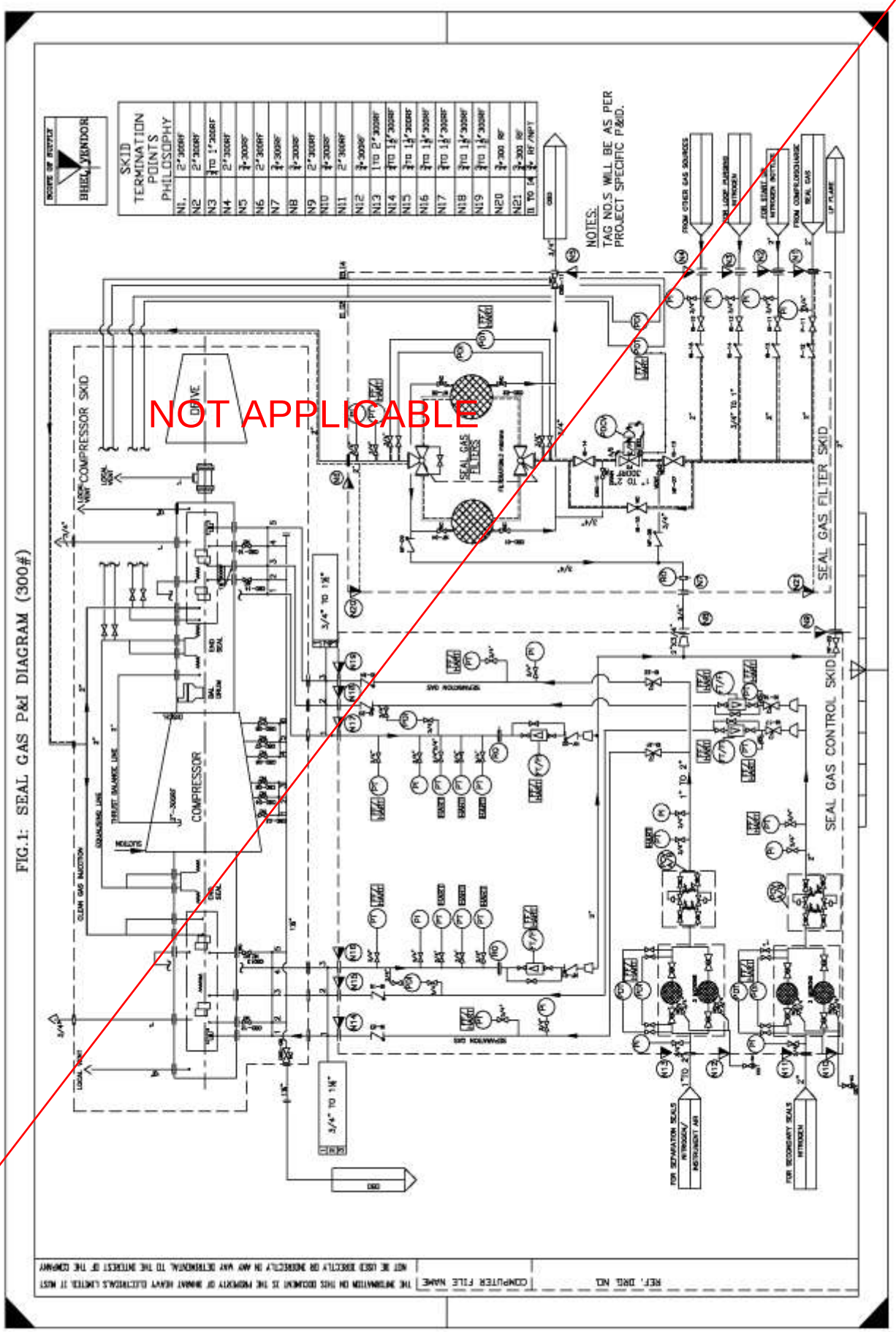

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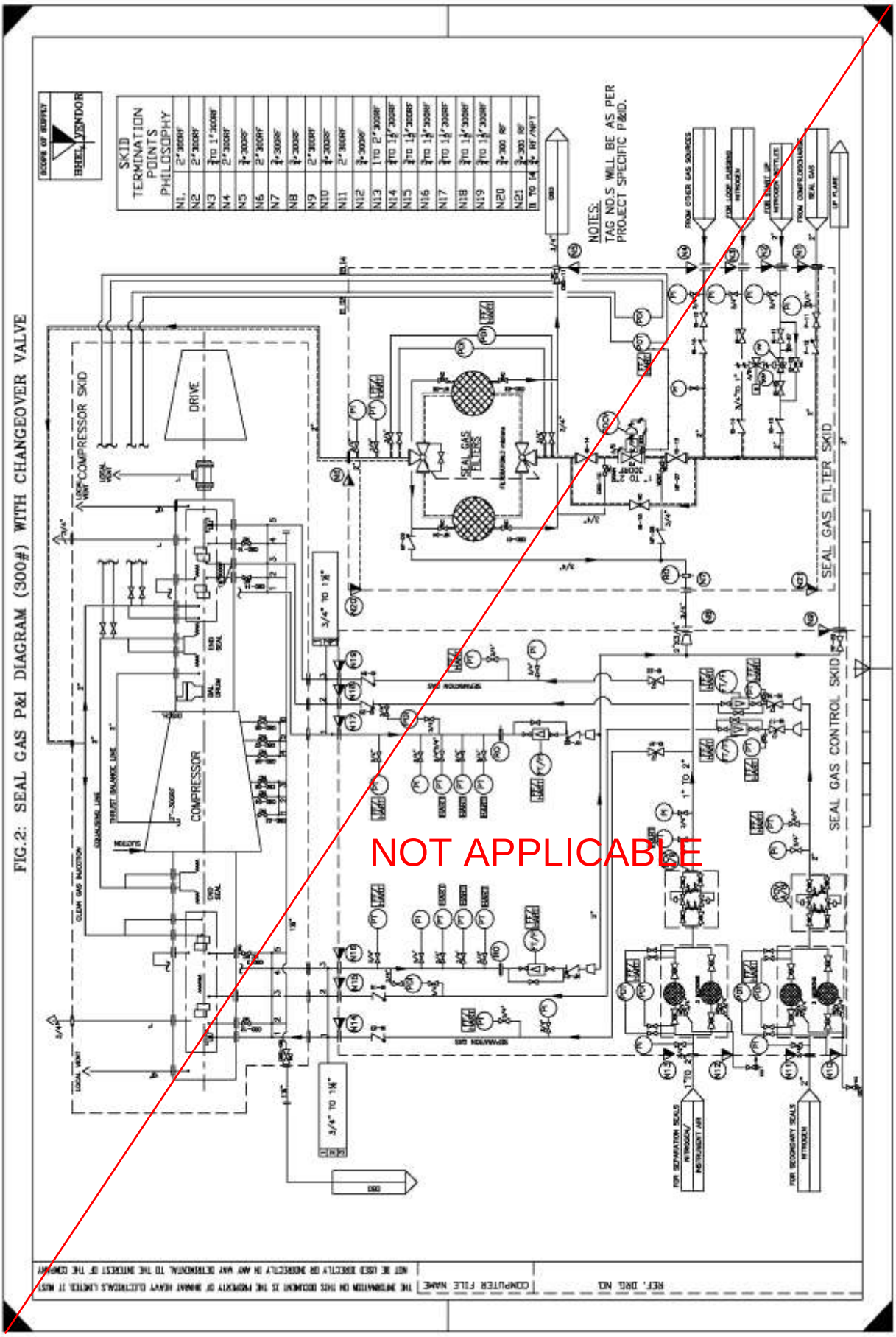

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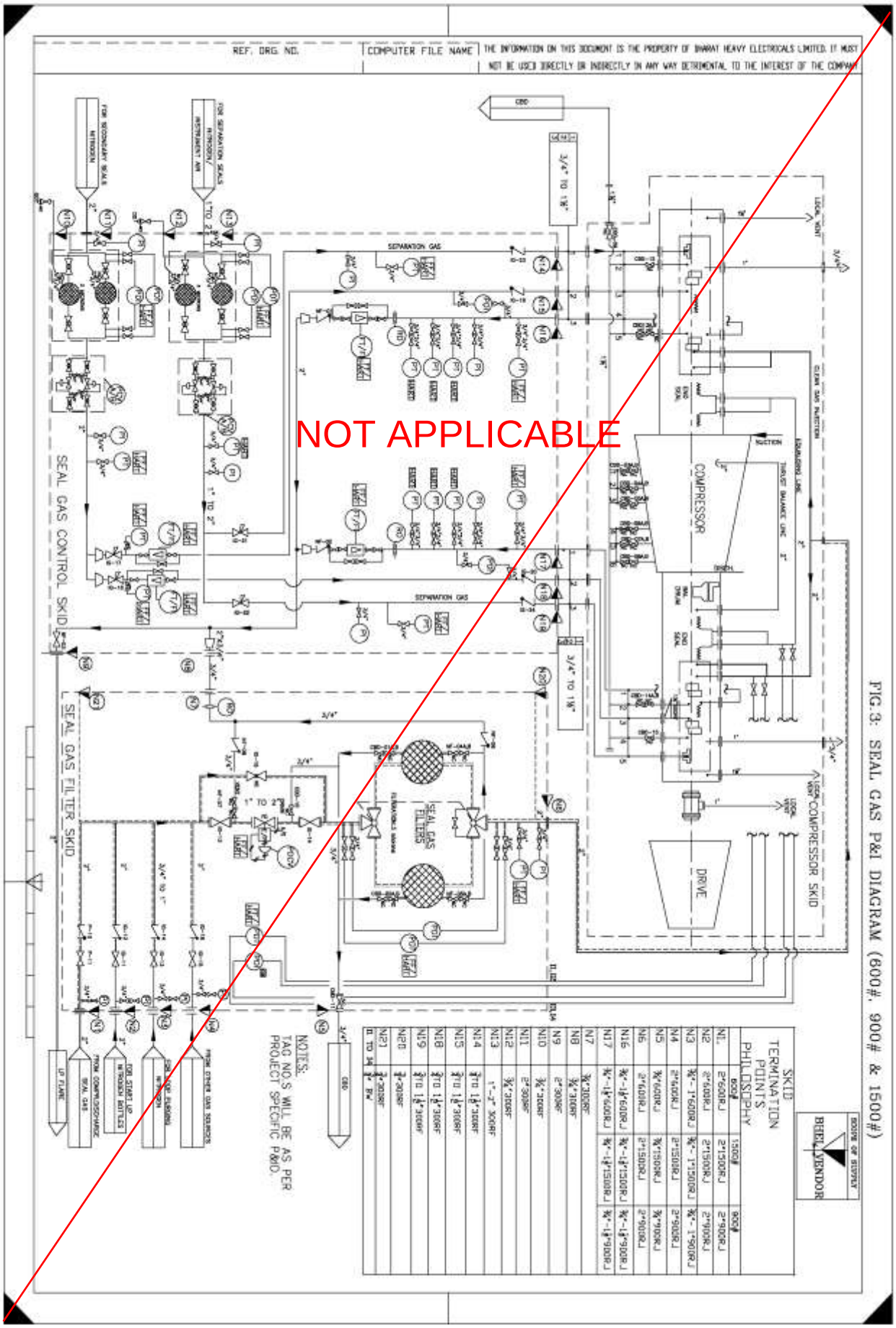

FIG.3: SEAL GAS P&I DIAGRAM (600#, 900# & 1500#)

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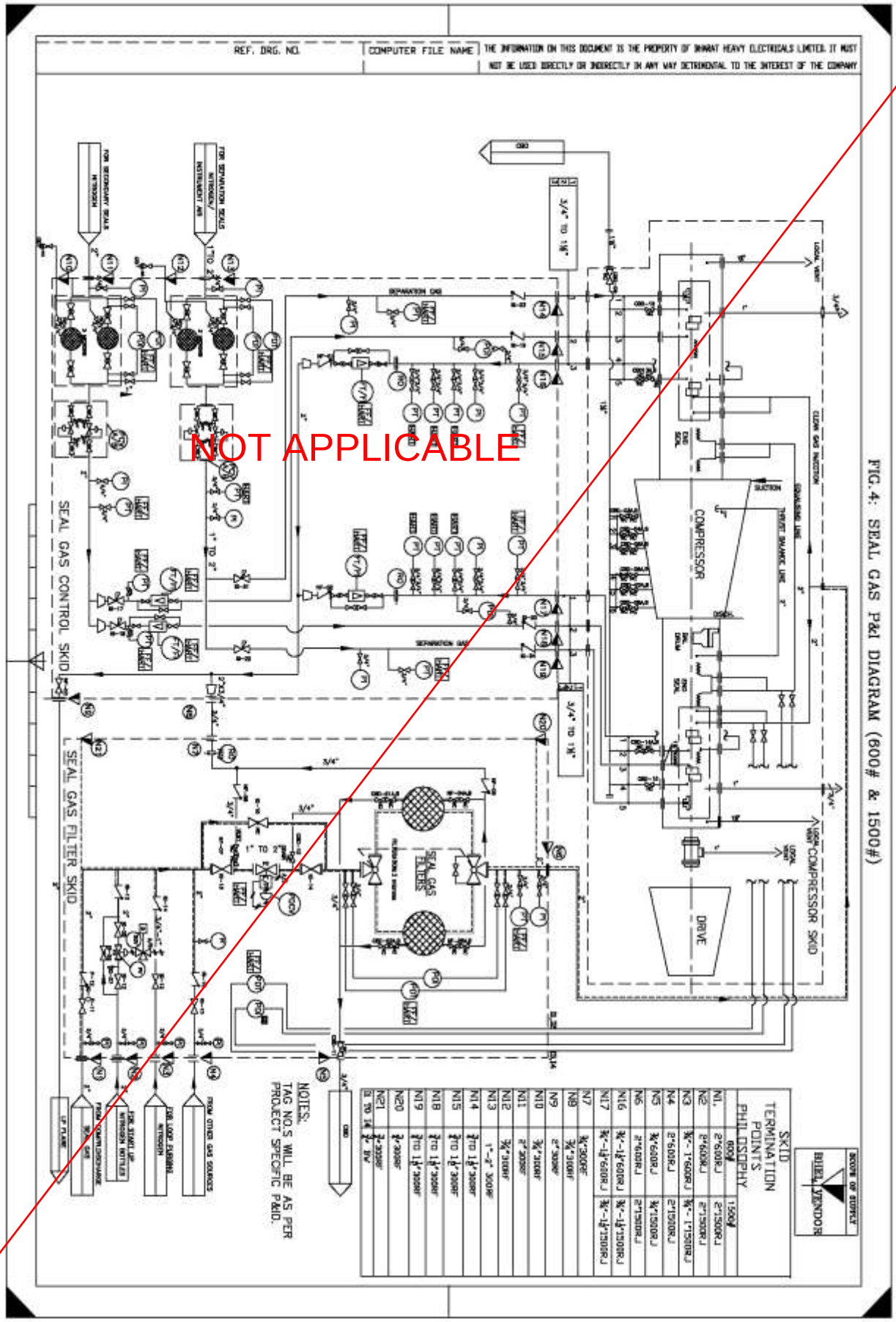

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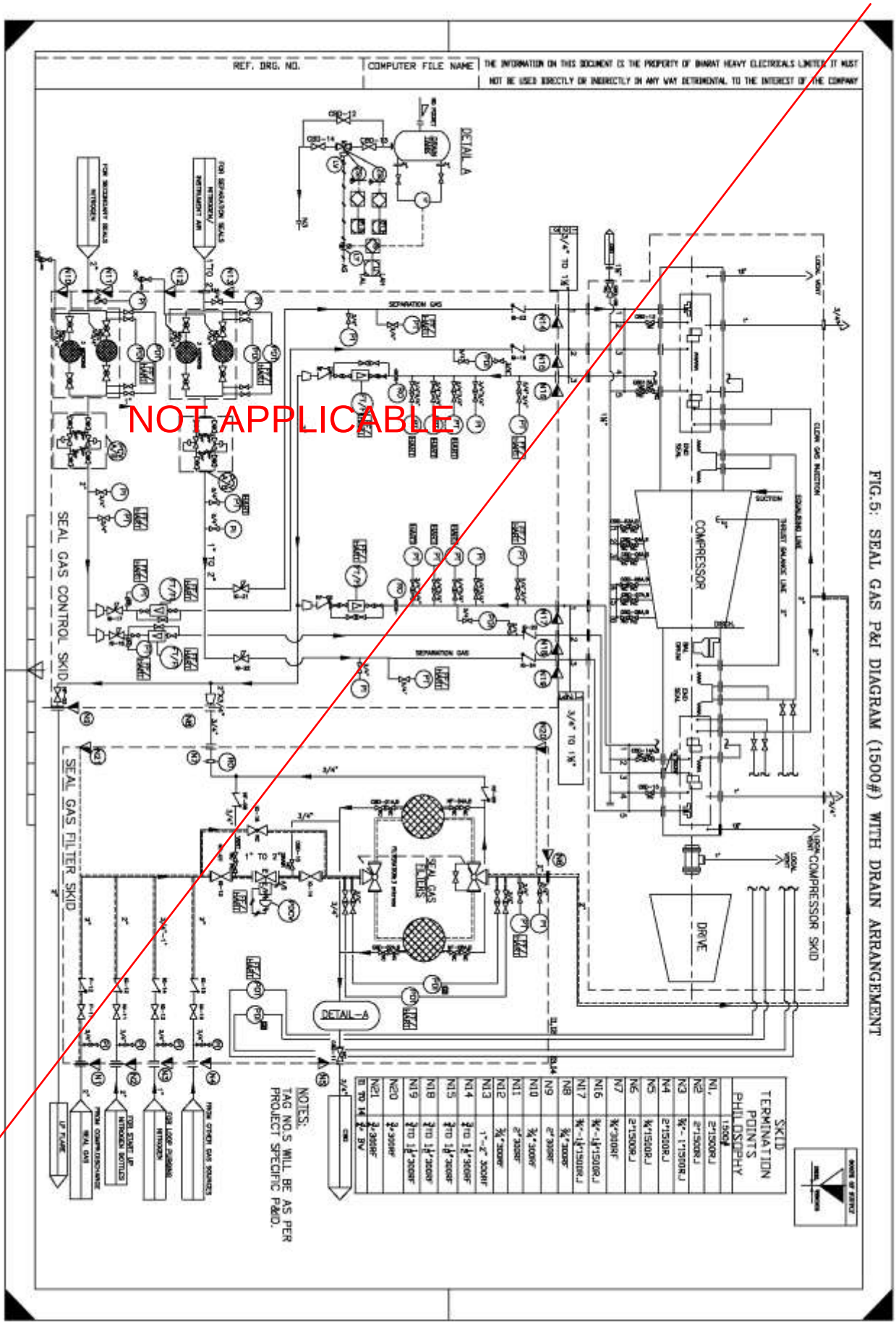

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~~Table 1: Technical Specifications of Instruments and other components~~

(* 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 **IP66; panel mount** 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 **IP67; panel mount** 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 07A1 J B7 KD L4 M5 Q4 QT T1 DF D1 TR FF model: 3051CD 3F 07 A1 J D01 B7 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) shall be included in the model number by the vendor SIL certified(for HART)	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/ FS1(or KS2) / LC1/ D46
4	Pressure Transmitters	21 nos (for fig. 2 & 4) 17 nos (for fig. 1, 3 & 5)	Smart (Hart Protocol/ FF) Transmitters Range : * Others same as sl.no. 3	Emerson	HART model: 3051CG X A 07A1 J B7 KD L4 M5 Q4 QT T1 DF D1 TR Note : X is as per range FF(FNICO/FISCO) model: 3051CG X F 07A1 J D01 B7 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/ FS1 (or KS2) / LC1/ D46 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 02 A1 J S2 B7 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 : *		FF model: 3051CD 2F 02 A1 J D01 B7 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
			Others same as sl.no. 3		
			Pr. Connections: 3" Flanged	YIL	Equivalent models for HART and FF
			Flush flange with spacer ring minimum SS316 with Flushing / Filling Connection (1/2"size)		
9	Magnetic level gauge for drain pot	1no.	Body matl.: SS 316L	Levcon or Chemtrols or Technomatic or Krohne	
			Pr.conn: 1" Flanged		
			The maximum visible range of a single gauge shall not exceed 1470 mm		

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			Ball check valve (offset design) required.		
10	Drain valve for drain pot	1no.	Smart/FF positioner as per sl.no 5 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 (Coalescing type) with change over transfer valve	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 or Boll & kirch, Germany; or Hydac, 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 or Dresser valve India Pvt Ltd.	

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16	Duplex Filter, regulator with SS housing and changeover transfer valve	2 nos.	As per system requirement	Norgren or Parker or or Boll & kirch, or Hydac	
17	In line check valves		As per system requirement	Audco or BDK or ATIPL	
18	Needle valves		As per system requirement	Audco or BDK or ATIPL	
19	Instrument root & Isolation valves		As per system requirement	Audco or BDK or ATIPL	
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	

~~Notes:~~

~~(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. For the items, which are not covered in the list or vendors not indicated, vendor has to procure from their standard sub-vendors.~~

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

~~(3) All the items of the same type of instrument shall be of same make.~~

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~~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)
9.1(a)	Compliance for BHEL specification and its Annexure	
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 procure from their standard sub-vendors. 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 for the satisfactory working of the seals shall be supplied by vendor without any price/delivery implications.	
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.	
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~~

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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--

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	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--

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~~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

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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	Shifted to Table-4		
44	Shifted to Table-4		
45	Shifted to Table-4		
46			
47			
48			
49			
50			

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TC55450.DOC

~~Table – 4: Variant Table~~

Var No	Description	Requirements		Material code	Reference P&ID
51	Seal gas Filter Skid	Rating: Insts Hookup: DCS Insts:	#300 Tubing 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: Insts Hookup: DCS Insts:	#300 Piping 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: Insts Hookup: DCS Insts: Startup Gas:	#300 Tubing HART Protocol 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 Insts Hookup DCS Insts Startup Gas:	#300 Piping HART Protocol 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 Insts Hookup DCS Insts	#300 Tubing 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 Insts Hookup DCS Insts	#300 Piping 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 Insts Hookup DCS Insts	#300 Tubing FF Instruments	TC9755450696	Fig.2
70	Seal gas Control Skid			TC9755450700	Fig.2

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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
43	**Seal gas Filter Skid**	**Rating** **Insts Hookup**	**#600** **Piping/Tubing**	**TC9755450432**	**Fig.3**
44	**Seal gas Control Skid**	**DCS Insts**	**HART Protocol**	**TC9755450440**	**Fig.3**
45	**Spares for Seal gas filter skid and control skid**			**TC9755450459**	**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

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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 – 4-A: Variant Table

75	Seal gas Filter Skid	Rating Insts Hookup	**#900** 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

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~~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** The word "TYPE" means the make, model no, range, size/length, rating, material as applicable	
	a) Pressure Gauges, Differential Pressure Gauges, level gauges-10% or min 1 no. each type.		
	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**~~

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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
03	17.09.2010	Variants 43,44,45 added, Changes Highlighted	RAM	VVS

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Approved Vendor List for Equipment/Materials

Control Stations (Flameproof)	Baliga Lighting Equipments (P) Limited, FCG Flameproof control gears P. Ltd, FCG Power Industries Pvt. Ltd., Flameproof Equipments Pvt. Ltd., Flexpro Electricals Pvt. Ltd., Petroleum Safety Products Ind. PVT. LTD., Kaysons Techno Equipment P LTD., Sudhir Switchgears PVT LTD.
Junction Box (Flameproof)	Baliga Lighting Equipments (P) Limited, FCG Flameproof control gears P. Ltd, FCG Power Industries Pvt. Ltd., Flameproof Equipments Pvt. Ltd., Flexpro Electricals Pvt. Ltd., Petroleum Safety Products Ind. PVT. LTD., Kaysons Techno Equipment P LTD., Sudhir Switchgears PVT LTD.,
Motors (Imported)	Asea Brown Bovery Limited (ABB Ltd.), NIDEC ASI SPA, CEMP SRL, General Electric Canada, Hitachi Ltd., Jeumont SA/ Framatone ANP, Loher GMBH, LLOYD Dynamowerke GMBH&CO. KG, Siemens AG, Toshiba Corporation, WEG Equipamentos Eletricos S.A., Wegeuro- Industria Electrica S.A.
Motors (Induction) MV (Zone-2 Type –e and n)	ABB Limited, Bharat Bijlee Ltd., Crompton Greaves Ltd., Kirloskar Electric Co. Ltd, Laxmi Hydraulics Pvt. Ltd., Marathon Electric Motor Ltd.
Cable glands (Hazardous Area)	Baliga Lighting Equipments (P) Limited, Comet Brass Products, Comet Industries, FCG Flameproof Control Gears P. Ltd., FCG Power Industries Pvt. Ltd., Flameproof Equipments Pvt. Ltd., Flexpro Electricals Pvt. Ltd., Standard Metal Industries, Kaysons Techno Equipment P LTD., Sudhir Switchgears PVT LTD.

Notes:-

1. This list is 'Preliminary' and Vendor / Contractor needs to take one time approval of all desired sub-vendors after Award of Purchase Order/Contract".

2. Vendor may procure material from any of the Owner/EIL approved vendors. However, current validity and range of approval as per EIL enlistment letter, work-load, stability and solvency needs to be verified by the vendor before placement of order.

3. Makes of items not covered above shall be subject to Owner/EIL approval.

Rev. No	Date	Purpose	Prepared by	Checked by	Approved by
B	07.01.16	Issued with MR	LCK	RKR	VKJ
A	08.04.15	Issued with MR	LCK	RKR	VKJ

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ANNEXURE-A to A672-001-16-51-SP-5003

PROJECT SUPPLIER LIST FOR METHANOL PROJECT OF APL
(INSTRUMENTATION ITEMS)

1. ITEM: AIR FILTER REGULATORS (15BA)

SL.NO.	NAME OF SUPPLIERS	VENDOR CODE	COUNTRY
1.	DIVYA CONTROL ELEMENTS PVT. LTD.	D077	INDIA
2.	JANATICS INDIA PVT. LTD.	J092	INDIA
3.	MARSH BELLOFRAM	M710	USA
4.	PLACKA INSTRUMENTS INDIA P LTD.	P293	INDIA
5.	SCHRADER DUNCAN LIMITED	S091	INDIA
6.	SHAH PNEUMATICS	S242	INDIA
7.	SHAVO NORGREN (I) PVT. LTD.	S035	INDIA
8.	THOMSON VALVES LTD.	T745	U.K
9.	VELJAN HYDRAIR PVT. LTD.	V019	INDIA

2 ITEM: SIGNAL CABLES (15CB)

SL.NO.	NAME OF SUPPLIERS	VENDOR CODE	COUNTRY
1.	ASSOCIATED CABLES PVT. LTD.	A034	INDIA
2.	ASSOCIATED FLEXIBLES & WIRES (P) LTD.	A132	INDIA
3.	CMI LIMITED	C019	INDIA
4.	CORDS CABLE INDUSTRIES LTD.	C145	INDIA
5.	DELTON CABLES LIMITED	D012	INDIA
6.	ELKAY TELELINKS LTD.	E063	INDIA
7.	KEI INDUSTRIES LIMITED	K082	INDIA
8.	POLYCAB WIRES PVT. LTD.	P254	INDIA
9.	RALLISON ELECTRICALS PVT. LTD.	R203	INDIA
10.	SUYOG ELECTRICALS LTD.	S304	INDIA
11.	T C COMMUNICATION PVT. LTD.	T243	INDIA
12.	THERMO CABLES LTD. (FORM. T-150)	T212	INDIA
13.	UDEY PYROCABLES PVT. LTD.	U015	INDIA

3 ITEM: OPTICAL FIBRE CABLE& ASSOC. ITEM (15CC)

SL.NO.	NAME OF SUPPLIERS	VENDOR CODE	COUNTRY
1.	ABB INDUSTRI AS	A714	NORWAY
2.	AKSH OPTIFIBRE LIMITED	A400	INDIA
3.	BIRLA ERICSSON OPTICAL LIMITED	B155	INDIA
4.	FINOLEX CABLES LTD.	F013	INDIA
5.	HIMACHAL FUTIRISTIC COMMUNICATIONS LTD.	H138	INDIA
6.	KABEL RHEYDT	K615	GERMANY
7.	KEC INETRNATIONAL -MYSORE	K190B	INDIA
8.	PIRELLI CAVI SPA	P610	ITALY
9.	STERLITE OPTICAL TECHNOLOGIES LTD.	S100	INDIA
10.	U M CABLES LTD.	U099	INDIA
11.	VINDHYA TELELINKS LIMITED	V092	INDIA

4. ITEM : COPPER TUBES (COATED, BARE) (15DB)

SL.NO.	NAME OF SUPPLIERS	VENDOR CODE	COUNTRY
1.	MEHTA TUBES LIMITED	M288	INDIA
2.	MULTIMETALS LIMITED	M048	INDIA
3.	RAJCO METAL INDUSTRIES P LTD.	R177	INDIA

6 ITEM : SOLENOID VALVES (15EA)

SL.NO.	NAME OF SUPPLIERS	VENDOR CODE	COUNTRY
1.	ALCON ALEXANDER CONTROLS LIMITED	A588	U. K
2.	ASCO JOUCOMATIC LTD.	A555	U.K
3.	ASCO JOUCOMATIC SA	A721	FRANCE
4.	ASCO NUMATICS (INDIA) P. LIMITED	A167	INDIA
5.	AVCON CONTROLS PVT. LTD.	A052	INDIA
6.	HERION WERKE	H554	GERMANY
7.	PRECISION INSTRUMENT COMPANY	P217	INDIA
8.	ROTEX AUTOMATION LTD.	R021	INDIA

9.	SCHRADER DUNCAN LIMITED	S091	INDIA
10.	THOMSON VALVES LTD.	T745	U.K
11.	VERSA BV	V542	NETHERLANDS

7 ITEM : CONTROL VALVES (15EB)

SL.NO.	NAME OF SUPPLIERS	VENDOR CODE	COUNTRY
1.	ARCA REGLER GMBH	A529	GERMANY
2.	AST APPARECCHI DI SICUREZZA E TENUTA SPA	A761	ITALY
3.	CCI VALVE TECHNOLOGY GMBH	C731	CZECH REPUBLIC
4.	CONTINENTAL VALVE LTD.	C032	INDIA
5.	DRESSER PRODUITS INDUSTRIES	D649	FRANCE
6.	DRESSER VALVE INDIA PVT. LTD.	D127	INDIA
7.	EMERSON PROCESS MANGMNT CHENNAI PVT. LTD.	E179A	INDIA
8.	FLOWSERVE INDIA CONTROL PVT. LTD.- BANGALOR	F176	INDIA
9.	FLOWSERVE PTE LTD.	F636	SINGAPORE
10.	FORBES MARSHALL ARCA P LTD. (FORMLY A214)	F151	INDIA
11.	ITALVALV S. N. C	I586	ITALY
12.	KENT INTROL UK LTD. (FORM. A-718)	K624	U.K
13.	KOSO INDIA PVT. LTD. (FORM. K176)	K179A	INDIA
14.	METSO FLOW CONTROL OY	M700	FINLAND
15.	MIL CONTROLS LIMITED	M055	INDIA
16.	MOTOYAMA ENGG. WORKS LTD.	M561	JAPAN
17.	SAMSON AG MESS-UND REGELTECHNIK	S510	GERMANY
18.	SAMSON CONTROLS PVT. LTD.	S442	INDIA
19.	SEVERN GLOCON LTD	S505	U.K
20.	SEVERN GLOCON INDIA PVT. LTD.	S023	INDIA
21.	SPX VALVES & CONTROLS (FORMLY DEZURIK)	S793	U.S.A
22.	WEIR VALVES & CONTROLS UK LTD.	W5941	U. K

8 ITEM : PRESSURE RELIEF VALVES (15EC)

SL.NO.	NAME OF SUPPLIERS	VENDOR CODE	COUNTRY
1.	ANDERSON GREENWOOD CROSBY	A710	U.S.A
2.	AST APPARECCHI DI SICUREZZA E TENUTA SPA	A761	ITALY
3.	BHEL (TRICHY)	B015	INDIA

4.	BLISS ANAND PVT. LTD.	B110	INDIA
5.	CURTISS WRIGHT FLOW CONTROL CORPORATION	C700	U.S.A &CANADA
6.	DARLING MUESCO (INDIA) PVT. LTD.	D101	INDIA
7.	DRESSER INC.	D523	U.S.A.
8.	INSTRUMENTATION LTD. (PALGHAT)	I172	INDIA
9.	LESER GMBH & co. kg	L569	GERMANY
10.	NAKAKITA SEISAKUSHO CO. LTD.	N541	JAPAN
11.	TYCO SANMAR LTD.	T181	INDIA
12.	WEIR BDK VALVES – A UNIT OF WEIR INDIA PVT.	W092	INDIA

9 ITEM : INSTRUMENT VALVES& MANIFOLDS (15ED)

SL.NO.	NAME OF SUPPLIERS	VENDOR CODE	COUNTRY
1.	ANDERSON GREENWOOD CROSBY	A710	U.S.A
2.	ARYA CRAFTS & ENGINEERING PVT. LTD.	A345	INDIA
3.	ASTEC VALVES & FITTINGS PVT. LTD.	A240	INDIA
4.	AUTOCLAVE ENGINERS FLUID COMPONENTS	A701	U.S.A.
5	BAUMER TECHNOLOGIES INDIA PVT. LTD. (W058)	B213	INDIA
6.	CHEMTROLS INDUSTRIES LTD.	C015	INDIA
7.	CIRCOR INSTR. TECHNOLOGIES INC-FORM. H608	C714	U.S.A.
8.	COMFIT & VALVES PVT. LTD.	C220	INDIA
9.	EXCEL HYDRO PNEUMATICS PVT. LTD.	E104	INDIA
10.	EXCELSIOR ENGG. WORKS	E008	INDIA
11.	FLUID CONTROLS PVT. LTD.	F146	INDIA
12.	HAM-LET (ISRAEL-CANADA) LTD.	H634	ISRAEL
13.	MICRO PRECISION PRODUCTS PVT. LTD.	M010	INDIA
14.	PANAM ENGINEERS	P307	INDIA
15.	PARKER HANNIFIN CORPORATION	P671	U.S.A
16	PRECISION ENGINEERING INDUSTRIES	P240	INDIA
17.	PRIME ENGINEERS	P303	INDIA
18.	SWAGELEK CO.	S773	U.S.A
19.	SWASTIK ENGINEERING WORKS	S303	INDIA
20.	TECNOMATIC INDIA PVT. LTD.	T047	INDIA
21.	TK FUJIKIN CORPORATION	T761	KOREA

10. ITEM:TANK PR. PROTECT. DEVICES / FLAME ARRSTR (15EE)

SL.NO.	NAME OF SUPPLIERS	VENDOR CODE	COUNTRY
1.	ANDERSON GREENWOOD CROSBY	A710	U.S.A
2.	ANDERSON GREENWOOD VAREC	A733	U.S.A
3.	BRAUNSCHWEIGER FLAMMENFILTER	B537	GERMANY
4.	GROTH CORPORATION	G568	U.S.A
5.	L & J TECHNOLOGIES	L562	U.S.A
6.	PRESSURE & FLOW CONTROL INDUSTRIES	P318	INDIA
7.	PROTEGO INDIA PVT. LTD.	P205	INDIA
8.	SAFETY SYSTEMS UK LTD.	S797	U.K

11. ITEM : ON-OFF VALVES (15EF)

SL.NO.	NAME OF SUPPLIERS	VENDOR CODE	COUNTRY
1.	CAMERON ITALY SRL (FORM. D659)	C718	ITALY
2.	CONTINENTAL VALVE LTD.	C032	INDIA
3.	EL-O-MATIC INDIA (PVT) LTD.	E141	INDIA
4.	FLOWSERVE INDIA CONTROLS PVT. LTD.	F176A	INDIA
5	FLOSERVE PTE LTD.	F636	SINGAPORE
6.	ITALVALV S. N. C	I586	ITALY
7.	KITAMURA VALVE MANUFACTURING CO. LTD.	K511	JAPAN
8.	KITZ CORPOPRATION OF EUROPE S. A	K620	SPAIN
9.	KOSO INDIA PVT. LOMITED	K179B	INDIA
10.	L & T VALVES LIMITED	L001	INDIA
11.	METSO FLOW CONTROL OY	M700	FINLAND
12.	MICROFINISH VALVES PVT. LIMITED	M094	INDIA
13.	MOTOYAMA ENGG. WORKS LTD.	M561	JAPAN
14.	PENTAIR VALVES & CONTROLS INDIA PVT. LTD.	T198	INDIA
15.	PERRIN GMBH	P689	GERMANY
16	PIBIVIESSE S. R. L.	P544	ITALY
17.	ROTEX MANUFACTURERS & ENGINEERS P LTD.	R199	INDIA
18.	SAMSON AG MESS-UND REGELTECHNIK	S510	GERMANY
19.	SPX VALVES & CONTROLS (FORMLY DEZURIK)	S793	U.S.A
20.	TYCO VALVES & CONTROLS	T733	U.S.A
21.	VIRGO VALVES & CONTROLS PVT. LTD.	V088	INDIA
22.	WEIR BDK VALVES –A UNIT OF WEIR INDIA PVT.	W092	INDIA
23.	WEIR VALVES & CONTROLS UK LTD.	W5941	U. K

12. ITEM : SELF ACTUATED PR. CONTROL VALVES (15EG)

SL.NO.	NAME OF SUPPLIERS	VENDOR CODE	COUNTRY
1.	DRESSER PRODUITS INDUSTRIES	D649	FRANCE
2.	DRESSER VALVE INDIA PVT. LTD.	D127	INDIA
3.	ELSTER-INSTROMET NV-FORMER. 1563	E626	BELGIUM
4.	EMERSON PROCES MGMT ASIA PACIFIC PTE LTD.	E6231	SINGAPORE
5.	EMERSON PROCESS MANGMT CHENNAI PVT. LTD.	E179A	INDIA
6.	ESME VALVES LTD.	E534	U.K
7.	GORTER CONTROLS B. V	G603	U.S.A.
8.	NIRMAL INDUSTRIAL CONTROL PVT. LTD.	N088	INDIA
9.	PIETRO FIORENTINI SPA	P538	ITALY
10.	RICHARDS INDUSTRIES (FORMERLY TRELOAR)	R610	U.S.A
11.	RMG REGEL-MESSTECHNIK GMBH	R539	GERMANY
12.	SAMSON AG MESS-UND REGELTECHNIK	S510	GERMANY
13.	SAMSON CONTROLS PVT. LTD.	S442	INDIA

13. ITEM: SP. CONTROL VALVES (ECC. DISC HI PERF) (15EI)

SL.NO.	NAME OF SUPPLIERS	VENDOR CODE	COUNTRY
1.	DRESSER PRODUITS INDUSTRIES	D649	FRANCE
2.	EMERSON PROCES MGMT ASIA PACIFIC PTE LTD.	E6232	SINGAPORE
3.	EMERSON PROCESS MANGMT CHENNAI PVT. LTD.	E179A	INDIA
4.	FLOWSERVE INDIA CONTROL PVT. LTD.-BANGALOR	F176	INDIA
5.	FLOWSERVE PTE LTD.	F636	SINGAPORE
6.	ITALVALV S. N. C	I586	ITALY
7.	KOSO INDIA PVT. LIMITED	K179B	INDIA
8.	METSO FLOW CONTROL OY	M700	FINLAND
9.	MOTOYAMA ENGG. WORKS LTD.	M561	JAPAN
10.	PENTAIR VALVES & CONTROLS INDIA PVT. LTD.	T198	INDIA
11.	SAMSON AG MESS-UND REGELTECHNIK	S510	GERMANY
12.	SPX VALVES & CONTROLS (FORMERLY DEZURIK)	S793	U.S.A
13.	TYCO VALVES & CONTROLS	T733	U.S.A
14.	TYCO VALVES & CONTROLS ITALIA SPA	T719A	ITALY
15.	WEIR VALVES & CONTROLS UK LTD.	W5941	U.K

14. ITEM: SPECIAL CONTROL VALVES (BUTTERFLY) (15EJ)

SL.NO.	NAME OF SUPPLIERS	VENDOR CODE	COUNTRY
1.	DRESSER PRODUITS INDUSTRIES	D649	FRANCE
2.	EMERSON PROCES MGMT ASIA PACIFIC PTE LTD.	E6232	SINGAPORE
3.	EMERSON PROCESS MANGMT CHENNAI PVT. LTD.	E179A	INDIA
4.	FLOWSERVE INDIA CONTROL PVT. LTD.- BANGALOR	F176	INDIA
5.	FLOWSERVE PTE LTD.	F636	SINGAPORE
6.	ITALVALV S. N. C	I586	ITALY
7.	METSO FLOW CONTROL OY	M700	FINLAND
8.	MOTOYAMA ENGG. WORKS LTD.	M561	JAPAN
9.	PENTAIR VALVES & CONTROLS INDIA PVT. LTD.	T198	INDIA
10.	SAMSON AG MESS-UND REGELTECHNIK	S510	GERMANY
11.	SPX VALVES & CONTROLS (FORMERLY DEZURIK)	S793	U.S.A
12.	TYCO VALVES & CONTROLS	T733	U.S.A
13.	WEIR VALVES & CONTROLS UK LTD.	W5941	U.K

15. ITEM: DESUPERHEATERS & PRDS (15EL)

SL.NO.	NAME OF SUPPLIERS	VENDOR CODE	COUNTRY
1.	ARCA REGLER GMBH	A529	GERMANY
2.	CCI VALVE TECHNOLOGY AB (FORMERLY B-706)	C706	SWEDEN
3.	CHEMTROLS INDUSTRIES LTD.	C015	INDIA
4.	CIRCOR FLOW TECHNOLOGIES INDIA PVT. LTD.	C226	INDIA
5.	FORBES MARSHALL ARCA P. LTD. (FORMRLY A214)	F151	INDIA
6.	HOLTER REGELARMATURE N GMBH & CO. KG (HORA)	H610	GERMANY
7.	IMTECH SYSTEMS BV (FORMERLY K-611)	I593	NETHERLANDS
8.	SAMSON AG MESS-UND REGELTECHNIK	S510	GERMANY
9.	SPX VALVES & CONTROLS	S7931	U.K
10.	WEIR VALVES & CONTROLS UK LTD.	W5941	U.K
11.	YARWAY CORPORATION	Y509	U.S.A

16. ITEM : SPECIAL CONTROL VALVES- MIXED(15EN)

SL.NO.	NAME OF SUPPLIERS	VENDOR CODE	COUNTRY
1.	DRESSER PRODUITS INDUSTRIES	D649	FRANCE
2.	DRESSER VALVE INDIA PVT. LTD.	D127	INDIA

3.	EMERSON PROCES MGMT ASIA PACIFIC PTE LTD.	E6232	SINGAPORE
4.	EMERSON PROCESS MANGMT CHENNAI PVT. LTD.	E179A	INDIA
5.	FLOWSERVE PTE LTD.	F636	SINGAPORE
6.	ITALVALV S. N. C	I586	ITALY
7.	KITAMURA VALVE MANUFACTURING CO. LTD.	K511	JAPAN
8.	KOSO INDIA PVT. LIMITED	K179B	INDIA
9.	METSO FLOW CONTROL OY	M700	FINLAND
10.	MOTOYAMA ENGG. WORKS LTD.	M561	JAPAN
11.	PENTAIR VALVES & CONTROLS INDIA PVT. LTD.	T198	INDIA
12.	SAMSON AG MESS-UND REGELTECHNIK	S510	GERMANY
13.	SPX VALVES & CONTROLS (FORMERLY DEZURIK)	S793	U.S.A
14.	TYCO VALVES & CONTROLS	T733	U.S.A
15.	WEIR VALVES & CONTROLS UK LTD.	W5941	U.K

17. ITEM: PILOT OPERATED SAFETY VALVES (15E0)

SL.NO.	NAME OF SUPPLIERS	VENDOR CODE	COUNTRY
1.	ANDERSON GREENWOOD CROSBY	A710	U.S.A
2.	AST APPARECCHI DI SICUREZZA E TENUTA SPA	A761	ITALY
3.	BLISS ANAND PVT. LTD.	B110	INDIA
4.	CAMERON LTD.	C720	CANADA, U.S.A & U. K.
5.	CURTISS WRIGHT FLOW CONTROL CORPORATION	C700	U.S.A &CANADA
6.	DRESSER INC.	D523	U.S.A
7.	LESER GMBH & CO. KG	L569	GERMANY
8.	TYCO SANMAR LTD.	T181	INDIA
9.	WEIR POWER & INDUSTRIAL FRANCE –FORM S791	W597	FRANCE

18. ITEM: SPECIAL CONTROL VALVES(ECC. ROTARY PLUG) (15ER)

SL.NO.	NAME OF SUPPLIERS	VENDOR CODE	COUNTRY
1.	DRESSER PRODUITS INDUSTRIES	D649	FRANCE
2.	DRESSER VALVE INDIA PVT. LTD.	D127	INDIA
3.	EMERSON PROCES MGMT ASIA PACIFIC PTE LTD.	E6232	SINGAPORE
4.	FLOWSERVE INDIA CONTROL PVT. LTD.-BANGLOR	F176	INDIA

5.	FLOWSERVE PTE LTD.	F636	SINGAPORE
6.	INSTRUMENTATION LTD. (PALGHAT)	I172	INDIA
7.	METSO FLOW CONTROL OY	M700	FINLAND
8.	SAMSON AG MESS-UND REGELTECHNIK	S510	GERMANY

19. ITEM : SPECIAL CONTROL VALVES (SEGMENTAL) (15ES)

SL.NO.	NAME OF SUPPLIERS	VENDOR CODE	COUNTRY
1.	DRESSER PRODUITS INDUSTRIES	D649	FRANCE
2.	DRESSER VALVE INDIA PVT. LTD.	D127	INDIA
3.	EMERSON PROCES MGMT ASIA PACIFIC PTE LTD.	E6232	SINGAPORE
4.	EMERSON PROCESS MANGMT CHENNAI PVT. LTD.	E179A	INDIA
5.	FLOWSERVE INDIA CONTROL PVT. LTD. - BANGLOR	F176	INDIA
6.	FLOWSERVE PTE LTD.	F636	SINGAPORE
7.	ITALVALV S. N. C	I586	ITALY
8.	KITAMURA VALVE MANUFACTURING CO. LTD.	K511	JAPAN
9.	KOSO INDIA PVT. LIMITED	K179B	INDIA
10.	METSO FLOW CONTROL OY	M700	FINLAND
11.	PENTAIR VALVES & CONTROLS INDIA PVT. LTD.	T198	INDIA
12.	SAMSON AG MESS-UND REGELTECHNIK	S510	GERMANY
13.	SPX VALVES & CONTROLS (FORMERLY DEZURIK)	S793	U.S.A

20. ITEM : SPECIAL CONTROL VALVES (PLUG) (15ET)

SL.NO.	NAME OF SUPPLIERS	VENDOR CODE	COUNTRY
1.	AST APPARECCHI DI SICUREZZA E TENUTA SPA	A761	ITALY
2.	EMERSON PROCESS MANGMT CHENNAI PVT. LTD.	E179A	INDIA

21. ITEM : SPECIAL CONTROL VALVES (BALL CONTROL) (15EU)

SL.NO.	NAME OF SUPPLIERS	VENDOR CODE	COUNTRY
1.	FLOWSERVE INDIA CONTROL PVT. LTD. - BANGLOR	F176	INDIA
2.	ITALVALV S. N. C	I586	ITALY
3.	KITAMURA VALVE MANUFACTURING CO. LTD.	K511	JAPAN
4.	KOSO INDIA PVT. LIMITED	K179B	INDIA
5.	METSO FLOW CONTROL OY	M700	FINLAND

6.	PENTAIR VALVES & CONTROLS INDIA PVT. LTD.	T198	INDIA
7.	PIBIVIESSE S. R. L.	P544	ITALY
8.	TYCO VALVES & CONTROLS	T733	U.S.A

22. ITEM : SPECIAL CONTROL VALVES (AXIAL) (15EV)

SL.NO.	NAME OF SUPPLIERS	VENDOR CODE	COUNTRY
1.	MOKVELD VALVES BV	M644	NETHERLANDS

23. ITEM : SPECIAL CONTROL VALVES (VARIABLE CV) (15EW)

SL.NO.	NAME OF SUPPLIERS	VENDOR CODE	COUNTRY
1.	DRESSER PRODUITS INDUSTRIES	D649	FRANCE
2.	DRESSER VALVE INDIA PVT. LTD.	D127	INDIA
3.	MIL CONTROLS LIMITED	M055	INDIA

24. ITEM : SPECIAL CONTROL VALVES (LOW CV) (15EX)

SL.NO.	NAME OF SUPPLIERS	VENDOR CODE	COUNTRY
1.	DRESSER PRODUITS INDUSTRIES	D649	FRANCE
2.	DRESSER VALVE INDIA PVT. LTD.	D127	INDIA
3.	EMERSON PROCES MGMT ASIA PACIFIC PTE LTD.	E6232	SINGAPORE
4.	EMERSON PROCESS MANGMT CHENNAI PVT. LTD.	E179A	INDIA
5.	FLOWSERVE PTE LTD.	F636	SINGAPORE
6.	INSTRUMENTATION LTD. (PALGHAT)	I172	INDIA
7.	MIL CONTROLS LIMITED	M055	INDIA
8.	SAMSON AG MESS-UND REGELTECHNIK	S510	GERMANY

25. ITEM : SPECIAL CONTROL VALVES (PISTON) (15EY)

SL.NO.	NAME OF SUPPLIERS	VENDOR CODE	COUNTRY
1.	SCHUF CHEMIEVENTILLE VERTRIEBS GMBH & CO.	S748	GERMANY

26. ITEM : SPECIAL CONTROL VALVES (FLUSH BOTTOM) (15EZ)

SL.NO.	NAME OF SUPPLIERS	VENDOR CODE	COUNTRY
1.	SCHUF CHEMIEVENTILLE VERTRIEBS GMBH & CO.	S748	GERMANY

27. ITEM : ORIFICE PLATES & FLANGES(15GA)

SL.NO.	NAME OF SUPPLIERS	VENDOR CODE	COUNTRY

1.	BALIGA LIGHTING EQUIPMENTS (P) LIMITED	B024	INDIA
2.	CAMERON LTD.	C720	CANADA, U.S.A &U. K.
3.	COMFIT & VALVES PVT. LTD.	C220	INDIA
4.	DANIEL MEASURMNT & CONTROL ASIA PACIFIC	D509	SINGAPORE & U.S.A
5.	EUREKA INDUSTRIAL EQUIPMENTS (P) LTD.	E022	INDIA
6.	GURU NANAK ENGG WORKS	G016	INDIA
7.	INSTRUMENTATION LTD. (PALGHAT)	I172	INDIA
8.	MICRO PRECISION PRODUCTS PVT. LTD.	M010	INDIA
9.	MINCO (INDIA) PVT LTD (GEN. INST.)	M045	INDIA
10.	PETROL VALVES SRL	P514	ITALY
11.	PIETRO FIORENTINI SPA	P538	ITALY
12.	STAR-MECH CONTROLS (INDIA) PVT. LTD.	S286	INDIA
13.	TM TECNOMATIC SPA	T516	ITALY

28. ITEM : FLOW ELEMENTS : (VENTURI, FLOW NOZZLES)(15GC)

SL.NO.	NAME OF SUPPLIERS	VENDOR CODE	COUNTRY
1.	MICRO PRECISION PRODUCTS PVT. LTD.	M010	INDIA
2.	MINCO (I) FLOW ELEMENT P. LTD. (GIC CO.)	M313	INDIA
3.	STAR-MECH CONTROLS (INDIA) PVT. LTD.	S286	INDIA
4.	TM TECNOMATIC SPA	T516	ITALY

29. ITEM:TEMP. ELEMENTS, THERMOWELLS (15HD)

SL.NO.	NAME OF SUPPLIERS	VENDOR CODE	COUNTRY
1.	ABB AUTOMATION LTD.	A682	U. K
2.	ALTOP INDUSTRIES LTD.	A206	INDIA
3.	DAILY THERMETRICS CORPORATION	D677	U.S.A
4.	DETRIV INSTRUMENTATION & ELECTRONICS LTD.	D004	INDIA
5.	GAYESCO LLC	G622	U.S.A
6.	PYRO-ELECTRIC INSTRUMENTS GOA PVT LTD	P190	INDIA
7.	TECHNO INSTRUMENTS	T232	INDIA
8.	TEMP-TECH	T095	INDIA
9.	TEMPSENS INSTRUMENTS INDIA PVT. LTD.	T146	INDIA
10.	THERMAL INSTRUMENT (I) P LTD. (GEN.INST.)	T241	INDIA
11.	THERMO ELECTRIC CO. INC.	T514	U.S.A
12.	THERMO-COUPLE PRODUCTS CO.	T705	U.S.A

13.	THERMO-ELECTRA B.V	T734	NETHERLANDS
14.	TM TECNOMATIC SPA	T516	ITALY
15.	WIKA ALEXANDER WIEGAND & CO. GMBH	W589	GERMANY

30. ITEM: PRESSURE GAUGES (15KA)

SL.NO.	NAME OF SUPPLIERS	VENDOR CODE	COUNTRY
1.	AN INSTRUMENTS PVT. LTD.	A053	INDIA
2.	ASHCROFT INDIA PVT. LTD.	A362	INDIA
3.	BADOTHERM PROCESS INSTRUMENTS B.V.	B696	NETHERLANDS, ROMANIA, UAE
4.	BAUMER BOURDON HAENNI SAS	B561	FRANCE
5.	BAUMER TECHNOLOGIES INDIA PVT.LTD(W058)	B213	INDIA
6.	BUDENBERG GAUGE CO. LTD	B618	U. K.
7.	GAUGES BOURDON (I) PVT. LTD. (GEN.INST)	G115	INDIA
8.	H GURU INSTRUMENTS (SOUTH INDIA) PVT. LTD.	H081	INDIA
9.	H.GURU INDUSTRIES	H099	INDIA
10.	MANOMETER (INDIA) PVT. LTD.	M029	INDIA
11.	WALCHANDNAGAR INDUSTRIES LTD. (TIWAC DIVN)	W064	INDIA
12.	WIKA ALEXANDER WIEGAND & CO	W589	GERMANY
13.	WIKA INSTRUMENTS INDIA PVT. LTD.	W061	INDIA

31. ITEM: DRAFT GAUGES (15KB)

SL.NO.	NAME OF SUPPLIERS	VENDOR CODE	COUNTRY
1.	AN INSTRUMENTS PVT. LTD.	A053	INDIA
2.	BADOTHERM PROCESS INSTRUMENTS B.V.	B696	NETHERLANDS, ROMANIA, UAE
3.	BUDENBERG GAUGE CO. LTD	B618	U. K.
4.	GAUGES BOURDON (I) PVT. LTD. (GEN.INST)	G115	INDIA
5.	SWITZER PROCESS INSTRUMENTS PVT. LTD.	S087	INDIA
6.	WIKA ALEXANDER WIEGAND & CO GMBH	W589	GERMANY

32. ITEM: DIFFERENTIAL PRESSURE GAUGES (15KD)

SL.NO.	NAME OF SUPPLIERS	VENDOR CODE	COUNTRY
1.	AN INSTRUMENTS PVT. LTD.	A053	INDIA
2.	BAUMER TECHNOLOGIES INDIA PVT.LTD(W058)	B213	INDIA
3.	GAUGES BOURDON (I) PVT. LTD. (GEN.INST)	G115	INDIA
4.	HIRLEKAR PRECISION ENGINEERING PVT. LTD.	H139	INDIA
5.	SWITZER PROCESS INSTRUMENTS PVT. LTD.	S087	INDIA

6.	WIKA INSTRUMENTS INDIA PVT. LTD.	W061	INDIA

33. ITEM: TEMP. GAUGES (BI METALLIC, FILLED SYSTEM)(15LA)

SL.NO.	NAME OF SUPPLIERS	VENDOR CODE	COUNTRY
1.	AN INSTRUMENTS PVT. LTD.	A053	INDIA
2.	ASHCROFT INDIA PVT. LTD.	A362	INDIA
3.	BADOTHERM PROCESS INSTRUMENTS B.V.	B696	NETHERLANDS, ROMANIA, UAE
4.	BAUMER BOURDON HAENNI SAS	B561	FRANCE
5.	BAUMER TECHNOLOGIES INDIA PVT.LTD(W058)	B213	INDIA
6.	GAUGES BOURDON (I) PVT. LTD. (GEN.INST)	G115	INDIA
7.	GOA INSTRUMENTS INDUSTRIES PVT. LTD.	G192	INDIA
8.	H GURU INSTRUMENTS (SOUTH INDIA) PVT. LTD.	H081	INDIA
9.	H.GURU INDUSTRIES	H099	INDIA
10.	WALCHANDNAGAR INDUSTRIES LTD. (TIWAC DIVN)	W064	INDIA
11.	WIKA ALEXANDER WIEGAND & CO	W589	GERMANY
12.	WIKA INSTRUMENTS INDIA PVT. LTD.	W061	INDIA

34. ITEM: VARIABLE AREA FLOW METERS (I, T)(15MB)

SL.NO.	NAME OF SUPPLIERS	VENDOR CODE	COUNTRY
1.	ABB AUTOMATION PRODUCTS GMBH	A682A	GERMANY
2.	ALFLOW GLASS EQUIPMENTS	A172	INDIA
3.	ASA SPA	A623	ITALY
4.	BROOKS INSTRUMENT	B510	U.S.A
5.	EUREKA INDUSTRIAL EQUIPMENTS (P) LTD.	E022	INDIA
6.	HEINRICHS MESSTECHNIK GMBH	H626	GERMANY
7.	INSTRUMENTATION ENGINEERS PVT. LTD.	I030	INDIA
8.	KROHNE MARSHALL PVT. LTD.	K105	INDIA
9.	KROHNE MESSTECHNIK GMBH & CO. KG	K582	GERMANY, NETHERLANDS, FRANCE, U.K
10.	PLACKA INSTRUMENTS INDIA P LTD.	P293	INDIA
11.	ROTA YOKOGAWA GMBH & CO. KG	R515	GERMANY
12.	TOKYO KEISO CO LTD.	T530	JAPAN
13.	YOKOGAWA INDIA LIMITED	Y006	INDIA

35. ITEM : GAUGE GLASSES & COCKS (15OA)

SL.NO.	NAME OF SUPPLIERS	VENDOR CODE	COUNTRY
1.	BLISS ANAND PVT LTD	B110	INDIA
2.	CESARE BONNETTI S.P.A.	C716	ITALY
3.	CHEMTROLS SAMIL (INDIA) PVT LTD	C201	INDIA
4.	JERGUSON GAUGE & VALVE	J543	U.S.A
5.	KLINGER SPA	K637	ITALY
6.	LEVCON INSTRUMENTS PVT. LTD.	L009	INDIA
7.	NIHON KLINGAGE CO LTD	N520	JAPAN
8.	PRATOLINA INSTRUMENTS PVT. LTD.	P017	INDIA
9.	PUNE TECHTROL PVT. LTD.	P239	INDIA
10.	SIGMA INSTRUMENTS CO.	S036	INDIA
11.	TECNOMATIC INDIA PVT. LTD.	T047	INDIA

36. ITEM: MAGNETIC LEVEL INSTRUMENTS (15OF)

SL.NO.	NAME OF SUPPLIERS	VENDOR CODE	COUNTRY
1.	ABB INC (FORMLY K622)	A759	U.S.A
2.	BLISS ANAND PVT. LTD.	B110	INDIA
3.	CESARE BONNETTI S.P.A.	C716	ITALY
4.	CHEMTROLS INDUSTRIES LTD.	C015	INDIA
5.	KLINGER SPA	K637	ITALY
6.	KROHNE MESSTECHNIK GMBH & CO. KG	K582	GERMANY, NETHERLANDS, FRANCE, U.K
7.	LEVCON INSTRUMENTS PVT. LTD.	L009	INDIA
8.	MAGNETROL INTERNATIONAL N.V	M508	BELGIUM
9.	NIHON KLINGAGE CO. LTD.	N520	JAPAN
10.	PRATOLINA INSTRUMENTS PVT. LTD.	P017	INDIA
11.	PUNE TECHTROL PVT. LTD.	P239	INDIA
12.	SIGMA INSTRUMENTS CO.	S036	INDIA
13.	TECNOMATIC INDIA PVT. LTD.	T047	INDIA

37. ITEM : FIELD INSTRUMENTS (P, DP, F, L, T, TD) (15RD)

SL.NO.	NAME OF SUPPLIERS	VENDOR CODE	COUNTRY
1.	ABB AUTOMATION PRODUCTS GMBH	A682A	GERMANY
2.	ABB INDIA LTD. (BANGALORE)	A200	INDIA
3.	EMERSON PROCES MGMT ASIA PACIFIC PTE LTD.	E623	SINGAPORE
4.	EMERSON PROCESS MANAGEMENT INDIA PVT.	E179	INDIA

	LTD.		
5.	ENDRESS+HAUSER GMBH+CO KG	E657	GERMANY
6.	ENDRESS+HAUSER WETZER GMBH+CO. KG	E641	GERMANY
7.	FUJI ELECTRIC SYSTEMS CO. LTD.	F644	JAPAN
8.	HONEYWELL AUTOMATION INDIA LTD.	H150	INDIA
9.	HONEYWELL INC.	H621	U.S.A
10.	INVENSYS INDIA PRIVATE LIMITED	I177	INDIA
11.	YOKOGAWA ELECTRIC CORPORATION	Y501	JAPAN
12.	YOKOGAWA INDIA LIMITED	Y006	INDIA

38. ITEM: TANK LEVEL INSTRUMENT (RADAR, ULTRASONIC)(15TC)

SL.NO.	NAME OF SUPPLIERS	VENDOR CODE	COUNTRY
1.	AMETEK DREXELBROOK	A727	U.S.A
2.	EMERSON PROCESS MANAGEMENT INDIA PVT LTD	E179	INDIA
3.	ENDRESS+HAUSER (I) AUTO. INSTR. PVT. LTD	E232	INDIA
4.	ENDRESS+HAUSER GMBH+CO. KG	E657	GERMANY
5.	ENRAF B.V. (GR. COMPANY OF HONEYWELL)	E550	NETHERLANDS
6.	HAWK MEASUREMENT SYSTEM PTY LTD	H622	AUSTRALIA
7.	KROHNE MESSTECHNIK GMBH & CO KG	K582	GERMANY, NETHERLANDS, FRANCE, U.K
8.	L & J TECHNOLOGIES	L562	U.S.A
9.	MAGNETROL INTERNATIONAL N.V	M508	BELGIUM
10.	MOBREY LTD (FORM. S-578)	M715	U.K. & UAE
11.	ROSEMOUNT TANK RADAR AB (FORM. S691)	R616	SWEDEN
12.	SIEMENS AG	S5241	GERMANY
13.	VEGA GRIESHABER KG	V518	GERMANY

39. ITEM : CONTROL PANEL & ACCESSORIES(15UA)

SL.NO.	NAME OF SUPPLIERS	VENDOR CODE	COUNTRY
1.	ACCUSONIC CONTROLS PVT. LTD.	A212	INDIA
2.	ELECTRONIC CORPORATION OF INDIA LTD.	E004	INDIA
3.	ELECTRONIC INSTRMNTATION & CONTROL P LTD.	E184	INDIA
4.	INDUSTRIAL CONTROLS & APPLIANCES PVT. LTD.	I010	INDIA

5.	INSTRUMENTATION LTD.	I004	INDIA
6.	IRIS AUTOMATION PVT LTD.	I206	INDIA
7.	POSITRONICS PVT LTD.	P134	INDIA
8.	PRIMA AUTOMATION INDIA PVT. LTD.	P213	INDIA
9.	PYROTECH ELECTRONICS PVT. LTD.	P214	INDIA
10.	RADHA KRISHNA CONTROLS	R084	INDIA

40. ITEM: SP. CONTROL VALVE (KNIFE GATE) (15VA)

SL.NO.	NAME OF SUPPLIERS	VENDOR CODE	COUNTRY
1.	ORBINOX INDIA PVT. LTD.	O104	INDIA
2.	PENTAIR VALVES & CONTROLS INDIA PVT. LTD.	T198	INDIA

41. ITEM : AVERAGING PITOT TUBES (15WC)

SL.NO.	NAME OF SUPPLIERS	VENDOR CODE	COUNTRY
1.	EMERSON PROCES MGMT ASIA PACIFIC PTE LTD.	E623	SINGAPORE
2.	EMERSON PROCESS MANAGEMENT INDIA PVT. LTD.	E179	INDIA
3.	MICRO PRECISION PRODUCTS PVT. LTD.	M010	INDIA
4.	MINCO (INDIA) PVT. LTD. (GEN. INST.)	M045	INDIA
5.	STAR-MECH CONTROLS (INDIA) PVT. LTD.	S286	INDIA
6.	THERMO FISHER SCIENTIFIC	T736	U.S.A & U.K.
7.	TM TECNOMATIC SPA	T516	ITALY
8.	TORBAR FLOWMETERS LTD.	T703	U. K.
9.	VERIS INC.	V581	U.S.A

42. ITEM : ALARM ANNUNCIATORS (15YA)

SL.NO.	NAME OF SUPPLIERS	VENDOR CODE	COUNTRY
1.	ELECTRONIC CORPORATION OF INDIA LTD.	E004	INDIA
2.	IDEC IZUMI CORPORATION	I545	JAPAN
3.	INSTALARM INSTRUMENTS PVT LTD.	I083	INDIA
4.	MINILEC (INDIA) PVT LTD	M171	INDIA
5.	MTL INSTRUMENTS PVT LTD	M154	INDIA
6.	PROCON INSTRUMENTATION PVT LTD	P014	INDIA
7.	RONAN ENGINEERING COMPANY	R540	U.S.A

43. ITEM: RUPTURE DISCS (15ZA)

SL.NO.	NAME OF SUPPLIERS	VENDOR CODE	COUNTRY
1.	BS & B SAFETY SYSTEMS (INDIA) LTD.	B017	INDIA
2.	FIKE CORPORATION-USA	F575	U.S.A
3.	REMBE GMBH SAFETY + CONTROL	R519	GERMANY

44. ITEM: TUBE FITTINGS (15AA)

SL.NO.	NAME OF SUPPLIERS	VENDOR CODE	COUNTRY
1.	ARYA CRAFTS & ENGINEERING PVT. LTD.	A345	INDIA
2.	ASTEC VALVES & FITTINGS PVT. LTD.	A240	INDIA
3.	AUTOCLAVE ENGINERS FLUID COMPONENTS	A701	U.S.A
4.	CIRCOR INSTR. TECHNOLOGIES INC-FORM.H608	C714	U.S.A
5.	COMFIT & VALVES PVT. LTD.	C220	INDIA
6.	EXCEL HYDRO PNEUMATICS PVT. LTD.	E104	INDIA
7.	EXCELSIOR ENGG. WORKS	E008	INDIA
8.	FLUID CONTROLS PVT. LTD.	F146	INDIA
9.	HAM-LET (ISRAEL-CANADA) LTD.	H634	ISRAEL
10.	MULTIMETAL INDUSTRIES	M058	INDIA
11.	PANAM ENGINEERS	P307	INDIA
12.	PARKER HANNIFIN CORPORATION	P671	U.S.A& U.K
13.	PRECISION ENGINEERING INDUSTRIES	P240	INDIA
14.	PRIME ENGINEERS	P303	INDIA
15.	RELIANCE ENGINEERING & ELECTRICALS CORPN	R002	INDIA
16.	SEALEXCEL (INDIA) PVT. LTD.	S146	INDIA
17.	SSP FITTINGS CORPORATION	S816	U.S.A
18.	SWAGELOK CO.	S773	U.S.A, U.K & SWITZERLAND
19.	SWASTIK ENGINEERING WORKS	S303	INDIA
20.	TK FUJIKIN CORPORATION	T761	SOUTH KOREA

45. ITEM: MACHINE MONITORING SYSTEMS (15BB)

SL.NO.	NAME OF SUPPLIERS	VENDOR CODE	COUNTRY
1.	GE INDIA INDUSTRIAL PVT. LTD.	G147A	INDIA
2.	ROCKWELL AUTOMATION INDIA PVT. LTD.	R178	INDIA
3.	SHINKAWA ELECTRIC COMPANY LTD.	S814	JAPAN

46. ITEM: SPL. LEVEL INSTRUMENTS-GUIDED WAVE RADAR(15OG)

SL.NO.	NAME OF SUPPLIERS	VENDOR CODE	COUNTRY
1.	ABB INC (FORMLY K622)	A759	U.S.A
2.	EMERSON PROCESS MANAGEMENT INDIA PVT. LTD.	E179	INDIA
3.	ENDRESS+HAUSER (I) AUTO. INSTR. PVT. LTD.	E232	INDIA
4.	ENDRESS+HAUSER GMBH+CO. KG	E657	GERMANY
5.	KROHNE MESSTECHNIK GMBH & CO. KG	K582	GERMANY, NETHERLANDS, FRANCE, U.K
6.	L & J TECHNOLOGIES	L562	U.S.A
7.	MAGNETROL INTERNATIONAL N.V	M508	BELGIUM
8.	VEGA GRIESHABER KG	V518	GERMANY

47. ITEM: SPEED TANSMITTERS(15TE)

SL.NO.	NAME OF SUPPLIERS	VENDOR CODE	COUNTRY
1.	ASEA BROWN BOVERY LTD. (ABB LTD.)	A661	SWITZERLAND
2.	HANS TURCK GMBH & CO. KG	H620	GERMANY
3.	JAPAN SERVO CO. LTD.	J531	JAPAN
4.	PEPPERL + FUCHS GMBH	P649	U.S.A, GERMANY & SINGAPORE

48. ITEM: INSTRUMENT TUBING (15AB)

SL.NO.	NAME OF SUPPLIERS	VENDOR CODE	COUNTRY
1.	HEAVY METALS & TUBES LIMITED (MENSANA)	H086	INDIA
2.	JINDAL SAW LTD. (NASHIK WORKS)	J110B	INDIA
3.	RATNAMANI METALS AND TUBES LTD.	R066	INDIA
4.	TK FUJIKIN CORPORATION	T761	SOUTH KOREA

49. ITEM: DISPLACER LEVEL INSTRUMENTS (16DB)

SL.NO.	NAME OF SUPPLIERS	VENDOR CODE	COUNTRY
1.	CHEMTROLS INDUSTRIES LTD.	C015	INDIA
2.	DRESSER PRODUITS INDUSTRIELS	D649	FRANCE
3.	DRESSER VALVE INDIA PVT. LTD.	D127	INDIA

4.	EMERSON PROCES MGMT ASIA PACIFIC PTE LTD.	E6232	SINGAPORE
5.	EMERSON PROCESS MANGMNT CHENNAI PVT. LTD.	E179A	INDIA
6.	FOXBORO ECKARDT GMBH	F637	GERMANY
7.	INVENSYS INDIA PRIVATE LIMITED	I177	INDIA
8.	TOKYO KEISO CO. LTD.	T530	JAPAN

50. ITEM: PRESSURE SWITCHES(15PI)

SL.NO.	NAME OF SUPPLIERS	VENDOR CODE	COUNTRY
1.	ASCO JOUCOMATIC LTD.	A555	U.K
2.	BAUMER BOURDON HAENNI SAS	B561	FRANCE
3.	DAG PROCESS INSTRUMENTS PVT. LTD.	D027	INDIA
4.	DELTA CONTROLS LTD.	D510	U.K
5.	INDFOS INDUSTRIES LIMITED	I132	INDIA
6.	KAUSTUBHA UDYOG	K175	INDIA
7.	PYROPRESS ENGG CO. LTD.	P608	U.K
8.	REGULATEURS GEORGIN S.A	R613	FRANCE
9.	ROBERTSHAW CONTROLS CO.	R526	U.S.A
10.	SIRCO CONTROLS LIMITED	S573	U.K
11.	SOR INC.	S552	U.S.A
12.	SWITZER PROCESS INSTRUMENTS PVT. LTD.	S087	INDIA
13.	UNITED ELECTRIC CONTROLS CO.	U503	U.S.A

51. ITEM: THERMO COUPLE EXTN. CABLES(15CA)

SL.NO.	NAME OF SUPPLIERS	VENDOR CODE	COUNTRY
1.	ASSOCIATED CABLES PVT. LTD.	A034	INDIA
2.	ASSOCIATED FLEXIBLES & WIRES [P] LTD.	A132	INDIA
3.	CORDS CABLE INDUSTRIES LTD.	C145	INDIA
4.	DELTON CABLES LIMITED	D012	INDIA
5.	KEI INDUSTRIES LIMITED	K082	INDIA
6.	T C COMMUNICATION PVT. LTD.	T243	INDIA
7.	THERMO CABLES LTD (FORM. T-150)	T212	INDIA
8.	UDEY PYROCABLES PVT. LTD.	U015	INDIA

52. ITEM: LOOP POWERED INDICATORS (15RA)

SL.NO.	NAME OF SUPPLIERS	VENDOR CODE	COUNTRY
1.	BEKA ASSOCIATES LTD.	B713	U.K
2.	EMERSON PROCESS MANAGEMENT INDIA PVT. LTD.	E179	INDIA
3.	ENDRESS+HAUSER WETZER GMBH+ CO.KG	E641	GERMANY
4.	HONEYWELL AUTOMATION INDIA LTD.	H150	INDIA
5.	INVENSYS INDIA PRIVATE LIMITED	I177	INDIA
6.	MTL INSTRUMENTS PVT. LTD.	M154	INDIA
7.	YOKOGAWA INDIA LIMITED	Y006	INDIA

53. ITEM : SIGNAL CABLE- FIRE RESISTANT (15CE)

SL.NO.	NAME OF SUPPLIERS	VENDOR CODE	COUNTRY
1.	ASSOCIATED FLEXIBLES & WIRES (P) LTD.	A132	INDIA
2.	CORDS CABLE INDUSTRIES LTD.	C145	INDIA
3.	ELKAY TELELINKS LTD.	E063	INDIA
4.	KEI INDUSTRIES LIMITED	K082	INDIA
5.	POLYCAB WIRES PVT. LTD.	P254	INDIA
6.	SUYOG ELECTRICALS LTD.	S304	INDIA
7.	THERMO CABLES LTD. (FORM. T-150)	T212	INDIA

54. ITEM: INTERFACE DEVICES(16ZA)

SL.NO.	NAME OF SUPPLIERS	VENDOR CODE	COUNTRY
1.	CAMILLE BAUER MESSINSTRUMENTE AG.	C517	SWITZERLAND
2.	GM INTERNATIONAL SRL	G634	ITALY
3.	HANS TURCK GMBH & CO. KG	H620	GERMANY
4.	IFM ELECTRONIC GMBH	I599	GERMANY
5.	MTL INSTRUMENTS PVT. LTD.	M154	INDIA
6.	OSNA ELECTRONICS PVT. LTD.	O031	INDIA
7.	PEPPERL + FUCHS GMBH	P649	U.S.A, GERMANY & SINGAPORE
8.	R STAHL SCHALTGERATE GMBH	R506	GERMANY

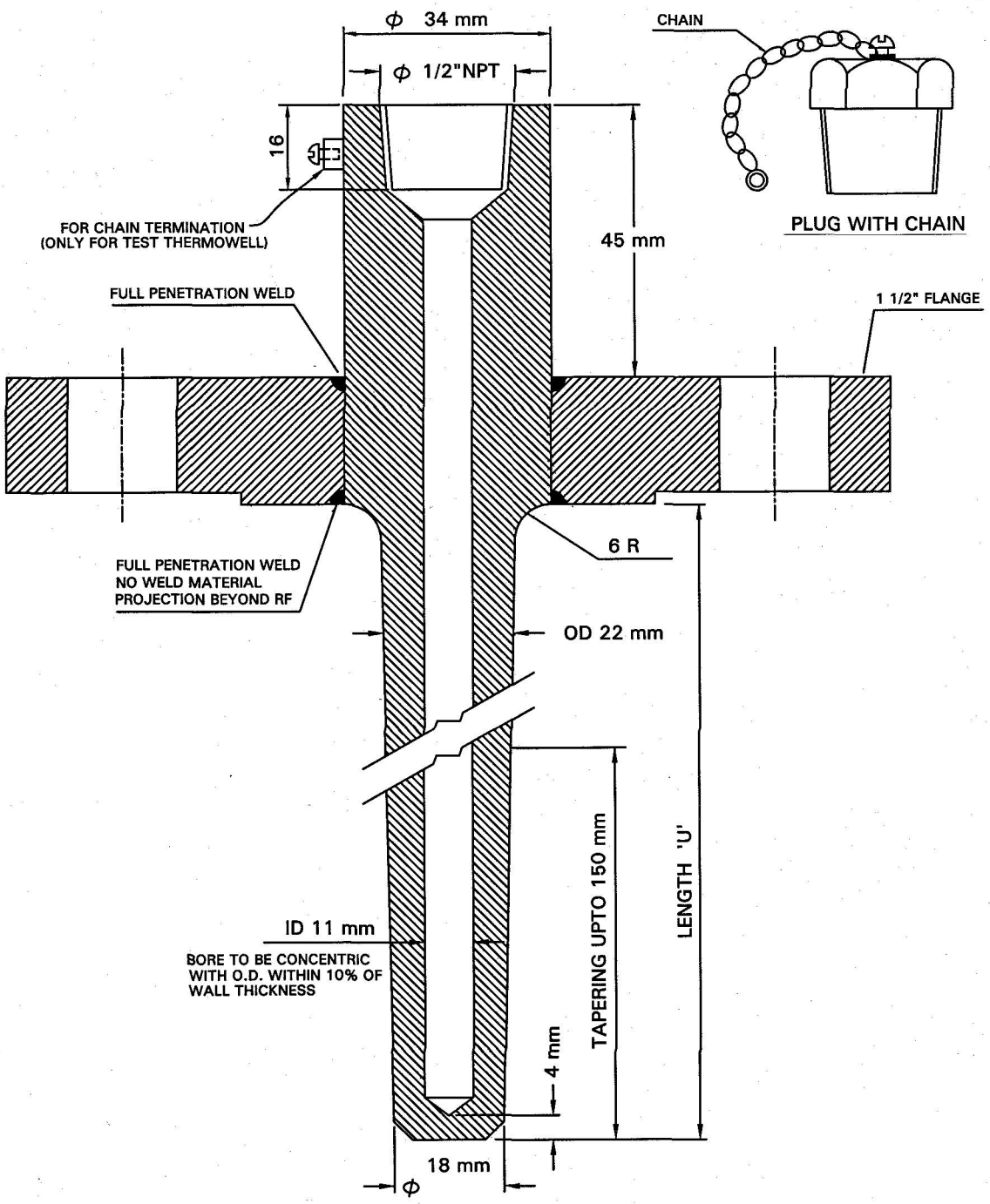
55. ITEM: SPEED TANSMITTERS (15TE)

SL.NO.	NAME OF SUPPLIERS	VENDOR CODE	COUNTRY
1.	ASEA BROWN BOVERY LTD. (ABB LTD.)	A661	SWITZERLAND
2.	HANS TURCK GMBH & CO. KG	H620	GERMANY
3.	JAPAN SERVO CO. LTD.	J531	JAPAN
4.	PEPPERL + FUCHS GMBH	P649	U.S.A, GERMANY & SINGAPORE

56. ITEM : CONTROL VALVE POSITIONERS (15DC)

SL.NO.	NAME OF SUPPLIERS	VENDOR CODE	COUNTRY
1.	FLOWSERVE INDIA CONTROL PVT. LTD.-BANGALOR	F176	INDIA
2.	SAMSON CONTROLS PVT. LTD.	S442	INDIA

THERMOWELL



NOTES -

1. THIS STANDARD IS APPLICABLE FOR ;
   a) TEMPERATURE GAUGES, BEADED TEMPERATURE ELEMENTS AND DUPLEX TEMPERATURE ELEMENTS.
   b) *THERMOWELL UPTO 1500# ANSI RATING OR EQUIVALENT.*
2. TYPE OF FLANGE SHALL BE RTJ TYPE FOR ANSI RATING ⩾ 600#.
3. DP TEST SHALL BE CARRIED OUT FOR ALL WELD JOINTS.
4. CHAIN AND PLUG SHALL BE APPLICABLE ONLY FOR TEST THERMOWELLS.

Rev. No.	Date	Purpose	Prepared by	Checked by	Stds. Committee Convenor	Stds. Bureau Chairman
2	21-06-06	REVISED & REISSUED	MN	TGM	PM	VJN

Approved by

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Annexure-5

वाल्वों के लिए तकनीकी टिप्पणियाँ

TECHNICAL NOTES FOR VALVES

Rev. No	Date	Purpose	Prepared by	Checked by	Standards Committee Convenor	Standards Bureau Chairman
					Approved by	
7	13.07.17	REVISED AND ISSUED AS STANDARD SPECIFICATION	PK	SH	MI	RN
6	04.08.10	REVISED AND ISSUED AS STANDARD SPECIFICATION	RN	ATD	SC	DM ND
5	04.07.08	REVISED AND ISSUED AS STANDARD SPECIFICATION	RN	SC	DM	VC
4	15.11.00	REVISED AND ISSUED AS STANDARD SPECIFICATION	RN	BRB	NS	MI
3	04.04.94	ISSUED IN LINE WITH GENERAL REVISION	AKG	NS	GRR	AS

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Abbreviations:

AARH	:	Arithmetic Average Roughness Height
ANSI	:	American National Standards Institute
API	:	American Petroleum Institute
ASME	:	American Society of Mechanical Engineers
ASTM	:	American Society for Testing & Materials
BGO	:	Bevel Gear Operator
BHN	:	Brinnel Hardness Number
BIS	:	Bureau of Indian Standards
BS	:	British Standard
BVIS	:	Bureau Veritas Industrial Services
BW	:	Butt Weld
CAT	:	Category
CEIL	:	Certification Engineers International Limited
CS	:	Carbon Steel
DFT	:	Dry Film Thickness
DNV	:	Det Norske Veritas
DP	:	Dye-Penetrant
eDMS	:	Electronic Document Management System
IBR	:	Indian Boiler Regulations
IGC	:	Inter Granular Corrosion
IS	:	Indian Standard
LT	:	Low Temperature
LTCS	:	Low Temperature Carbon Steel
MOV	:	Motor Operated Valve
MP	:	Magnetic Particle
MR	:	Material Requisition
NDT	:	Non Destructive Testing
PMI	:	Positive Material Identification
PO	:	Purchase Order
PR	:	Purchase Requisition
RFQ	:	Request for Quotation
SCRD	:	Screwed
SS	:	Stainless Steel
SW	:	Socket Weld

Piping Standards Committee

Convenor : Mr M. Ismaeel

Members : Mr. Amrendra Kumar
Mr. G. Balaji
Mr. Udayan Chakravarty
Mr. K.J. Harinarayanan (S&ME)
Mr. S. Ghoshal (Process-2)
Mr. G.K. Iyer (Projects)
Mr. Pankaj Kumar Rai (Construction)

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1.0 GENERAL

1.1 Vendor shall supply valves in accordance with the valve specification sheets along with auxiliaries, if any, such as gear operator, bypasses, drains, locking arrangements etc. wherever specified in the specification sheets, subject notes and other enclosures to the material requisition (MR).

1.2 Vendor shall quote in strict accordance with the valve data / specification sheets, subject technical notes and all other enclosures to the MR. For 'Cat-I valves', no deviations whatsoever shall be accepted. Post Order Waiver/ Deviation format 5-0000-0180-F1 as mentioned in Cl. 5.17 of specification for Quality Management System Requirements from Bidder (6-78-0001) is not applicable for Cat-I valves. For Cat-II Valves, if exceptions/ deviations become absolutely must, the same shall be requested as explained in clause 2.3.6 giving reasons for seeking such exceptions/ deviations.

1.3 All codes and standards for manufacture, testing, inspection etc. shall be of latest editions as on issue date of RFQ.

2.0 DOCUMENTATION

2.1 All document submissions to EIL shall be through EIL eDMS.

2.2 For 'Cat-I' valves, no documents shall be submitted with the offer.

2.3 For 'Cat-II' valves, vendor shall submit the following documents with the offer:

2.3.1 Manufacturer's complete descriptive and illustrative catalogue / literature.

2.3.2 Detailed dimensioned cross section drawing with parts / material lists, weight etc.

2.3.3 Drawings for valves with accessories like gear operator, hydraulic / pneumatic operator, motor, extension bonnet, extended stems with stands, bypass etc. giving major salient dimensions.

2.3.4 One copy of the valve specification sheets signed as "Accepted" by the manufacturer. Deviations, if any shall be marked as applicable on the valve specification sheet.

2.3.5 If the valve is regretted or has no deviation, the manufacturer shall write clearly on valve specification sheets as "Regret" or "No Deviation".

2.3.6 For 'CAT-II' valves, if there is any deviation, the same shall be listed clausewise.

2.3.7 On failure to submit documents as specified in clauses 2.1.1 to 2.1.6 above, the offer is likely to be rejected.

2.4 The following documents shall be submitted through eDMS of EIL after placement of the order:

2.4.1 For Cat-I valves to manufacturers' standard specified in MR/valve specification sheet, detailed dimensioned cross section drawing with parts, materials, weight, etc. shall be submitted for records/information.

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2.4.2 For 'Cat-II' valves, Vendor shall submit for review drawings mentioned in clauses 2.1.2 & 2.1.3 before start of manufacture. No other drawings shall be submitted for review.

2.4.3 Test report shall be supplied for all mandatory tests as per the applicable code. Test reports shall also be furnished for any supplementary tests as specified in clauses 3.13, 3.14 & 3.15.

2.4.4 Material test certificates (physical properties, chemical composition & heat treatment report) of the pressure containing parts shall be furnished for the valves supplied. Material test certificates for the other parts shall also be furnished for verification during inspection.

2.5 In addition to submissions through EIL eDMS, Catalogues/Drawings shall be in submitted in hard copies (6 sets) and soft copies (2 CDs/DVDs) along with delivery for Purchaser's record for all categories/types of valves.

3.0 DESIGN AND CONSTRUCTION

3.1 Valve shall be designed, manufactured, tested, inspected and marked as per the manufacturing standards, design codes and standards indicated in the respective valve specification sheets. Any conflict between the requisition, enclosures, specification sheets and referred standards/ codes shall be brought to the notice of the purchaser for clarifications and resolution, before proceeding with the manufacture. The purchaser's decision shall be final and binding to the vendor. The drawings submitted for review shall not include any deviations except as communicated in writing in Deviation permits. The Drawings shall be reviewed only for design and construction features.

3.2 All flanged valves shall have flanges integral (except forged valves) with the valve body. Flange face finish shall be normally specified in the valve specification sheet as 125 AARH etc. The interpretation for range of face finish shall be as follows:

Stock Finish	:	1000 μ in AARH max.
125 AARH	:	Serrations with 125 to 250 μ in AARH
63 AARH	:	32 to 63 μ in AARH

3.3 For all weld end valves with bevel end as per ASME B16.25, the contour of bevel shall be as follows:

Material	Wall Thickness	Weld Contour
Carbon Steel (Except Low Temp. Carbon Steel)	Upto 22 mm	Figure 2 Type A
	> 22 mm	Figure 3 Type A
Alloy Steel, Stainless Steel & Low Temp. Carbon Steel	Upto 10 mm	Figure 4
	> 10 mm & Upto 25 mm	Figure 5 Type A
	> 25 mm	Figure 6 Type A

Valve ends shall match thickness of the connecting pipe. Sloping of inside contour of valves shall be done wherever necessary to achieve this.

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3.4 For flanged valves with ring joint flanges the hardness shall be as follows:

Flange Material	Min. Hardness of Groove (BHN)
Carbon Steel	140
1% Cr to 5% Cr, 9% Cr	150
Type 304, 316, 321, 347	160
Type 304L, 316L	140

3.5 Following requirements for check valves shall be met over and above the valve specification sheet requirements:

3.5.1 Unless specified otherwise in the data sheet all check valves 3" & above (except in 900#, 1500# & 2500# rating) shall have a drain boss at location "G" (Refer Fig.No.1 of ASME B16.34) where pocket is formed in valve body. A tapped drain hole with plug shall be provided as per ASME B16.34. Threads shall be as per ASME B1.20.1 (Taper) NPT.

3.5.2 For heavy check valves, provisions shall be available for lifting by way of lugs, eye bolts and other such standard devices.

3.6 If an overlay weld-deposit is used for the body seat ring seating surface, the corrosion resistance of the seat ring base material shall be at least equal to the corrosion resistance of the material of the shell.

3.7 Following valve bypass requirements shall be met:

3.7.1 By-pass requirement for Gate valves shall be as follows unless otherwise mentioned.

ASME 150 Class	On sizes 26" and above
ASME 300 Class	On sizes 16" and above
ASME 600 Class	On sizes 6" and above
ASME 900 Class	On sizes 4" and above
ASME 1500 Class	On sizes 4" and above
ASME 2500 Class	On sizes 3" and above

3.7.2 The by-pass piping arrangement shall be such that clearance between main valve body and by-pass assembly shall be the minimum possible for layout reasons. Vendor shall follow the sketch enclosed in Specification No. 6-44-0052-A1.

3.7.3 By-pass valve shall be a globe valve. The sizes shall be as under:

On main valve ≤ 4"	:	1/2"
On main valve 6" to 8"	:	3/4"
On main valve 10" & above	:	1"

By-pass piping shall be of same metallurgy as main valve. The by-pass piping, fittings and valve tag numbers shall be as specified in Specification No. 6-44-0052-A2. In case details of by-pass arrangement for any Valve tag number is missing, Vendor shall bring the same to notice of EIL and provide by-pass as per details specified.

3.7.4 Vendor shall supply the by-pass valve duly tested and fitted to the main valve. Valves with by-pass shall have the direction of flow marked on the main valve. By-pass attachment to the

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main valve body shall not be screwed. All fillet welds for by-pass installation shall be 100% examined by DP/MP test and Butt-weld joints shall be 100% examined by radiography.

3.8 Valve body / bonnet shall be forged / cast as specified. Forgings are acceptable in place of casting but not vice-versa.

3.9 Stem shall be forged or machined from forged / rolled bar. No casting is permitted. However, integral stem of cast material is acceptable for Plug valves.

3.10 Stelliting / hardfacing by deposition, shall be minimum 1.6 mm.

3.11 Renewable seat rings shall be seal welded for valves of size 3" and above to prevent loosening in service.

3.12 For Low Temperature & Cryogenic valve requirements, refer Specification.No.6-44-0052-A3 unless otherwise specified.

3.13 For Hydrogen service valve requirements, refer Specification.No.6-44-0052-A4 unless otherwise specified.

3.14 Valves under 'NACE' category shall meet the requirements specified in MR-0103 unless otherwise specified.

3.15 For all austenitic stainless steel valves Inter Granular Corrosion (IGC) test shall be conducted as per the following:

3.15.1 ASTM A262 Practice 'B' with acceptance criteria of '60 mils/year (max.)' for all materials - forged, rolled, wrought and casting.

Or

ASTM A262 Practice 'E' with acceptance criteria of 'No cracks as observed from 20X magnification' for all materials other than castings. 'Microscopic structure to be observed from 250X magnification' in addition.

3.15.2 When specifically asked for in MR for high temperature application of some grades of austenitic stainless steel (eg. SS309, 310, 316, 316H etc.) ASTM A262 Practice 'C' with acceptance criteria of '15 mils/year (max.)' shall be conducted.

3.15.3 For the IGC test as described in Clauses 3.15.1 & 3.15.2, two sets of samples shall be drawn from each solution annealing lot. One set shall correspond to the highest Carbon content and the other to the highest pressure rating. When testing is conducted as per practice 'E', photograph of the microscopic structure shall be submitted for record.

3.16 All types of 321 or 347 stainless steel valves shall be in a stabilised heat treated condition. Stabilising heat treatment shall be carried out subsequent to the normal solution annealing. Soaking temperature and holding time for stabilising heat treatment shall be 900°C and 4 hours respectively.

3.17 Spiral wound bonnet gaskets are to be provided with inner/outer ring except when encapsulated gaskets type body-bonnet joints are employed. Outer ring may be avoided in case of non-circular spiral wound gasket used in 150# valve provided the outermost layer of spiral touches the bolts ascertaining the centering.

3.18 All Stainless Steel Castings shall be solution heat treated.

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3.19 Only normalized and tempered material shall be used in the following specifications :

Castings : A217 Gr.WC1, A217 Gr.WC4, A217 Gr.WC5, A217 Gr.WC6, A217 Gr.WC9, A217 Gr.C5, A217 Gr.C12

Forgings : A182 Gr.F11 Cl.2, A182 Gr.F12 Cl.2

3.20 Ball / Plug / Butterfly Valves

3.20.1 As a prequalification, fire safe test as per API 607 / API 6FA / BS EN ISO 10497 (Supersedes BS 6755 Part II) shall be carried out on soft seated ball, plug & butterfly valves and also on lubricated plug valves The test shall be witnessed and certified by a third party inspection agency like Lloyds, BVIS, DNV or EIL/ CEIL unless otherwise specified. The vendor has to submit test certificate for the particular design of the valve offered, if fire safe design is required as per the Valve Material Specification sheet..

3.20.2 Each valve shall be supplied with a lever / wrench except for gear operated / motor operated valves.

3.20.3 Soft-seated ball, plug & butterfly valves shall be supplied with antistatic devices.

3.20.4 BW / SW end ball valves shall have a 100 mm long seamless pipe nipple welded to each end of the valve. Nipples are to be welded prior to assembling Teflon seats / seals. Specifications of the nipples shall be as indicated in the MR.

3.20.5 The face-to-face dimensions of all ball valves shall be same as those of gate valves of the corresponding ANSI class (except 10" onwards in Class 150 where the face-to-face dimensions shall be as per API 6D long pattern).

3.20.6 The ball of ball valve shall not protrude outside the end flanges of valve.

3.20.7 Ball valves shall be of floating ball/trunnion mounted type as per following:

150#	8" & below	Floating ball
	10" & above	Trunnion mounted
300#	4" & below	Floating ball
	6" & above	Trunnion mounted
600# & above	1.5" & below	Floating ball
	2" & above	Trunnion mounted

3.20.8 Unless otherwise specified in the data sheets, bore of all reduced bore ball valves shall be limited to one size lower than the nominal bore.

3.21 The MOVs are to be installed in an open area and the actuators shall be suitable for all weather conditions. The testing of complete assemblies of MOVs along with the actuators shall be done by the supplier at his works.

3.22 Ends of flanged valves of 22" size shall match corresponding flanges to MSS-SP44 unless otherwise specified.

3.23 Yoke material shall be same as bonnet material where maximum temperature specified is more than 427°C.

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4.0 OPERATION

4.1 Gear operation shall be provided as under:

Valve Type	Class	Size Requiring Gear-Operator
Gate Valve, Globe Valve & Diaphragm Valve	150 Class	12" and larger
	300 Class	12" and larger
	600 Class	10" and larger
	900 Class	6" and larger
	1500 Class	3" and larger
	2500 Class	3" and larger
Ball Valve / Plug Valve (Other than pressure balance plug valves)	150 Class	6" and larger
	300 Class	6" and larger
	600 Class	4" and larger
	900 Class	3" and larger
	1500 Class	3" and larger
Butterfly Valve	150, 300 Class	6" and larger

For sizes lower than these ranges, hand wheel / lever / wrench shall be provided. For pressure balance plug valves manufacturer's recommendation shall be acceptable provided the requirements specified in clause 4.6 are met.

4.2 Gear operator shall be provided, with position indicators for open / close positions and with limit stops. (Limit stops are not applicable for gate and globe valves).

4.3 Where gear operator is not called for as per Clause 4.1 but vendor recommends a gear operator, the same shall be highlighted.

4.4 Gear operator shall be so designed as to operate effectively with the differential pressure across the closed valve equal to the cold non-shock pressure rating.

4.5 Ball, plug and butterfly valves, shall have "Open" position indicators with limit stops.

4.6 Hand wheel diameter shall not exceed 750mm and lever length shall not exceed 500mm on either side. Effort to operate shall not exceed 35 Kg at handwheel periphery. However, failing to meet the above requirements, vendor shall offer gear operated valve and quote as per clause 4.3.

5.0 INSPECTION AND TESTING

5.1 Every valve shall be subjected to all the mandatory tests and checks called in the respective codes / data sheet by EIL inspection or any third party as approved by the purchaser. For IBR valves refer clause 7.0.

5.2 Every valve, its components and auxiliaries must be subjected to all the mandatory tests and checks called for in the respective codes, data sheets etc. by the manufacturer.

5.3 Though the extent of inspection shall be as under, exact extent with hold points shall be decided by EIL regional inspection office and recorded in the form of inspection plan. In case of third party inspection, the inspection plan shall be approved by the purchaser.

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Forged Valves:

1. Visual and dimensional inspection.
2. Review of material test certificates.
3. Any mandatory or supplementary test.
4. Hydrostatic test on 10% valves selected on random basis.
5. Strip check is required for 1% of total ordered quantity of Gate & Globe valves (min. 1 No.) for each Valve sheet no., however, strip check is not required for CS/ Brass/ Bronze material valves with 13% Cr/ Brass/ Bronze trims.

Cast Steel Valves:

1. Visual and dimensional inspection.
2. Review of material test certificates.
3. Review of radiographs/radiographic reports or any other NDT tests wherever applicable as per data sheet.
4. Any mandatory or supplementary test.
5. Hydrostatic test 100% for body, 10% other test.
6. Strip check is required for 1% of total ordered quantity of Gate & Globe valves (min. 1 No.) for each Valve sheet no., however, strip check is not required for CS/ Brass/ Bronze material valves with 13% Cr/ Brass/ Bronze trims.

   Samples for strip check shall be selected at random and shall generally be in the highest size in the lot.

5.4 In case of motor operated or actuator operated valves, functional / operational checks as per the requirements of the specifications shall be made on each valve.

6.0 RADIOGRAPHY OF CAST VALVES

6.1 Valve castings shall undergo radiographic examination as specified below.

Material	Rating	Size Range	Radiography
All	150#	24" and below	NIL**
		26" and above*	100%
	300#	16" and below	NIL**
		18" and above	100%
	600# & above	All sizes	100%

* No radiography is required for valves of size 26" and above in cooling water service.

**For sizes 24" & below in 150# and 16" & below in 300#, radiography percentage if specifically mentioned in individual valve material spec sheet shall govern.

Radiography specified as random 10% or 20% etc. in the respective valve data sheet implies 10% or 20% etc. of number of valves ordered against each item number with a minimum of one valve against each item.

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6.2 Radiography procedure, areas of casting to be radiographed shall be as per ASME B16.34 and acceptance criteria shall be as per ASME B16.34 Annexure-B. However for areas of casting to be radiographed for types of valves not covered in ASME B16.34, vendor shall radiograph castings in line with ASME B16.34.

6.3 For random radiography wherever specified in individual data sheets, the sampling shall be per size of the quantity ordered for each foundry.

6.4 Radiography wherever specified in the data sheets or as per clause 6.1 shall be done by X-ray / γ-ray to get the required sensitivity.

7.0 IBR CERTIFICATION

7.1 For valves described "IBR", valves shall be in accordance with the latest IBR (Indian Boiler Regulation) including the requirements specified in the specification.

7.2 For SW / BW end carbon steel valves under IBR, the chemical composition shall conform to the following:

Carbon (Max)	:	0.25%
Others (S, P, Mn)	:	As per IBR

7.3 Valves coming under the purview of "IBR"(Indian Boiler Regulations) shall each be individually accompanied by IBR certificate original in Form III-C duly approved by IBR authority / local authority empowered by the Central Boiler Board of India. Photocopy of original certificate duly attested by the local boiler inspector where the supplier is located is the minimum requirement for acceptance.

7.4 All "IBR" valves shall be painted red in body-bonnet / body-cover joint.

8.0 MARKING

8.1 Valve markings, symbols, abbreviations etc. shall be in accordance with MSS-SP-25 or the standard referred in specification sheet as applicable. Vendor's name, valve rating, material designation, nominal size, direction of flow (if any) etc. shall be integral on the body.

8.2 Each valve shall have a corrosion resistant tag giving size, valve tag / code no., securely attached to the valve body.

8.3 Paint or ink for marking shall not contain any harmful metal or metal salts such as zinc, lead or copper which cause corrosive attack on heating.

8.4 Carbon Steel / Alloy Steel valves shall be painted with one coat of inorganic zinc silicate (minimum DFT 65 to 75 microns).

9.0 DESPATCH

9.1 Valve shall be dry, clean and free from moisture, dirt and loose foreign materials of any kind.

9.2 Valves shall be protected from rust, corrosion and any mechanical damage during transportation, shipment and storage.

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9.3 Rust preventive on machined surfaces to be welded shall be easily removable with a petroleum solvent or shall not be harmful to welding.

9.4 Each end of valve shall be protected with the following materials:

Flange Face	:	Wood or Plastic Cover
Bevelled End	:	Wood or Plastic Cover
SW & SCRD. End	:	Plastic Cap

9.5 End protectors of wood / plastic to be used on flange faces shall be attached by at least three bolts and shall not be smaller than the outside diameter of the flange. However, plastic caps for SW & SCRD end valves shall be press fit type.

9.6 End protectors to be used on bevelled end shall be securely and tightly attached.

9.7 For special service valves additional requirement for despatch shall be as prescribed in data sheet.

10.0 ATTACHMENTS

6-44-0052-A1	:	Bypass Piping Arrangement
6-44-0052-A2	:	Specifications for Bypass Piping, Fittings and Valves
6-44-0052-A3	:	Special Requirements for Low Temperature and Cryogenic Valves
6-44-0052-A4	:	Special Requirements for Hydrogen Service Valves

11.0 REFERENCES

6-78-0001	:	Specification for Quality management system requirements from bidders
6-78-0003	:	Specification for documentation requirements from suppliers
6-81-0001	:	Specification for Positive Material Identification (PMI) at Supplier's Works
6-81-0004	:	Inspection and Test plan for Valves

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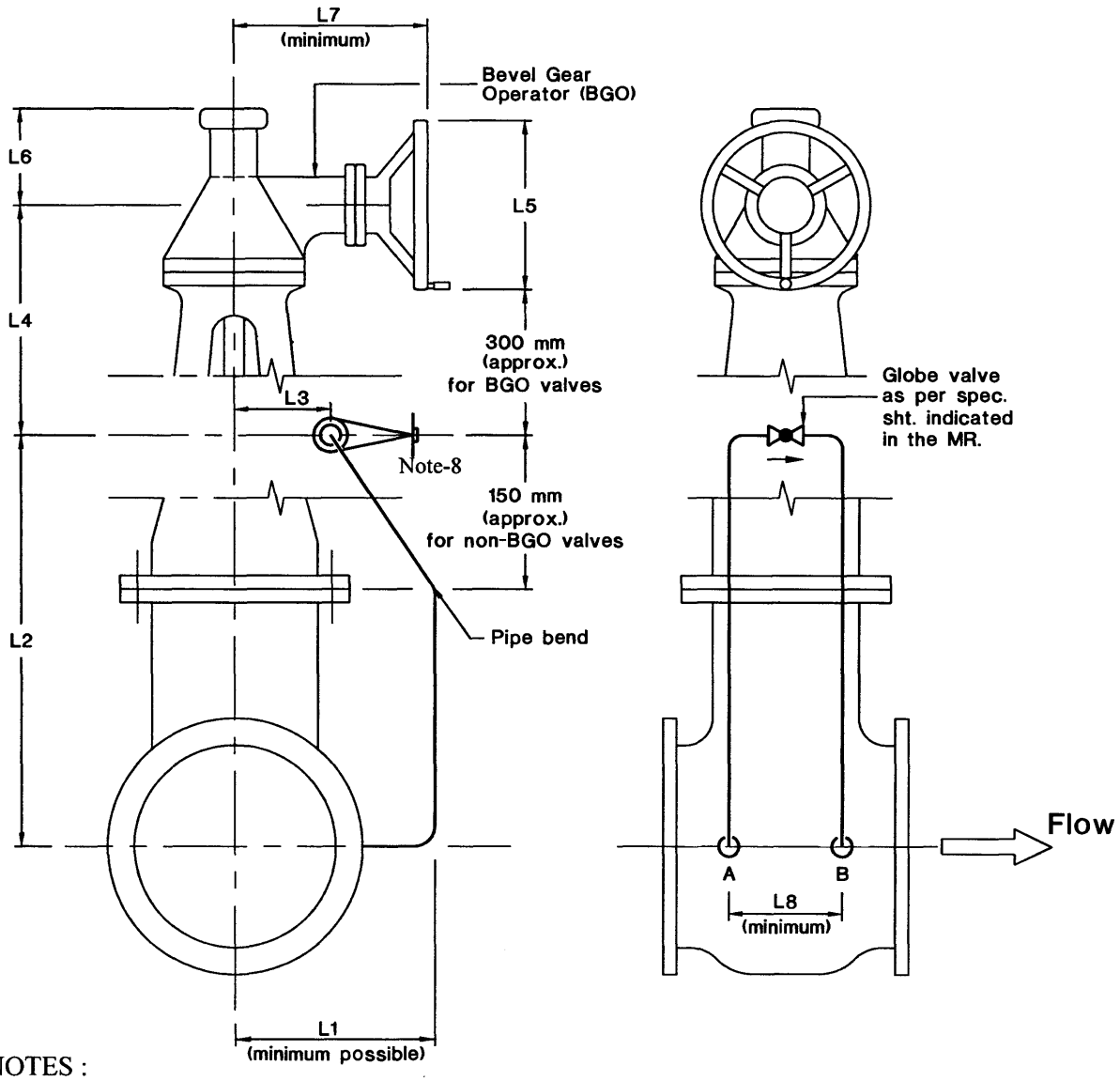
BYPASS PIPING ARRANGEMENT



NOTES :

1. The orientation & location of handwheel of bevel gear operator & the bypass arrangement shall be strictly as per this sketch.

2. The bypass connection ends shall be socket welded upto 600# and butt welded for 900# and above rating.

3. The bypass arrangement shall be properly clamped to & supported by the body of the main valve.

4. Basic design of bypass shall be to MSS-SP-45.

5. Material of bypass pipe & 90° elbows shall be same or equivalent to the body material as indicated in Specification No. 6-44-0052-A2.

6. This sketch is applicable for both BGO & NON-BGO Valves.

7. Vendor shall furnish dimensions L1 to L8.

8. Stem shall not be horizontal in the case of CRYO Valves

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SPECIFICATIONS FOR BYPASS PIPING, FITTINGS AND VALVES

Class (Main Valve Sht.no.)	Pipe	Fittings	Bypass Valve Sht.no.
A1A(51301), A3A(51321), A9A(51301), A10A(51301), A11A(51301), A33A(51301), B1A(51401), B9A(51401), D1A(51501), D9A (51501)	ASTM A106 Gr.B (SMLS) 0.5"-0.75": S160 1.0"-1.5" : XS	ASTM A105 0.5"-0.75": SW 6000# 1.0"-1.5" : SW 3000#	52001
A6A(51301), B6A(51401)	ASTM A106 Gr.B (SMLS) 0.5"-0.5" : XXS 0.75"-1.5": S160	ASTM A105 0.5"-0.5" : SW 9000# 0.75"-1.5": SW 6000#	52001
A13A(51301), B13A(51401)	ASTM A106 Gr.B (SMLS) 0.5"-1.5" : XXS	ASTM A105 0.5"-1.5" : SW 9000#	52001
A2A(51302), B2A(51402), D2A (51502)	ASTM A106 Gr.B (SMLS)- IBR 0.5"-0.75": S160 1.0"-1.5" : XS	ASTM A105 - IBR 0.5"-0.75": SW 6000# 1.0"-1.5" : SW 3000#	52002
A4A (51303), B4A (51403), D4A (51503)	ASTM A333 Gr.6 (SMLS)- LT 0.5"-0.75": S160 1.0"-1.5" : XS	ASTM A350Gr.LF2-LT 0.5"-0.75": SW 6000# 1.0"-1.5" : SW 3000#	52003
A5A (51304), B5A (51404), D5A (51504)	ASTM A106 Gr.B (SMLS) -H2 0.5"-0.75": S160 1.0"-1.5": XS	ASTM A105 - H2 0.5"-0.75": SW 6000# 1.0"-1.5" : SW 3000#	52004
A7A (51307)	ASTM A106 Gr.B (SMLS) 0.5"-0.75" : S160 1.0"-1.5": XS	ASTM A105 0.5"-0.75": SW 6000# 1.0"-1.5" : SW 3000#	52007
A16A (51311), B16A (51411), D16A (51511)	ASTM A106 Gr.B (SMLS) - NACE 0.5"-0.5" : XXS 0.75"-1.5": S160	ASTM A105 - NACE 0.5"-0.5" : SW 9000# 0.75"-1.5": SW 6000#	52011
A19A (51313), B19A (51413), D19A (51513)	ASTM A106 Gr.B (SMLS) 0.5"-0.75" : S160 1.0"-1.5": XS	ASTM A105 0.5"-0.75": SW 6000# 1.0"-1.5" : SW 3000#	52013
E1A (51601), F1A (51701)	ASTM A106 Gr.B (SMLS) 0.5"-1.5" : S160	ASTM A234 Gr.WPB/ ASTM A105 0.5"-1.5" : BW, S160	52101
E2A (51602), F2A (51702)	ASTM A106 Gr.B (SMLS) - IBR 0.5"-1.5" : S160	ASTM A234 Gr.WPB/ ASTM A105 - IBR 0.5"-1.5" : BW, S160	52102
E5A (51604), F5A (51704)	ASTM A106 Gr.B (SMLS) - H2 0.5"-1.5" : S160	ASTM A234 Gr.WPB/ ASTM A105 - H2 0.5"-1.5" : BW, S160	52104
E9A (51605), F9A (51705)	ASTM A106 Gr.B (SMLS) 0.5"-1.5" : SCH XXS	ASTM A234 Gr.WPB/ ASTM A105 0.5"-1.5" : BW, SCH XXS	52105
E19A (51613), F19A (51713)	ASTM A106 Gr.B (SMLS) 0.5"-1.5" : SCH XXS	ASTM A234 Gr.WPB/ ASTM A105 0.5"-1.5" : BW, SCH XXS	52113

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Class (Main Valve Sht.no.)	Pipe	Fittings	Bypass Valve Sht.no.
A5Y (51384), A33Y (51384)	ASTM A106 Gr.B (SMLS) 0.5"-1.5" : S160	ASTM A105 0.5"-1.5" : SW 6000#	52085
A1D (51330), B1D (51430), D1D (51530)	ASTM A335Gr.P11(SMLS) 0.5"-0.75" : S160 1.0"-1.5": XS	ASTM A182 Gr.F11Cl.2 0.5"-0.75": SW 6000# 1.0"-1.5" : SW 3000#	52030
D2D (51531)	ASTM A335Gr.P11 (SMLS) - IBR 0.5"-0.75" : S160 1.0"-1.5": XS	ASTM A182 Gr.F11Cl.2 - IBR 0.5"-0.75": SW 6000# 1.0"-1.5" : SW 3000#	52031
B5D (51432), D5D (51532)	ASTM 335Gr.P11(SMLS)- H2 0.5"-0.75" : S160 1.0"-1.5": XS	ASTM A182 Gr.F11Cl.2 - H2 0.5"-0.75": SW 6000# 1.0"-1.5" : SW 3000#	52032
B1E (51433)	ASTM A335Gr.P22(SMLS) 0.5"-0.75" : S160 1.0"-1.5": XS	ASTM A182 Gr.F22Cl.3 0.5"-0.75": SW 6000# 1.0"-1.5" : SW 3000#	52033
D5E (51534)	ASTM A335Gr.P22(SMLS) - H2 0.5"-0.75" : S160 1.0"-1.5": XS	ASTM A182 Gr.F22Cl.3 - H2 0.5"-0.75": SW 6000# 1.0"-1.5" : SW 3000#	52034
A4F (51336), B4F (51436)	ASTM A335 Gr.P5(SMLS) 0.5"-0.75" : S160 1.0"-1.5": XS	ASTM A182 Gr.F5 0.5"-0.75": SW 6000# 1.0"-1.5" : SW 3000#	52036
B3F (51436)	ASTM A335 Gr.P5(SMLS) 0.5"-1.5" : XXS	ASTM A182 Gr.F5 0.5"-1.5" : SW 9000#	52036
A4G (51339), B4G (51439)	ASTM A335 Gr.P9(SMLS) 0.5"-0.75" : S160 1.0"-1.5": XS	ASTM A182 Gr.F9 0.5"-0.75": SW 6000# 1.0"-1.5" : SW 3000#	52039
F2D (51731)	ASTM A335 Gr.P11 (SMLS) - IBR 0.5"-1.5" : S160	ASTM A234Gr.WP11Cl.1/ A182 Gr.F11Cl.2 - IBR 0.5"-1.5" : BW, S160	52131
E5E (51634)	ASTM A335 Gr.P22(SMLS) - H2 0.5"-0.75" : S160 1.0"-1.5": XS	ASTM A234Gr.WP22Cl.1/ A182 Gr.F22Cl.3 - H2 0.5"-0.75" : BW, S160 1.0"-1.5" : BW, XS	52134
A1K (51345), A3K (51345), B1K (51445), D1K (51545)	ASTM A312 TP304(SMLS) 0.5"-0.75" : 80S 1.0"-1.5": 40S	ASTM A182 Gr.F304 0.5"-1.5" : SW 3000#	52045
A2K (51346), B2K (51446), D2K (51546)	ASTM A312 TP304(SMLS) - CRYO 0.5"-0.75" : 80S 1.0"-1.5": 40S	ASTM A182 Gr.F304 - CRYO 0.5"-1.5" : SW 3000#	52046
B4K (51448), B5K (51448)	ASTM A312 TP304H (SMLS) 0.5"-1.5" : 80S	ASTM A182 Gr.F304H 0.5"-1.5": SW 3000#	52048

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Class (Main Valve Sht.no.)	Pipe	Fittings	Bypass Valve Sht.no.
A6K (51350), B6K (51450)	ASTM A312 TP304L (SMLS) 0.5"-0.75" : 80S 1.0"-1.5": 40S	ASTM A182 Gr.F304L 0.5"-1.5": SW 3000#	52050
A1M (51361), B1M (51461)	ASTM A312 TP316(SMLS) 0.5"-0.75" : 80S 1.0"-1.5": 40S	ASTM A182 Gr.F316 0.5"-1.5": SW 3000#	52061
B5M (51462)	ASTM A312 TP316H (SMLS) - H2 0.5"-0.75" : 80S 1.0"-1.5": 40S	ASTM A182 Gr.F316H - H2 0.5"-1.5": SW 3000#	52062
B3M (51463)	ASTM A312 TP321(SMLS) 0.5"-0.75" : 80S 1.0"-1.5": 40S	ASTM A182 Gr.F321 0.5"-1.5": SW 3000#	52063
A1N (51366), B1N (51466)	ASTM A312 TP 316L (SMLS) 0.5"-0.75" : 80S 1.0"-1.5": 40S	ASTM A182 Gr.F316L 0.5"-1.5": SW 3000#	52066
B6N (51471)	ASTM A312 TP316L (SMLS) 0.5"-0.75" : 80S 1.0"-1.5": 40S	ASTM A182 Gr.F316L 0.5"0.5"-1.5": SW 3000#	52071

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SPECIAL REQUIREMENTS FOR LOW TEMPERATURE & CRYOGENIC VALVES

1.0 SCOPE

All valves of Low Temperature Carbon Steel (LTCS) and all grades of austenitic SS (CRYO) material are categorized as cryogenic valves. All these valves shall have extended bonnet as per BS 6364 except check valves.

Following qualification criteria shall be met by the valve vendors to quote valves for cryogenic services:

2.0 QUALIFICATION CRITERIA

i) Both cryogenic test (clause 2.1) and reference list (clause 2.2) together shall be considered for vendor qualification and vendor shall furnish the same, along with his offer.

ii) Vendors who do not have cryogenic test reports and reference list covering valves of all sizes, materials and ratings required by MR, should confirm / furnish the following for consideration of their offer:

a. Evidence of having conducted successfully at least one cryogenic test as per BS 6364. Test certificate shall be furnished with the offer.

b. Vendor shall confirm to conduct cryogenic test per clauses 2.1 & 2.3 for the remaining valves not later than 12 weeks from the date of purchase order.

c. Vendor shall also furnish reference list for valves supplied for non-cryo service if reference list referred in 2.2.1 does not cover all the sizes of MR.

Offers of vendors who do not comply with above requirements would be rejected.

2.1 Cryogenic Test

Vendors to furnish copies of cryogenic test certificate for tests conducted as per details given below:

2.1.1 Test shall be as per BS 6364.

2.1.2 Test temperature, unless specifically called for otherwise in the individual MR, shall be -45°C for LTCS and -196°C for all grades of austenitic stainless steel.

2.1.3. Tests carried out on a particular size of one type of valve, pressure rating and material shall qualify all sizes equal to and below the test valve size for the same type, pressure rating and material. In case of austenitic SS any one grade would qualify for all other grades of austenitic SS.

2.1.4. Tests should have been witnessed and certified by any one of the following third party inspection agencies; M/s Lloyd, BV, DNV, TUV or EIL/ CEIL.

2.1.5. Cryogenic test need not be conducted for every order. Test conducted previously and witnessed by inspection agencies listed above shall be considered acceptable and need not be repeated.

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2.2 Reference List

Vendor shall furnish reference list for valves supplied for cryogenic service indicating the name of client, year of supply, size, material, pressure rating, type of valve and quantity.

2.3 Post Order Testing Procedure

2.3.1. Before conducting post order testing, vendor shall submit the following for approval:

a. Test procedure (as per BS 6364).
b. Cross-section drawing of the valve with material of construction.
c. Schematic of test rig (as per BS 6364) with complete details.

2.3.2. Test has to be conducted irrespective of the service on largest size for each type of valve and for each material and class rating. Vendor shall offer one, two or three valves for selection of test valve by inspector depending upon whether quantity of largest valve in the order is one, two or three and more than three respectively.

In the event of failure of the test valve to meet the specification requirements, the vendor shall conduct test on two more valves. These two valves which pass test successfully, are of lower size, then the qualification will be valid only to sizes upto which test has been conducted successfully.

2.3.3. In case of non-conductance of cryogenic test(s) within 12 weeks or failure in the test(s) conducted after receipt of order, the owner reserves the right to invoke any of the provisions of the purchase order including cancellation of the purchase order at the risk and cost of vendor.

3.0 Bonnet extension, wherever specified in the valve sheet to BS 6364 shall be for "non cold box application" unless otherwise specified in the MR. Even if not called for in valve sheet, valves indicated as "LT" or "CRYO" shall be supplied with bonnet extension.

4.0 Bonnet and Gland extension joints shall be of butt welded/integrally cast construction.

5.0 Repair welding procedure for austenitic stainless steel valves in "CRYO" service shall have to be qualified for impact test as per ASME B31.3. Minimum acceptable impact energy shall be 20 J or lateral expansion of 0.38 mm at temperature of -196°C.

6.0 Wherever impact test of SS studs / nuts is called for in the data sheet, the impact value shall be 27 J at the intended service temperature specified in the data sheets.

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SPECIAL REQUIREMENTS FOR HYDROGEN SERVICE

1.0 GENERAL

1.1 These requirements are applicable for valves used in Hydrogen service. These are in addition to the requirements described in "Technical Notes for Valves" Spec. No. 6-44-0052, and shall be read in conjunction with this specification.

1.2 All cast valve flanges & bodies with flange rating of Class 900 or greater shall be examined in accordance with paragraphs 7.2 through 7.5 of Appendix-VII of ASME SEC-VIII, DIV.1, regardless of casting quality factor.

1.3 Body / bonnet / cover joints & stuffing box of all valves shall have low emission. One valve per metallurgy, per rating, per size 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. Selection of valves for helium leak test shall be at random. Test duration shall be as follows:

Test Duration in Minutes					
Nominal Size	Pressure Class				
	Upto 300	600	800 & 900	1500	2500
Upto 2"	3	6	9	12	12
3" to 6"	6	9	12	15	18
8" to 16"	9	9	12	15	18
18" to 24"	9	12	15	18	21

The valve shall show no leakage. No leakage is defined as a total leakage rate of less than 0.0001 ml/s of helium.

2.0 Only normalized and tempered material shall be used in the following specifications:

Castings : A217 Gr.WC1, A217 Gr.WC4, A217 Gr.WC5, A217 Gr.WC6, A217 Gr.WC9, A217 Gr.C5, A217 Gr.C12

Forgings : A182 Gr.F11 Cl.2

3.0 CS & AS VALVES

3.1 Bend test and Magnetic Particle inspection of the entire surface of body and bonnet casting shall be in accordance with ASTM A217. Supplementary requirement S3 & S4 evaluation of magnetic particle, inspection shall be in accordance with MSS-SP-53 except that no linear discontinuities shall be allowed.

3.2 The Brinell hardness of heat treated casting shall not exceed 200 BHN for carbon steel & 225 for alloy steel.

3.3 Repair to defective casting shall be outlined in writing to the purchaser before repair starts. Repair method to be approved prior to welding.

3.4 Casting shall be preheated to a minimum of 400°F prior to welding and all Chromium-Molybdenum alloys shall be postweld heat treated after welding is complete. Stress relieving is essential for welds.

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3.5 Carbon steel shall be normalised and alloy steels shall be normalised & tempered.

3.6 Dye Penetrant test of welds shall be in accordance with ASTM B165 Procedure B-2. Interpretation as per Appendix-8 of ASME-VIII Div.1.

3.7 The tensile stress for AS shall be less than 100,000 psi.

3.8 Charpy V-notch impact testing is to be done for valve material (average 20 ft-lb for set of 3 [minimum value 15 ft-lb] at 30°F).

3.9 For radiography and acceptance criteria for valve castings, refer Cl. 4.2.

4.0 SS VALVES

4.1 Valve casting shall be in solution heat treated and pickled condition.

4.2 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.

4.3 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.

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