EDC-FGD
BAP BHEL RANIPET

FLUE GAS DESULFURIZATION SYSTEM

TECHNICAL SPECIFICATION FOR PNEUMATICALLY / MANUALLY OPERATED CONTROL VALVES

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NTPC: FGD: CERA: R00	Date: 18-03-2020

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1.0 INTENT OF SPECIFICATION

This specification together with the attached Technical Data Sheet and other attachments to inquiry / order defines the minimum mandatory requirements governing the design, sizing and selection of control valves along with their accessories /auxiliaries for use in the process of Flue gas Desulphurization (FGD) system.

1.1. The design, material, construction, manufacture, inspection, testing and performance of valves shall comply with all currently applicable statutes, regulations and safety codes in the locality where the valves will be installed.

1.2. Compliance to this specification shall not relieve the Bidder of the responsibility of furnishing equipment and accessories/auxiliaries of proper design, materials and workmanship to meet the specified start up and operating conditions.

1.3. In case the Bidder considers requirement of additional instrumentation, controls, safety devices and any other accessories/auxiliaries essential for safe and satisfactory operation of the equipment, he shall recommend the same along with reasons in a separate section along with his proposal and include the same in his scope of supply. The Bidder shall offer only proven design in successful operation.

2.0 STANDARDS AND CODES

The valves shall conform to the latest editions of applicable codes and standards as mentioned elsewhere. Valves in general shall conform to the requirements of the following standards:

ASME B 1.20.1	Pipe Threads, general purpose (Inch)
ASME B 16.5	Steel Pipe Flanges and flanged fittings
ASME B 16.10	Face to Face and End to End dimension of valves
ASME B 16.20	Ring – Joint Gaskets and grooves for steel Pipe flanges
ASME B 16.34	Valves – Flanged, Threaded and welding end,
API-598	Valves inspection test.

3.0 GENERAL SPECIFICATION FOR DESIGN/ CONSTRUCTION/ MATERIAL PARTICULARS OF CONTROL VALVE

a) All Control valves shall be designed based on the requirements of the application, process operating conditions and this specification.

b) Vendor shall supply all interconnecting instrument tubing and fittings between the valve actuator, positioner and filter regulator.

c) Any special tool required for assembly, disassembly & maintenance shall also be supplied by vendor.

d) Valves to be installed outside shall be required to have the stem properly protected against atmospheric corrosion.

e) All rising stem valves shall be provided with back seat to permit repacking (of glands) with valves in operation. All valves shall preferably be of outside screw and yoke type.

f) All valves shall have indicators or direction clearly marked so that the valves opening/ closing can be readily determined.

g) The valves shall be designed taking into consideration the abrasive nature of lime slurry. The maximum particle size in the slurry shall be in the order of 43 microns. The maximum specific gravity of limestone slurry shall be 1.23. Valves shall be designed suitable to take care of this specific gravity and particle size.

h) Control will be used for regulation of slurry flow. Pneumatically operated valves shall be provided with the following accessories in addition to other standard items:
   - Pneumatic actuator
   - Electronic positioner to regulate the opening/closing of valve
   - Air filter, solenoid valve and limit switch
   - Draining arrangement wherever required.

i) All control valves shall be provided with bonnet-back seating arrangement to enable on line changing of gland packing.

j) All control valves shall be designed for reconditioning seating surfaces and replacement of stem and disc without removing the valve body from the line

k) All valves shall be provided with embossed name plate giving details such as tag number (as indicated in Annexure I), type, size etc.

l) For control valves wherever thickness of body/bonnet is not mentioned in the valves standards, thickness mentioned in IS- 1538 for fitting shall be applicable.

m) All valves shall be provided with proper name plates indicating complete information about the valves.

4.0 MATERIAL OF CONSTRUCTION

4.1 Control Valve

Material of Control valves for slurry application shall be as per enclosed **Annexure I** or its equivalent. Vendor shall provide the counter flange along with necessary nuts, bolts, gaskets etc.

Note: All parts of the valve exposed to slurry shall be rubber lined of Ceramic material.

Valve Type	Control
Valve Size & Quantity	Refer Annexure I
Body Material	SS316 or equivalent
Bonnet Type & Material	Refer Annexure I
End Connection	Refer Annexure I
Rating	Vendor to specify
Sleeve Material	Natural rubber
Sleeve Cone Size	Vendor to specify
Stroke Length	Vendor to specify
Leakage Class	CLASS IV
Gland Packing	VITON

Max Sound Level	<85 dBA
Stem Material	Hastelloy-C/C-22 or C276
Bolt & Nut	SS304

4.2 Control VALVE Sizing

Each control valve shall be sized and selected to provide reliable operation and control at the specified operating and design conditions. Control valve sizing shall generally be based on ISA S75.01.

The valve sizing shall be suitable for obtaining maximum flow conditions with valve opening at approximately 80 % of total valve stem travel. Further, the valve stem travel range from minimum flow condition to maximum flow condition shall not be less than 50 % of the total valve stem travel.

4.3 Control Valve design

a. The control valve shall be rated to meet the design pressure and design temperature of the application. For flanged valves, the valve body rating shall never be lower than the flange rating. The flange rating for valve bodies smaller than 16-inch nominal size shall be minimum ASME Class 300. Flange rating for valve bodies16-inch nominal size and larger shall be minimum ASME Class 150.

b. Control valve body Material shall meet or exceed, the requirements of the application. Trim materials shall be selected to withstand corrosion, erosion and wear under severe service conditions.

4.4 Trim Design

Valve trim shall be of the quick change type for ease of maintenance. No internal components shall be screwed or welded into the valve bodies or bonnets. Trim shall be designed to provide equal pressurization around the plug in order to minimize vibration and prevent any potential for binding.

4.5 SPECIFICATION FOR PNEUMATIC ACTUATOR

a.	Quantity	01 No. for each valve
b.	Type	Vendor to specify the Model No. ,
c.	Action	Refer Annexure 1
d.	Close/open at air Pressure	Vendor to design actuator for 4 Kg/sq.cm (Min.)

e.	Air Connection	All connection are ¼" NPT(F)
f.	Local Position Indicator	To be provided.
g.	Hand wheel for manual open	Required (for valves greater than 8 inch)
h.	Actuator travel time	Vendor to specify
i.	Actuator Protection Class	IP-65 (Min)
j.	Actuator Thrust	Vendor to specify
k.	Speed adjustment for actuator operation	To be provided to facilitate speed adjustments both during opening &closing by means of flow control valve
l.	Solenoid valve	Shall be of SS Body, 24V DC
m.	Air filter regulator	Size of filter shall be 5 Micron, Filter material shall be sintered bronze/equivalent, Body shall be aluminium, Metallic bowl with auto drain, 1/4" NPT Pneumatic connection shall be envisaged
n.	Open & Close lock Mechanism	Required - Vendor to confirm
o.	Power failure	Stay put/ Fail Keep
p.	Air Failure	Stay put/ Fail Keep
q.	Signal Failure	Stay put/ Fail Keep
r.	Valve sizing calculation	Vendor to give

4.6 LIMIT SWITCHES (Proximity sensor based):

a) Quantity /valve : One for Open & one for Close position

b) No. of Contacts potential corresponding to valve. : Two normally open & two normally closed free contacts in each limit switch open & close positions of the

c) Contact Rating : 60V, 6VA

d) Protection : Weather proof IP 55.

e) Limit Switch Box : Limit Switch terminals shall be brought out to a Terminal Box

5.0 ELECTRONIC POSITIONER:

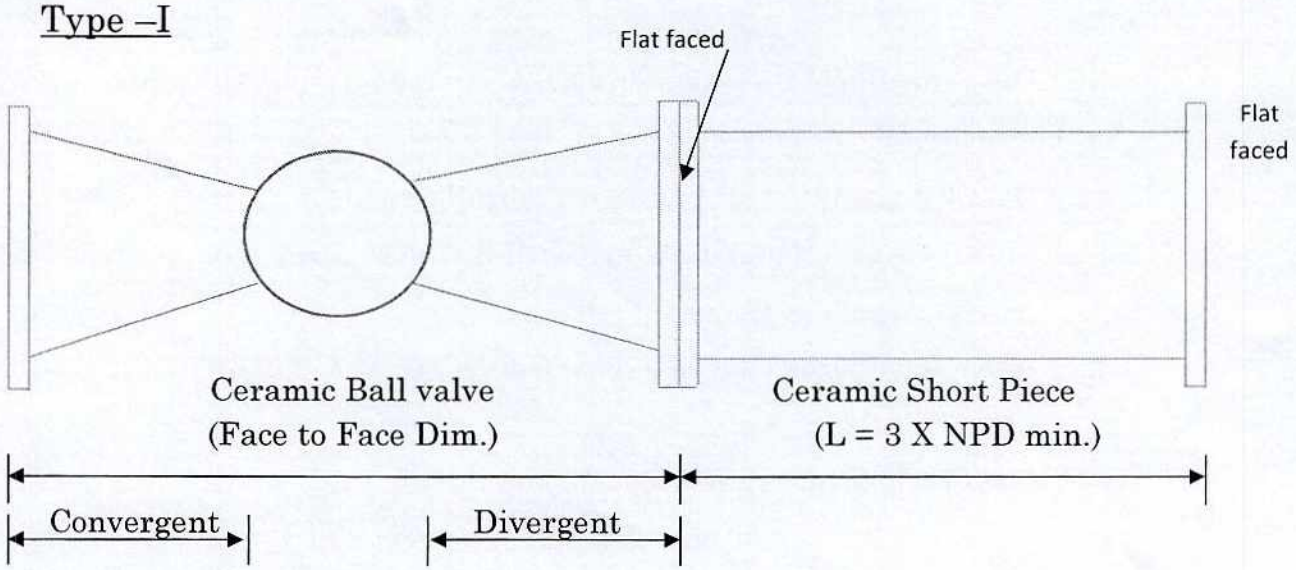
MODEL	
TYPE	Electro Pneumatic, Microprocessor Based, Loop Powered.
INPUT (mA)	4-20mA
Valve position sensing output	4-20mA O/P Signal for Control System
Protection class	IP-65 (MIN)
Electrical conn Pneumatic conn	1/2" NPT Side/Bottom Entry 1/4" NPT
Inbuilt Display With Push Button	Required for Configuration
Pressure Gauge	Required
EMC OR CE Compliance	Required, EN50081-2 & EN50082 or Equivalent
Positioner Transmitter	Applicable (Capacitance or Resistance Type.)
Power supply	Loop powered from the output card of control system.
Hart Protocol (Universal HART calibration to provided)	Compatibility for remote calibration and diagnostic (Super-Imposed Hart signal on input signal (4-20mA))
In-built operator panel	Display with push buttons for configuration and display on the positioner itself (password protected/ hardware lock).

6.0 SCOPE OF SUPPLY

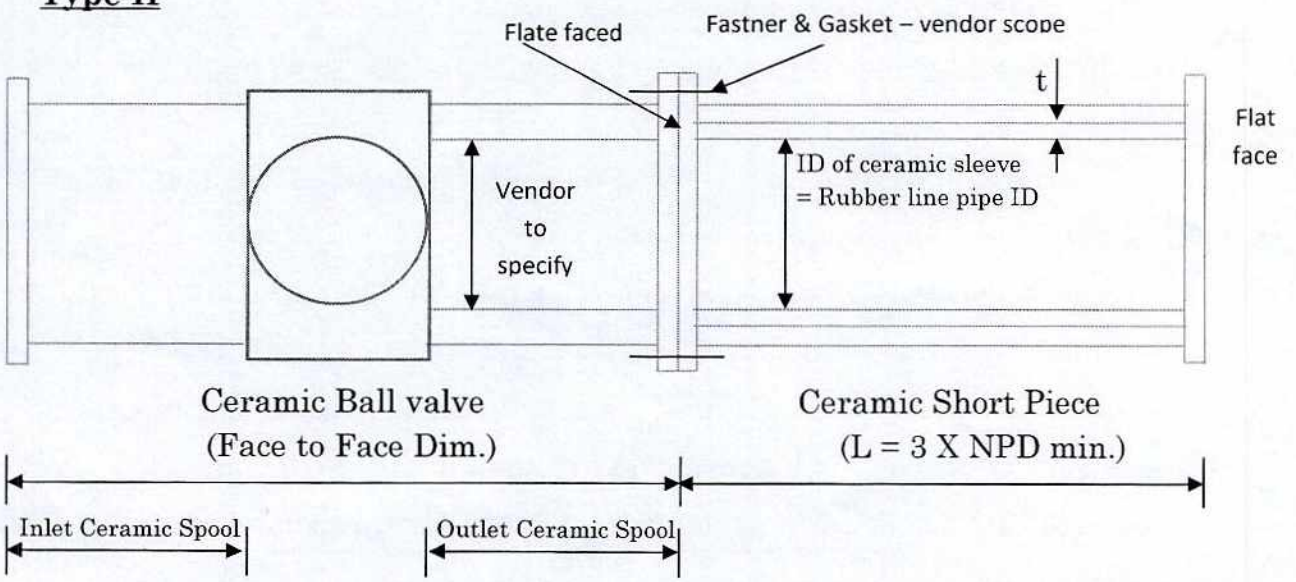
1. Vendor to supply either Type-I or Type-II Ceramic ball valve along with flanges for each valve on both sides & Pneumatic accessories, SS 304 tubing and air sets, Air filter regulator with auto drain & Metallic bowl, Terminal Box with wiring & double compression cable gland, Electronic positioner, Limit switch, Manual override provision, Declutching lever as per Annexure-I.

2. Vendor to supply Ceramic short spool piece as per Annexure- II.

Type –I



Type-II



7.0 NAME PLATES

Each equipment / instrument shall be provided with rating plate or nameplate or label designating the tag no., service of the item etc.

8.0 INSPECTION

Inspection shall be carried out by BHEL Engineers at vendor works.

9.0 DOCUMENTS / DETAILS ALONG WITH BID

The following information / documents shall be submitted along with the offer

a. Duly filled up data sheet for each valve type as per **Annexure-I & II** in the enclosed format.

b. Detailed assembly drawing with overall dimensions.

c. Valve cross sectional drawings with Bill of Material including the material specifications.

d. Valve Regulation Characteristic Curve.

e. Cv calculation.

f. List of applicable standards for shop test.

g. Reference list for the offered model.

h. Typical Quality plan for supply of the above equipments.

i. Valves Catalogues.

j. List of commissioning spares.

k. Recommended spares list for 3 year O&M along with item wise price.

l. Any deviation shall be specifically mentioned in the enclosed deviation format **Annexure-III**.

m. Valve Performance curves – Opening Vs Flow; Opening Vs Cv & Input Signal Vs Flow

n. Test Reports/Certificates: Factory Valve signature test reports (Pr vs Valve travel and Travel vs I/P signal) are to be provided. Teat certificate as per Manufacture standard/Relevant standard are to be submitted.

In case of any deviation, the Bidder shall indicate the deviation, clause by clause in the deviation format attached in **Annexure-III**. If

there is no deviation "**NIL**" statement shall be furnished. In the absence of **Annexure-III**, it will be construed that the bid confirms strictly to the specification. Acceptance or rejection of the offer with or without deviations (either fully or partially) is sole discretion of the purchaser without seeking further clarification from the bidder.

NOTE: Bidders to note that failing to submit the above documents, the bid shall be considered as incomplete and liable for rejection.

10.0 DOCUMENTS / SERVICE AFTER ORDER

10.1. The following documents are to be submitted for BHEL's approval.

- Duly filled up data sheet in the enclosed format.
- Detailed assembly drawing with overall dimensions.
- Valve cross sectional drawings with Bill of Material including the material specifications.
- C_v Calculation
- Quality plan

10.2. The following are to be submitted to BHEL's review and acceptance.

- Material test certificate
- Hydraulic & Leak test certificates
- Performance guarantee certificate
- Erection manual
- O&M manuals

11.0 DOCUMENTATION

a. The documentation during bid and post order stage shall meet the following requirements.
b. All documents and drawings shall be submitted in English.
c. Hard copies of all documents and drawings during bid stage to be submitted in duplicate.
d. Hard copies of all documents for approval to be submitted in triplicate.
e. Hard copies of all final documents, drawings, manual etc., shall be submitted in bound folder in duplicate.
f. Soft copies of all final documents in MS office in the form of CD-1 set.

g. Soft copies of all final drawings in AutoCAD, latest version in the form of CD-1 set

12.0 PACKING

a) Valves to be packed based on the sizes and each package or shipping units shall be clearly marked or stencilled on at least two sides.
b) In addition, each package or shipping unit shall have the symbol painted in red on at least two sides of the package, covering one fourth of the area of the side.
c) Imported Supply: All imported supply should be packed as per Sea worthy packing standards Annexure – VIII: PE-TS-888-100-A001. All imported items should have Sea worthy packing. Liberal packing materials and struts shall be provided to arrest rolling and to protect from transit damages

13.0 Requirement of manually operated ball valve

a) Hand operated lever
b) Valve position indicator- 0- 90 degree
c) Valve locking feature at any position between 0-90
d) position transmitter – not required
e) Limit switch not required
f) Actuator – not required

Vendor's Signature & Seal

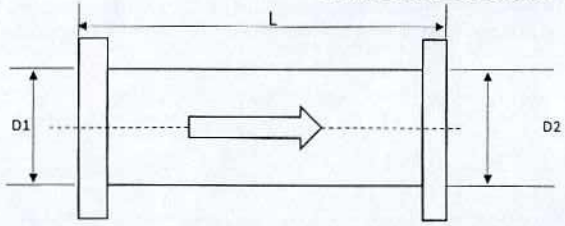
ANNEXURE- I - DATA SHEET FOR CERAMIC BALL VALVES

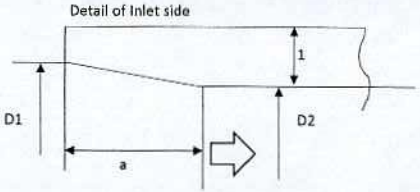
CERAMIC BALL VALVE PARAMETERS			VALVE SIZE	DN 50				DN 100				DN 125			DN 150	Vendor Acceptance/ Comments
			BHEL/ Vendor data	VARIANT 1	VARIANT 2	VARIANT 3	VARIANT 4	VARIANT 1	VARIANT 2	VARIANT 3	VARIANT 4	VARIANT 2	VARIANT 3	VARIANT 4	VARIANT 1	
				NKP	BARH I	BARH II	MAUDA	NKP	BARH I	BARH II	MAUDA	BARH I	BARH II	MAUDA	NKP	
Parameters	Clause No.	Details	QTY	3	3	2	2	3	3	2	2	3	2	2	3	
Service Condition			BHEL data	pH meter Analyser (re-circulation) line Valve				Absorber Limestone Slurry Feed Valve				Filtrate Water Absober Return Flow Valve			Filtrate Water Absober Return Flow Valve	
Process Condition	1	Press.(kPag) - Max./Nor.	BHEL data	370/310	370/310	330/280	320/270	970/830	2110/1790	1580/1340	1220/1030	570/480	490/420	490/420	600/500	
	2	Temp.(degC) - Max./Nor.	BHEL data	70/63	70/62.1	70/61	70/61.5	50/27	50/27	50/27	50/27	70/62.1	70/58	70/58	70/63	
	3	Flow (m3/hr) - Max./Nor.	BHEL data	24/20	24/20	24/20	24/20	53/44.24	39/33	38/32	30/25	78/65	73/61	57/48	105/87.5	
	4	Head in Meter of Fluid (mH)	BHEL data	20.4	20.4	17.9	17.4	55	135	100	75	40	35	35	35	
	5	Spec gravity	BHEL data	1.219	1.216	1.213	1.212	1.215	1.215	1.215	1.215	1.067	1.068	1.065	1.068	
	6	Vapour pressure kg/cm2 - Max./Min.	BHEL data	0.316/0.232	0.316/0.223	0.212/0.316	0.217/0.316	0.126/0.037	0.216/0.037	0.126/0.037	0.126/0.037	0.316/0.223	0.185/0.316	0.185/0.316	0.316/0.232	
Fluid condition	7	Medium	BHEL data	Gypsum Slurry				Limestone Slurry				Filtrate Slurry			Filtrate Slurry	
	8	Slurry concentration	BHEL data	30% wt	30% wt	30% wt	30% wt	30% wt	30% wt	30% wt	30% wt	11% wt	11% wt	11% wt	11% wt	
	9	Max Pressure Drop across the Valve <0.5Bar	Vendor to specify their value													
Process Connection	10	Type/Rating - B16.5 CL 150	vendor to confirm													
Design Standard	11	Leakage Class - "ANSI / FCI Class IV"	Vendor to Specify													
	12	Max Sound Level <85 dbA	Vendor to Specify													
	13	Character - EQ%	Vendor to Specify													
	14	PN Rating - PN16	Vendor to Specify													
	15	Design Cv of the Valves	Vendor to Specify													
Material	16	Ball & linear -Material - Ceramic	Vendor to Specify MOC													
	17	Body - "SS316/316L or Equivalent"	Vendor to confirm													
	18	Stem -"Hastelloy-c / C22 or C 276 "	Vendor to confirm													
	19	Botl and Nut - "SS304"	BHEL data	SS304	SS304	SS304	SS304	SS304	SS304	SS304	SS304	SS304	SS304	SS304	SS304	
	20	Bonnet Type & Material	Vendor to Specify													
	21	Ball Socket	Vendor to Specify													
	22	Wear Sleeve - SiC / Al_2O_3	Vendor to Specify													
	23	Sleeve Cone size	Vendor to Specify													
	24	Gland Packing (Viton)	Vendor to Specify													
	25	Bushing	Vendor to Specify													
	26	Handle	Vendor to Specify													
	27	Seat	Vendor to Specify													
	28	Recommended Min. Pipe ID	Vendor to Specify													
	29	Gasket (Viton/PTFE)	Vendor to confirm													
	30	Gear Box	Vendor to Specify													
	31	End Connection	Vendor to confirm	Flate faced	Flate faced	Flate faced	Flate faced	Flate faced	Flate faced	Flate faced	Flate faced	Flate faced	Flate faced	Flate faced	Flate faced	
	32	Face to Face dimension (includding straight piece if applicable)	Vendor to Specify													
Valve Operation condtion	33	Valve Operation - Lever/ Gear Box	Vendor to Specify													
	34	Pressure Drop fro Rate Flow (bar)	Vendor to Specify													
	35	Design Pressure (bar)	Vendor to Specify													
	36	Body Test Pressure (bar)	Vendor to Specify													
	37	Seat Teat Pressure (bar)	Vendor to Specify													
	38	Max. Shut off Pressure (bar)	Vendor to Specify													
Actuator	39	Type	BHEL data	Manual				Pneumatic actautor regulating				Pneumatic actautor regulating			Pneumatic actautor regulating	
	40	Make	Vendor to Specify													
	41	Model	Vendor to Specify													
	42	Torque Rating	Vendor to Specify													
	43	Air Consumption	Vendor to Specify													
	44	Operating Time For Opening	Vendor to Specify													
	45	Operating Time For Closing	Vendor to Specify													
	46	Accessories Offered	Vendor to Specify													
	47	Air Connection -1/4" NPT (F)	Vendor to Specify													
	48	Actuator to be designed for instrument air pressure	BHEL data	NA	NA	NA	NA	4kg/cm2	4kg/cm2	4kg/cm2	4kg/cm2	4kg/cm2	4kg/cm2	4kg/cm2	4kg/cm2	
	49	Opening	BHEL data					90 Deg	90 Deg	90 Deg	90 Deg	90 Deg	90 Deg	90 Deg	90 Deg	
	50	Open & Close lock Mechanism -required	Vendor to confirm													
	51	Power failure -Stayput/Fail Keep	Vendor to confirm	NA	NA	NA	NA									
	52	Air Failure -Stayput/Fail Keep	Vendor to confirm	NA	NA	NA	NA									
	53	Signal Failure - Stayput/Fail Keep	Vendor to confirm	NA	NA	NA	NA									
	54	Filter Regulator with Autodrain & Metallic Bowl	Vendor to confirm	NA	NA	NA	NA									

ANNEXURE- I - DATA SHEET FOR CERAMIC BALL VALVES

CERAMIC BALL VALVE PARAMETERS			VALVE SIZE	DN 50				DN 100				DN 125			DN 150	Vendor Acceptance/ Comments
			BHEL/ Vendor data	VARIANT 1	VARIANT 2	VARIANT 3	VARIANT 4	VARIANT 1	VARIANT 2	VARIANT 3	VARIANT 4	VARIANT 2	VARIANT 3	VARIANT 4	VARIANT 1	
				NKP	BARH I	BARH II	MAUDA	NKP	BARH I	BARH II	MAUDA	BARH I	BARH II	MAUDA	NKP	
Parameters	Clause No.	Details	QTY	3	3	2	2	3	3	2	2	3	2	2	3	
Service Condition			BHEL data	pH meter Analyser (re-circulation) line Valve				Absorber Limestone Slurry Feed Valve				Filtrate Water Absober Return Flow Valve			Filtrate Water Absober Return Flow Valve	
Solenoid Valve	55	Make	Vendor to Specify	NA	NA	NA	NA									
	56	Type	Vendor to Specify	NA	NA	NA	NA									
	57	Quantity	Vendor to Specify	NA	NA	NA	NA									
	58	Rating	Vendor to Specify	NA	NA	NA	NA									
	59	Power input -24V DC	Vendor to Specify	NA	NA	NA	NA									
	60	Pneumatic Connection size	Vendor to Specify	NA	NA	NA	NA									
	61	Electric connection size	Vendor to Specify	NA	NA	NA	NA									
Limit Switch	62	Make	Vendor to Specify													
	63	Type	Vendor to Specify													
	64	Quantity	Vendor to Specify													
	65	Contact Rating	Vendor to Specify													
	66	Reset Type	Vendor to Specify													
Electronic Positioner	67	Make	Vendor to Specify	NA	NA	NA	NA									
	68	Type	Vendor to Specify	NA	NA	NA	NA									
	69	Quantity	Vendor to Specify	NA	NA	NA	NA									
	70	Connection	Vendor to Specify	NA	NA	NA	NA									
Accessories	71	Positioner Transmitter Signal	BHEL data	NA	NA	NA	NA	4-20mA	4-20mA	4-20mA	4-20mA	4-20mA	4-20mA	4-20mA	4-20mA	
	72	PN operated input signal	BHEL data	NA	NA	NA	NA	4-20 mA	4-20 mA	4-20 mA	4-20 mA	4-20 mA	4-20 mA	4-20 mA	4-20 mA	
	73	Ceramic lined spool after divergent conic portion	BHEL data	Required- as per Annexure II	Required- as per Annexure II	Required- as per Annexure II	Required- as per Annexure II	Required- as per Annexure II	Required- as per Annexure II	Required- as per Annexure II	Required- as per Annexure II	Required- as per Annexure II	Required- as per Annexure II	Required- as per Annexure II	Required- as per Annexure II	
	74	Manual Overide	Vendor to conform	NA	NA	NA	NA									
	75	Declutching Lever	Vendor to conform	NA	NA	NA	NA									
Junction Box	76	Junction box with wiring & double compression cable Gland	Vendor to conform	NA	NA	NA	NA									
General	77	Weight Per Valve	Vendor to Specify													
	78	Applicable Standard	Vendor to Specify													
	79	Valve GA Drawing / Cross Sectional Drg.	Vendor to Specify													
	80	Valve sizing calculation	Vendor to Specify													
	81	Enquiry / PO Reference	Vendor to Specify													

ANNEXURE-II - CERAMIC SHORT PIECE DATA SHEET





Note:
1. a As long possible
2. In case of D1 = D2 : Inner surface shall be straighten
3. Arrow mark of flow direction shall be indicated outer surface

SHORT PIECE SIZE (NPD)	SHORT PIECE MATERIAL	MATERIAL QUANTITY	SHORT PIECE DIMENSION				CONNECTION TYPE		NOTE	
			D1 (INLET)	D2 (OUTLET) (ID OF CERAMIC SLEEVE)	L	t (CERAMIC SLEEVE WALL THICKNESS)	SIDE A	SIDE B	CONTROL VALVE ID (mm)	CONNECTING PIPE ID (mm) (INLET/OUTLET)
50	CERAMIC	10	Vendor to decide	39.80	3 X NPD	Vendor STD	ANSI 150 FF	ANSI 150 FF	Vendor to decide	39.80
100	CERAMIC	10	Vendor to decide	92.20	3 X NPD	Vendor STD	ANSI 150 FF	ANSI 150 FF	Vendor to decide	92.20
125	CERAMIC	7	Vendor to decide	118.00	3 X NPD	Vendor STD	ANSI 150 FF	ANSI 150 FF	Vendor to decide	118.00
150	CERAMIC	3	Vendor to decide	143.70	3 X NPD	Vendor STD	ANSI 150 FF	ANSI 150 FF	Vendor to decide	143.70

ANNEXURE-III

FORM FOR TECHNICAL DEVIATIONS (If any)

SL. NO	SEC / CLAUSE NO.	SPECIFICATION	STATEMENT OF DEVIATIONS/VARIATIONS	REASON FOR DEVIATION	COST OF WITHDRAWAL

Date: **Signature & seal of the Bidder**

ANNEXURE-IV

SLURRY PARAMETERS:

Sl.No	Parameter	Slurry characteristics
1.	Maximum solid particle size	150mesh (140 micron)
2.	Normal solid particle size,d50	325 Mesh (43micron)
3.	Solid to be handled	Absorbers and other impurities
4.	Sp Gravity of Slurry	1.215
5.	Hardness of particle	5-7 (Mho scale)
6.	Concentration of slurry	30% by weight
7.	Sp Gravity of Lime Stone particles	2.80
8.	Sp gravity of heaviest particles (Columbium and Iron oxide)	5.9
9.	Concentration of Chlorine	25000 ppm
10.	Viscosity of Slurry	20-30 cp
11.	Maximum operating temperature of Slurry	70 deg C
12.	SiO2 content	4 to 6 g/l