ANNEXURE –C to Open tender ENQ. No. BAP/PUR/FGD/SLURRY VALVES/4230341E dt.05.06.2013

S.NO	MATERIAL CODE	ITEM DESCRIPTION	SPECIFICATION REFERENCE	QUANTITY (NO)	DESTINATION
1	RFW000700000 & RFW201190000	8 INCH MOTORIZED OPERATED BUTTERFLY VALVES	NTPC:BONG:FGD:SLVALVES-BFVM-SPEC-038:REV-01	3	NTPC BONGAIGAON SITE
2	RFW000750001	2 INCH PNEU OPERATED BUTTERFLY VALVES	NTPC:BONG:FGD:WVALVES-BUTTERFLY VALVE SPEC-029:REV-01	18	NTPC BONGAIGAON SITE
3	RFW000750002	3 INCH PNEU OPERATED BUTTERFLY VALVES	NTPC:BONG:FGD:WVALVES-BUTTERFLY VALVE SPEC-029:REV-01	3	NTPC BONGAIGAON SITE
4	RFW000750003	6 INCH PNEU OPERATED BUTTERFLY VALVES	NTPC:BONG:FGD:WVALVES-BUTTERFLY VALVE SPEC-029:REV-01	3	NTPC BONGAIGAON SITE
5	RFW000750004	8 INCH PNEU OPERATED BUTTERFLY VALVES	NTPC:BONG:FGD:WVALVES-BUTTERFLY VALVE SPEC-029:REV-01	12	NTPC BONGAIGAON SITE
6	RFW000760001	2 INCH MANUALLY OPERATED BUTTERFLY VALVES	NTPC:BONG:FGD:WVALVES-BUTTERFLY VALVE SPEC-030:REV-01	9	NTPC BONGAIGAON SITE
7	RFW000760002	3 INCH MANUALLY OPERATED BUTTERFLY VALVES	NTPC:BONG:FGD:WVALVES-BUTTERFLY VALVE SPEC-030:REV-01	3	NTPC BONGAIGAON SITE
8	RFW000760003	8 INCH MANUALLY OPERATED BUTTERFLY VALVES	NTPC:BONG:FGD:WVALVES-BUTTERFLY VALVE SPEC-030:REV-01	6	NTPC BONGAIGAON SITE
9	RFW000770001	6 INCH PNEU OPERATED PINCH VALVES	NTPC:BONG:FGD:SLVALVES-PINCHVALVES SPEC-031 A:REV-01	6	NTPC BONGAIGAON SITE

10	RFW000770002	8 INCH PNEU OPERATED PINCH VALVES	NTPC:BONG:FGD:SLVALVES-PINCHVALVES SPEC-031 A:REV-01	3	NTPC BONGAIGAON SITE
11	RFW000780001	1 INCH MANUALLY OPERATED DIAPHRAGM VALVES	NTPC:BONG:FGD:WVALVES-DIAPHRAGM VALVE SPEC-032 :REV-01	27	NTPC BONGAIGAON SITE
12	RFW000780002	2 INCH MANUALLY OPERATED DIAPHRAGM VALVES	NTPC:BONG:FGD:WVALVES-DIAPHRAGM VALVE SPEC-032 :REV-01	105	NTPC BONGAIGAON SITE
13	RFW000780003	4 INCH MANUALLY OPERATED DIAPHRAGM VALVES	NTPC:BONG:FGD:WVALVES-DIAPHRAGM VALVE SPEC-032 :REV-01	21	NTPC BONGAIGAON SITE
14	RFW000780004	6 INCH MANUALLY OPERATED DIAPHRAGM VALVES	NTPC:BONG:FGD:WVALVES-DIAPHRAGM VALVE SPEC-032 :REV-01	30	NTPC BONGAIGAON SITE
15	RFW000780005	8 INCH MANUALLY OPERATED DIAPHRAGM VALVES	NTPC:BONG:FGD:WVALVES-DIAPHRAGM VALVE SPEC-032 :REV-01	24	NTPC BONGAIGAON SITE
16	RFW000840001 & RFW201200001	32 INCH MOTORIZED OPERATED BUTTERFLY VALVES	NTPC:BONG:FGD:SLVALVES-BUTTERFLY VALVE SPEC-038 :REV-01	14	NTPC BONGAIGAON SITE
17	RFW000840002 & RFW201200002	36 INCH MOTORIZED OPERATED BUTTERFLY VALVES	NTPC:BONG:FGD:SLVALVES-BUTTERFLY VALVE SPEC-038 :REV-01	14	NTPC BONGAIGAON SITE
18	RFW000890001 & RFW201220001	3 INCH MANUALLY OP BUTTERFLY VALVES	NTPC:BONG:FGD:SLVALVES-BUTTERFLY VALVE SPEC-030 :REV-01	5	NTPC BONGAIGAON SITE
19	RFW000890002 & RFW201220002	4 INCH MANUALLY OP BUTTERFLY VALVES	NTPC:BONG:FGD:SLVALVES-BUTTERFLY VALVE SPEC-030 :REV-01	3	NTPC BONGAIGAON SITE
20	RFW000890003 & RFW201220003	6 INCH MANUALLY OP BUTTERFLY VALVES	NTPC:BONG:FGD:SLVALVES-BUTTERFLY VALVE SPEC-030 :REV-01	13	NTPC BONGAIGAON SITE

21	RFW000890004 & RFW201220004	8 INCH MANUALLY OP BUTTERFLY VALVES	NTPC:BONG:FGD:SLVALVES-BUTTERFLY VALVE SPEC-030 :REV-01	4	NTPC BONGAIGAON SITE
22	RFW000900001 & RFW201180001	1-1/2 INCH PNEU OPERATED PINCH VALVES	NTPC:BONG:FGD:SLVALVES-PINCHVALVES SPEC-031 :REV-01	4	NTPC BONGAIGAON SITE
23	RFW000900002 & RFW201180002	3 INCH PNEU OPERATED PINCH VALVES	NTPC:BONG:FGD:SLVALVES-PINCHVALVES SPEC-031 :REV-01	4	NTPC BONGAIGAON SITE
24	RFW000900003 & RFW201180003	4 INCH PNEU OPERATED PINCH VALVES	NTPC:BONG:FGD:SLVALVES-PINCHVALVES SPEC-031 :REV-01	8	NTPC BONGAIGAON SITE
25	RFW000900004 & RFW201180004	8 INCH PNEU OPERATED PINCH VALVES	NTPC:BONG:FGD:SLVALVES-PINCHVALVES SPEC-031 :REV-01	3	NTPC BONGAIGAON SITE
26	RFW000910001 & RFW201040001	1 INCH MANUALLY OPERATED DIAPHRAGM VALVES FOR LIMESTONE APPLICATION	NTPC:BONG:FGD:WVALVES-DIAPHRAGM VALVE SPEC-032 :REV-01	54	NTPC BONGAIGAON SITE
27	RFW000910003 &RFW201040008	1 INCH MANUALLY OPERATED DIAPHRAGM VALVES FOR PW APPLICATION	NTPC:BONG:FGD:WVALVES-DIAPHRAGM VALVE SPEC-032 :REV-01	2	NTPC BONGAIGAON SITE
28	RFW000910004 & RFW201040002	1-1/2 INCH MANUALLY OPERATED DIAPHRAGM VALVES FOR LIMESTONE APPLICATION	NTPC:BONG:FGD:WVALVES-DIAPHRAGM VALVE SPEC-032 :REV-01	14	NTPC BONGAIGAON SITE
29	RFW000910005 & RFW201040003	2 INCH MANUALLY OPERATED DIAPHRAGM VALVES FOR LIMESTONE APPLICATION	NTPC:BONG:FGD:WVALVES-DIAPHRAGM VALVE SPEC-032 :REV-01	27	NTPC BONGAIGAON SITE
30	RFW000910007 & RFW201040004	3 INCH MANUALLY OPERATED DIAPHRAGM VALVES FOR FW APPLICATION	NTPC:BONG:FGD:WVALVES-DIAPHRAGM VALVE SPEC-032 :REV-01	16	NTPC BONGAIGAON SITE
31	RFW000910009 & RFW201040005	4 INCH MANUALLY OPERATED DIAPHRAGM VALVES FOR LIMESTONE & FW APPLICATION	NTPC:BONG:FGD:WVALVES-DIAPHRAGM VALVE SPEC-032 :REV-01	42	NTPC BONGAIGAON SITE

32	RFW000910011 & RFW201040006	6 INCH MANUALLY OPERATED DIAPHRAGM VALVES FOR FW APPLICATION	NTPC:BONG:FGD:WVALVES-DIAPHRAGM VALVE SPEC-032 :REV-01	9	NTPC BONGAIGAON SITE
33	RFW000910012 & RFW201040007	8 INCH MANUALLY OPERATED DIAPHRAGM VALVES FOR FW APPLICATION	NTPC:BONG:FGD:WVALVES-DIAPHRAGM VALVE SPEC-032 :REV-01	8	NTPC BONGAIGAON SITE
34	RFW000930001 & RFW201210001	2 INCH PNEU OPERATED BUTTERFLY VALVES	NTPC:BONG:FGD:SLVALVES-BUTTERFLY VALVE SPEC-029 :REV-01	17	NTPC BONGAIGAON SITE
35	RFW000930003 & RFW201210003	3 INCH PNEU OPERATED BUTTERFLY VALVES	NTPC:BONG:FGD:SLVALVES-BUTTERFLY VALVE SPEC-029 :REV-01	5	NTPC BONGAIGAON SITE
36	RFW000930004 & RFW201210004	4 INCH PNEU OPERATED BUTTERFLY VALVES	NTPC:BONG:FGD:SLVALVES-BUTTERFLY VALVE SPEC-029 :REV-01	15	NTPC BONGAIGAON SITE
37	RFW000930005 & RFW201210005	6 INCH PNEU OPERATED BUTTERFLY VALVES	NTPC:BONG:FGD:SLVALVES-BUTTERFLY VALVE SPEC-029 :REV-01	13	NTPC BONGAIGAON SITE
38	RFW000930006 & RFW201210006	8 INCH PNEU OPERATED BUTTERFLY VALVES	NTPC:BONG:FGD:SLVALVES-BUTTERFLY VALVE SPEC-029 :REV-01	4	NTPC BONGAIGAON SITE
39	RFW000930007 & RFW201210007	10 INCH PNEU OPERATED BUTTERFLY VALVES	NTPC:BONG:FGD:SLVALVES-BUTTERFLY VALVE SPEC-029 :REV-01	8	NTPC BONGAIGAON SITE
40	RFW201180005	6 INCH PNEU OPERATED PINCH VALVES	NTPC:BONG:FGD:SLVALVES-PINCHVALVES SPEC-031 :REV-01	2	NTPC BONGAIGAON SITE
41	RFW201210002	2 INCH PNEU OPERATED BUTTERFLY VALVES	NTPC:BONG:FGD:SLVALVES-BUTTERFLY VALVE SPEC-029 :REV-01	2	NTPC BONGAIGAON SITE
42	RFW201220005	2 INCH MANUALLY OP BUTTERFLY VALVES	NTPC:BONG:FGD:SLVALVES-BUTTERFLY VALVE SPEC-030 :REV-01	2	NTPC BONGAIGAON SITE

BONGAIGAON– 3X250 MW
FLUE GAS DESULFURIZATION SYSTEM

TECHNICAL SPECIFICATION FOR MOTORIZED OPERATED BUTTERFLY VALVES FOR HANDLING SLURRY

CUSTOMER : NATIONAL THERMAL POWER CORPORATION LIMITED

NTPC: BONG: FGD: SLVALVES-BFVM -SPEC-038: REV-01

Flue Gas Desulphurization Group
Air Quality Control Systems
BAP:: BHEL :: Ranipet

TECHNICAL SPECIFICATION FOR MOTORIZED BUTTERFLY VALVES FOR SLURRY APPLICATION

Prepared	Checked	Approved
N.SRIDHAR **Asst. Engineer - FGD**	**MANOJ KUMAR THAKUR** **Engineer-FGD**	**SASHI KUMAR** **Senior Engineer-FGD**
R01 dated 15 04 2013		

CONTENTS

1.0	**PROJECT INFORMATION**	
	▪ Owner	NTPC
	▪ Buyer	BHEL, Ranipet
	▪ Process / application	Wet Lime Stone FGD system
1.1	**SITE CONDITIONS**	
	▪ Ambient temperature (Guarantee)	27 Deg C
	▪ Ambient temperature (Design)	50 Deg C
	▪ Height above sea level	47 m
	▪ Relative Humidity	60 %
1.2	**LOCATION AND APPROACH**	
	▪ Project location	
	▪ State	Assam
	▪ District	Kokrajhar
	▪ Place	Kumkuri near Salakati, Bongaigaon
	▪ Height above sea level	47 m

2.0 INTENT OF SPECIFICATION

This specification together with the attendant Technical Data Sheet and other specifications/attachments to inquiry / order defines the minimum requirements for motorized butterfly valves along with their accessories /auxiliaries for use in the process of Flue gas Desulphurization (FGD) system handling limestone slurry.

Bidder shall make all possible efforts to comply strictly with the requirements of this specification and other specifications/attachments to inquiry/order.

In case, deviations are considered essential by the Bidder (after exhausting all possible efforts), these shall be separately listed in the Bidder's proposal under separate section, titled as "List of Deviations/Exceptions to the Enquiry Document (Annexure-III)". Deviation shall be listed separately for each document with cross reference to Page No./Section/Clause No./Para etc. of the respective document supported with proper reasons for the deviation for purchaser's consideration. Any deviation, not listed under the above section, even if reflected in any other portion of the proposal, shall not be considered applicable. No deviation or exception shall be permitted without the written approval of the purchaser.

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. The valves shall conform to the latest editions of applicable codes and standards as mentioned elsewhere. Nothing in this specification shall be construed to relieve the Bidder of his responsibility. 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.

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.

3.0 STANDARDS AND CODES

Valves in general shall conform to the requirements of the following standards:

a. ANSI B 16.34 Standard for valves.
b. AWWA-C-504 Rubber seated butterfly valves.
c. BS-5155/EN-593 Cast iron and carbon steel butterfly valves for general purpose.
d. ANSI-B-16.10 Valves face to face and other relevant dimension.

e. API-598 Valves inspection test.
f. ANSI-B-16.5 specification for flange dimension

4.0 DESIGN/CONSTRUCTION OF BUTTERFLY VALVES

4.1. All valves shall be suitable for the service conditions i.e flow, temperature and pressure at which they are required to operate.
4.2. The valves as well as all accessories shall be designed for easy disassembly and maintenance.
4.3. Valves to be installed outside shall be required to have the stem properly protected against atmospheric corrosion
4.4. The valves supplied shall be suitable for limestone slurry application (slurry parameters are listed in Annexure-I)
4.5. The valves shall be designed for the design pressure/temperature of the system on which it is installed and in accordance with AWWA-C-504, EN-593 or any other approved equivalent standard latest edition.
4.6. The valves shall be suitable for installation in any position (horizontal/ vertical etc.) and shall be of double-flanged construction. However for sizes 150 NB and below the valves may be lugged Wafer construction.
4.7. The seals, both on the body (sleeve) and on the disc shall be of the material specified. Necessary shaft seal shall be provided and adequately designed to ensure no leakage across the seal. This seal shall be designed so that they will allow replacement without removal of the valve shaft. The sealing ring on the disk shall be continuous type and easily replaceable.
4.8. For all types of valves, the design with shaft eccentric to the disc is preferred. The shaft shall be solid type and shall pivot on bushings. Bushings/sleeve type bearings shall be contained in the hub of valve body. The bearing shall be self-lubricated type with low coefficient of friction and should not have any harmful effect on water and on valve components.
4.9. The design of the shaft shall be such that it will safely sustain maximum differential pressure across the closed valve. The shaft and any key (taper pin etc.) for transmitting the torque between shaft and disc shall be capable of withstanding the maximum torque required to operate the valve. However, the shaft diameter shall not be less than the minimum shaft diameter specified in relevant code. Necessary Torque Calculation and the torque class selected on the basis of the same shall be furnished to the Employer for information.
4.10. The disc shall rotate from the full open to the tight shut position. The disc shall be contoured to ensure the least possible resistance to flow and shall be suitable for throttling operation. While the disc is in the throttled position, valve shall not

create any noise or vibration. The operating mechanism shall be mounted directly on or supported from the valve body.

4.11. All valves shall be complete with: position indicator (located in a visible place), arrow indicating the flow direction; adjustable mechanical stop limiting devices to prevent over travel of valve disc in open/close position; all valves shall be "tight shut off"

4.12. Fabricated steel (IS:2062 Gr B) butterfly valves instead of cast Iron body valves are also acceptable for size above 300 mm NB diameter for water application other than Sea-water / corrosive water. In such a case, however, the bidder will have to necessarily submit thickness calculations, in order to establish the integrity of the fabricated valve body under the system operating pressure condition. Bidder has to clearly indicate the material offered in the bid. No change shall be entertained during detailed engg.

4.13. Limit and torque switches (if applicable) shall be enclosed in water tight enclosures along with suitable space heaters for motor actuated valves, which may be either for on-off operation or inching operation with position transmitter.

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

4.15. All valves shall be provided with embossed name plate giving details such as tag number, type, size etc.

4.16. The actuator-operated valves shall be designed on the basis of the following :

- The internal parts shall be suitable to support the pressure caused by the actuators;
- The valve-actuator unit shall be suitably stiff so as not to cause vibrations, misalignments, etc.
- All actuator operated valves shall be provided with hand operated gearing mechanism also.
- All actuators operated valves shall open/ close fully within time required by the process but not later than 60 seconds after actuators starts.

5.0 MATERIAL OF CONSTRUCTION (BUTTERFLY VALVES)

Material of pneumatically operated butterfly 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 the parts of the valve exposed to slurry must be rubber lined.

6.0 SCOPE OF SUPPLY

a) Valve as per specification
b) Motorized actuator as per the specification.
c) Limit switch – 2 Nos. for each valves as per the spec.

7.0 PROOF OF DESIGN TEST (TYPE TEST) FOR BUTTERFLY VALVES

Proof of Design (P.O.D.) test certificates shall be furnished by the bidder for all applicable size-ranges and classes of Butterfly valves supplied by him, in the absence of which actual P.O.D. test shall be conducted by the bidder in the presence of Employer's representative. All valves that are designed and manufactured as per AWWA-C-504 shall be governed by the relevant clauses of P.O.D test in AWWA-C-504. For Butterfly valves designed and manufactured to EN-593 or equivalent, the P.O.D. test methods and procedures shall generally follow the guidelines of AWWA-C-504 in all respect except that Body & seat hydro test and disc-strength test shall be conducted at the pressures specified in EN-593 or the applicable code. Actuators shall also meet requirements of P.O.D. testof AWWA-C-504

8.0 SPECIFICATION FOR ACTUATOR

1.	Quantity	01 No. for each valve
2.	Type	Linear electrical actuator/Rotex/Elomatic/Virgo
3.	Failure position (power failure)	Close
4.	Local Position Indicator	To be provided.
5.	Hand wheel for manual opn	Required (> 8 inch)
6.	Actuator torque	Vendor to specify
7.	Actuator Protection Class	IP-65 (Min)
8.	Actuator Thrust	Vendor to specify
9.	Actuator travel time for 90 degree	Vendor to specify
10.	Power supply	Vendor to specify
11.	Working current of actuator	Vendor to specify
12.	Stall current of actuator	Vendor to specify
13.	Torque switch / rating	2 NOS, 2 NO+2NC contacts suitable for 24V DC/230V AC, min 5A for 24 V DC
14.	Potentiometer	Required for 0 to 100% valve opening indication
15.	Control box (3ϕ)	Integral starter required with PLC, remote manual operation from operator work stn.

9.0 LIMIT SWITCHES:

a) Quantity /valve : 2 nos for close / open indication, ,
b) No. of Contacts : 2NO+2NC contacts
c) Contact Rating : 24V DC / 230V AC
d) Protection : Weather proof IP 55.
e) Limit Switch Box : Limit Switch terminals shall be brought out to a Terminal Box

10.0 PAINTING OF VALVES:

The detailed painting procedure is enclosed in Annexure-V

11.0 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-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. Recommended spares list for 3 year O&M along with item wise price.
k. Any deviation shall be specifically mentioned in the enclosed deviation format **Annexure-IV**.

In case of any deviation, the Bidder shall indicate the deviation, clause by clause in the deviation format attached in **Annexure-IV**. If there is no deviation "**NIL**" statement shall be furnished. In the absence of **Annexure-IV**, 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.

12.0 DOCUMENTS / SERVICE AFTER ORDER

12.1. 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

12.2. 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

13.0 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.

14.0 INSPECTION

Shall be done by BHEL inspector at Vendor's works.

ANNEXURE I

15.0 DETAILED LIST OF VALVES WITH OPERATING PARAMETERS

Indent no	**RFW00070**
Material Code	**RFW000700000**
Process Liquid	**LIME/GYPSUM SLURRY**
Service	**ISOLATION**
Type of valve	**BUTTERFLY VALVE**
Mode of Operation	**MOTORIZED**
Size	**8 INCH**

Sl No.	Valve / Instrument Tag No	Operating Conditions		Design Conditions		Material of Construction				End Connection	QTY
		T (°C)	P (Kg/cm^2)	T (°C)	P (Kg/cm²)	Body Material	Disc	Stem	Lining		
1.	00HTM04AA101	50	0.98	80	5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1

16.0 MANDATORY SPARES

Indent no	**RFW20119**
Material Code	**RFW201190000**
Process Liquid	**LIME/GYPSUM SLURRY**
Service	**ISOLATION**
Type of valve	**BUTTERFLY VALVE**
Mode of Operation	**MOTORIZED**
Size	**8 INCH**

Sl No.	Valve / Instrument Tag No	Operating Conditions		Design Conditions		Material of Construction				End Connection	QTY
		T (°C)	P (Kg/cm^2)	T (°C)	P (Kg/cm^2)	Body Material	Disc	Stem	Lining		
1.	M1-BFV-MT-SL-8	50	0.98	80	5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
2.	M2-BFV-MT-SL-8	50	0.98	80	5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1

ANNEXURE II

17.0 DATA SHEET FOR VALVES(TO BE FILLED SEPARATELY FOR EACH TYPE OF VALVE)

Sl No	DESCRIPTION	TO BE FILLED BY VENDOR
I	**Valve Size**	
a.	Make	
b.	Model/ Type	
c.	Fluid details - Medium handled	
	Temperature range (°C)	
d.	Rated flow (m^3/hr.)	
e.	Design Cv of the valve	
f.	Valve rating	
g.	Valve operation- (Lever/ Gear box)	
h.	Pressure Drop for rated flow (bar(g))	
i.	Design pressure (bar(g))	
j.	Hydraulic test pressure	
	➢ Body (bar(g))	
	➢ Seat (bar(g))	
k.	Max. Shut off pressure (bar(g))	
II	**CONSTRUCTION DETAILS**	
a.	Material of construction	
	➢ Body	
	➢ Stem	
	➢ Disc	
	➢ Seat	
	➢ Bushing	
	➢ Handle	
b.	Fasteners	
c.	End Connection / Rating / Standard	
d.	Recommended minimum pipe ID mm	
e.	Details of Gearbox if applicable	
III	**GENERAL**	
a.	Weight per valve	
b.	Applicable standards	
c.	Valve GA Drawing / Cross Sectional Drg.	
d.	Enquiry / PO reference	

ANNEXURE-III

18.0 DATA SHEET FOR MOTORIZED ACTUATOR

1) ACTUATOR

a) Make :
b) Model :
c) Type :
d) Torque rating :
f) Operating time for opening :
Operating time for closing :
g) Accessories offered :
h) Type of stay put :
i) Actuator torque :
j) Actuator Protection Class :
k) Actuator Thrust :
l) Actuator travel time for 90 :
m) Power supply :
n) Working current of actuator :
o) Stall current of actuator :

2) LIMIT SWITCH

a) Make :
b) Type :
c) Quantity :
d) Contact rating :
e) Reset type :

NOTE:

Vendor should fill up the "Vendor's Confirmation column" and submit a signed copy of this specification with his offer.

Vendor's Signature & Seal

ANNEXURE IV

19.0 FORMS 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-V

20.0 PAINTING PROCEDURE:

Primer Coat		Intermediate Coat		Finish coat			Total DFT µm (min)
Paint	No of Coats /DFT	Paint	No of Coats	Paint	No of Coats	Shade	
HB Chlorinated Rubber based Zinc Phosphate Primer DFT= 50 µm per coat (Solid by Volume min 60%)	2	--	--	Chlorinated Rubber Based Finish paint DFT= 30 µm per coat (Solid by Volume min 60%)	2	Gray shade to R9002	160

BONGAIGAON– 3X250 MW
FLUE GAS DESULFURIZATION SYSTEM

TECHNICAL SPECIFICATION FOR PNEUMATICALLY OPERATEDBUTTERFLY VALVES FOR HANDLING SLURRY

CUSTOMER : NATIONAL THERMAL POWER CORPORATION LIMITED

NTPC: BONG: FGD: WVALVES-BUTTERFLY VALVE SPEC-029: REV-01

Flue Gas Desulphurization Group
Air Quality Control Systems
BAP:: BHEL :: Ranipet

Technical specification for Pneumatically Operated Butterfly Valves for slurry application:

Prepared	Checked	Approved
SRIDHAR **Asst. Engineer-FGD**	**ASHWIN R** **Engineer Trainee- FGD**	**SASHI KUMAR** **Senior Engineer-FGD**
R01 dated 30 03 2013		

CONTENTS

1.0	**PROJECT INFORMATION**	
	▪ Owner	NTPC
	▪ Buyer	BHEL, Ranipet
	▪ Process / application	Wet Lime Stone FGD system
1.1	**SITE CONDITIONS**	
	▪ Ambient temperature (Guarantee)	27 Deg C
	▪ Ambient temperature (Design)	50 Deg C
	▪ Height above sea level	47 m
	▪ Relative Humidity	60 %
1.2	**LOCATION AND APPROACH**	
	▪ Project location	
	▪ *State*	*Assam*
	▪ *District*	*Kokrajhar*
	▪ *Place*	*Kumkuri near Salakati, Bongaigaon*
	▪ *Height above sea level*	*47 m*

2.0 INTENT OF SPECIFICATION

This specification together with the attendant Technical Data Sheet and other specifications/attachments to inquiry / order defines the minimum requirements for pneumatically operated butterfly valves along with their accessories /auxiliaries for use in the process of Flue gas Desulphurization (FGD) system handling limestone slurry.

Bidder shall make all possible efforts to comply strictly with the requirements of this specification and other specifications/attachments to inquiry/order. In case, deviations are considered essential by the Bidder (after exhausting all possible efforts), these shall be separately listed in the Bidder's proposal under separate section, titled as "List of Deviations/Exceptions to the Enquiry Document (Annexure-III)". Deviation shall be listed separately for each document with cross reference to Page No./Section/Clause No./Para etc. of the respective document supported with proper reasons for the deviation for purchaser's consideration. Any deviation, not listed under the above section, even if reflected in any other portion of the proposal, shall not be considered applicable. No deviation or exception shall be permitted without the written approval of the purchaser.

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. The valves shall conform to the latest editions of applicable codes and standards as mentioned elsewhere. Nothing in this specification shall be construed to relieve the Bidder of his responsibility. 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.

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.

3.0 STANDARDS AND CODES

Valves in general shall conform to the requirements of the following standards:

a. ANSI B 16.34 Standard for valves.
b. AWWA-C-504 Rubber seated butterfly valves.
c. BS-5155/EN-593 Cast iron and carbon steel butterfly valves for general purpose.
d. ANSI-B-16.10 Valves face to face and other relevant dimension.
e. API-598 Valves inspection test.
f. ANSI-B-16.5 specification for flange dimension

3.1 SCOPE OF SUPPLY

a) Valve as per specification
b) Pneumatic actuator as per the specification No.
c) Limit switch – 2 Nos. for each valves as per the spec.
d) Air filter Regulator -1 No. per valve as per the spec.
e) Solenoid valve – 1 No. for each valve as per the

4.0 DESIGN/CONSTRUCTION OF BUTTERFLY VALVES

4.1. All valves shall be suitable for the service conditions i.e flow, temperature and pressure at which they are required to operate.

4.2. The valves as well as all accessories shall be designed for easy disassembly and maintenance.

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

4.4. The valves supplied shall be suitable for limestone slurry application (slurry parameters are listed in Annexure-I)

4.5. The valves shall be designed for the design pressure/temperature of the system on which it is installed and in accordance with AWWA-C-504, EN-593 or any other approved equivalent standard latest edition.

4.6. The valves shall be suitable for installation in any position (horizontal/ vertical etc.) and shall be of double-flanged construction. However for sizes 150 NB and below the valves may be lugged Wafer construction.

4.7. The seals, both on the body (sleeve) and on the disc shall be of the material specified. Necessary shaft seal shall be provided and adequately designed to ensure no leakage across the seal. This seal shall be designed so that they will allow replacement without removal of the valve shaft. The sealing ring on the disk shall be continuous type and easily replaceable.

4.8. For all types of valves, the design with shaft eccentric to the disc is preferred. The shaft shall be solid type and shall pivot on bushings. Bushings/sleeve type bearings shall be contained in the hub of valve body. The bearing shall be self-lubricated type with low coefficient of friction and should not have any harmful effect on water and on valve components.

4.9. The design of the shaft shall be such that it will safely sustain maximum differential pressure across the closed valve. The shaft and any key (taper pin etc.) for transmitting the torque between shaft and disc shall be capable of withstanding the maximum torque required to operate the valve. However, the shaft diameter shall not be less than the minimum shaft diameter specified in relevant code. Necessary Torque Calculation and the torque class selected on the basis of the same shall be furnished to the Employer for information.

4.10. The disc shall rotate from the full open to the tight shut position. The disc shall be contoured to ensure the least possible resistance to flow and shall be suitable for

throttling operation. While the disc is in the throttled position, valve shall not create any noise or vibration. The operating mechanism shall be mounted directly on or supported from the valve body.

4.11. All valves shall be complete with: position indicator (located in a visible place), arrow indicating the flow direction; adjustable mechanical stop limiting devices to prevent over travel of valve disc in open/close position; all valves shall be "tight shut off"

4.12. Valves-350Nb and above shall have pressure equalizing bypass valves, wherever system parameters warrant the same.

4.13. Valves-350Nb and above shall also be provided with gear operator arrangement suitable for manual operation. Manual operation of valve shall be through worm and gear arrangement having totally enclosed gearing with hand wheel diameter and gear ratio designed to meet the required operating torque It shall be designed to hold the valve disc in intermediate position between full open and full closed position without creeping or fluttering. Adjustable stops shall be provided to prevent over travel in either direction.

4.14. Fabricated steel (IS:2062 Gr B) butterfly valves instead of cast Iron body valves are also acceptable for size above 300 mm NB diameter for water application other than Sea-water / corrosive water. In such a case, however, the bidder will have to necessarily submit thickness calculations, in order to establish the integrity of the fabricated valve body under the system operating pressure condition. Bidder has to clearly indicate the material offered in the bid. No change shall be entertained during detailed engg.

4.15. Limit and torque switches (if applicable) shall be enclosed in water tight enclosures along with suitable space heaters for motor actuated valves, which may be either for On-Off operation or inching operation with position transmitter.

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

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

4.18. The actuator-operated valves shall be designed on the basis of the following :

a. The internal parts shall be suitable to support the pressure caused by the actuators;
b. The valve-actuator unit shall be suitably stiff so as not to cause vibrations, misalignments, etc.
c. All actuator operated valves shall be provided with hand operated gearing mechanism also.
d. All actuators operated valves shall open/ close fully within time required by the process but not later than 60 seconds after actuators starts.

5.0 MATERIAL OF CONSTRUCTION (BUTTERFLY VALVES)

Material of Diaphragm 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 the parts of the valve exposed to slurry must be rubber lined.

6.0 PROOF OF DESIGN TEST (TYPE TEST) FOR BUTTERFLY VALVES

Proof of Design (P.O.D.) test certificates shall be furnished by the bidder for all applicable size-ranges and classes of Butterfly valves supplied by him, in the absence of which actual P.O.D. test shall be conducted by the bidder in the presence of Employer's representative.
All valves that are designed and manufactured as per AWWA-C-504 shall be governed by the relevant clauses of P.O.D test in AWWA-C-504. For Butterfly valves designed and manufactured to EN-593 or equivalent, the P.O.D. test methods and procedures shall generally follow the guidelines of AWWA-C-504 in all respect except that Body & seat hydro test and disc-strength test shall be conducted at the pressures specified in EN-593 or the applicable code. Actuators shall also meet requirements of P.O.D. testof AWWA-C-504

7.0 SPECIFICATION FOR PNEUMATIC ACTUATOR

a) Quantity	01 No. for each valve
b) Type	Rotary actuator, Pneumatic (spring return)
c) Action	Air to Open
d) Failure position (air failure)	Close
e) Close/open at air Pressure	4 to 6 kg/cm^2 optg design for 4 kg/cm^2
e) Air Connection	¼" NPT(F) drawn copper tubing
f) Local Position Indicator	To be provided.
g) Hand wheel for manual opn	Required (> 8 inch)
h) Actuator travel time	Vendor to specify
i) Actuator Protection Class	IP-65 (Min)
j) Actuator Thrust	Vendor to specify
k) Spring range (kg/cm2)	Vendor to specify
l) Speed adjustment for actuator operation	Vendor to specify
m) Solenoid valve type	3/2 way, 24V DC power supply, ex. proof,

	1/4" NPT pneumatic connection, 1/2" NPT
	Electrical connection. Solenoid Valve Energised for valve to open & Solenoid valve De-energised for valve to close.
n) Air filter regulator	Size of filter shall be 5 Micron, Filter material shall be sintered bronze/equivalent, Body shall be aluminium, 1/4" NPT Pneumatic connection shall be envisaged. 2" Pressure gauge along with air filter to be provided.

8.0 LIMIT SWITCHES:

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

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

c) Contact Rating : 24 V DC

d) Protection : Weather proof IP 55.

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

9.0 PAINTING OF VALVES:

The detailed painting procedure is enclosed in Annexure-IV

10.0 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 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**.

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.

11.0 DOCUMENTS / SERVICE AFTER ORDER

11.1. 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.
- Quality plan

11.2. 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

12.0 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.

13.0 INSPECTION

Shall be done by BHEL inspector at Vendor's works.

ANNEXURE I

14.0 DETAILED LIST OF VALVES WITH OPERATING PARAMETERS

Indent no	**RFW00075**
Material Code	**RFW000750001**
Process Liquid	**LIME/GYPSUM SLURRY**
Service	**ISOLATION**
Type of valve	**BUTTERFLY VALVE**
Mode of Operation	**PNEUMATIC**
Size	**2 INCH**

Sl No.	Valve / Instrument Tag No	Operating Conditions		Design Conditions		Material of Construction				End Connection	QTY
		T (°C)	P (Kg/cm^2)	T (°C)	P (Kg/cm^2)	Body Material	Disc	Stem	Lining		
1.	10HTQ09AA202	50	ATM	80	5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
2.	10HTQ09AA204	50	ATM	80	5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
3.	10HTQ09AA206	50	ATM	80	5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
4.	10HTQ09AA208	50	ATM	80	5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
5.	20HTQ09AA202	50	ATM	80	5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
6.	20HTQ09AA204	50	ATM	80	5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
7.	20HTQ09AA206	50	ATM	80	5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
8.	20HTQ09AA208	50	ATM	80	5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
9.	30HTQ09AA202	50	ATM	80	5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1

10.	30HTQ09AA204	50	ATM	80	5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
11.	30HTQ09AA206	50	ATM	80	5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
12.	30HTQ09AA208	50	ATM	80	5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
13.	10HTQ08AA204	50	Atm	80	5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
14.	10HTQ08AA202	50	Atm	80	5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
15.	20HTQ08AA204	50	Atm	80	5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
16.	20HTQ08AA202	50	Atm	80	5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
17.	30HTQ08AA204	50	Atm	80	5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
18.	30HTQ08AA202	50	Atm	80	5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1

Indent no	**RFW00075**
Material Code	**RFW000750002**
Process Liquid	**LIME/GYPSUM SLURRY**
Service	**ISOLATION**
Type of valve	**BUTTERFLY VALVE**
Mode of Operation	**PNEUMATIC**
Size	**3 INCH**

Sl No.	Valve / Instrument Tag No	Operating Conditions		Design Conditions		Material of Construction				End Connection	QTY
		T (°C)	P (Kg/cm^2)	T (°C)	P (Kg/cm^2)	Body Material	Disc	Stem	Lining		
1.	10HTT01AA201	50	3	80	5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
2.	20HTT01AA201	50	3	80	5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
3.	30HTT01AA201	50	3	80	5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1

Indent no	**RFW00075**
Material Code	**RFW000750003**
Process Liquid	**LIME/GYPSUM SLURRY**
Service	**ISOLATION**
Type of valve	**BUTTERFLY VALVE**
Mode of Operation	**PNEUMATIC**
Size	**6 INCH**

Sl No.	Valve / Instrument Tag No	Operating Conditions		Design Conditions		Material of Construction				End Connection	QTY
		T (°C)	P (Kg/cm^2)	T (°C)	P (Kg/cm^2)	Body Material	Disc	Stem	Lining		
1.	10HTQ39AA101	50	1.5	80	5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
2.	20HTQ39AA101	50	1.5	80	5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
3.	30HTQ39AA101	50	1.5	80	5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1

Indent no	**RFW00075**
Material Code	**RFW000750004**
Process Liquid	**LIME/GYPSUM SLURRY**
Service	**ISOLATION**
Type of valve	**BUTTERFLY VALVE**
Mode of Operation	**PNEUMATIC**
Size	**8 INCH**

Sl No.	Valve / Instrument Tag No	Operating Conditions		Design Conditions		Material of Construction				End Connection	QTY
		T (°C)	P (Kg/cm^2)	T (°C)	P (Kg/cm^2)	Body Material	Disc	Stem	Lining		
1.	10HTM00AA201	50	1	80	5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
2.	10HTM00AA202	50	5.7	80	7.5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
3.	10HTM00AA203	50	1	80	5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
4.	10HTM00AA204	50	5.7	80	7.5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
5.	20HTM00AA201	50	1	80	5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
6.	20HTM00AA202	50	5.7	80	7.5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
7.	20HTM00AA203	50	1	80	5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
8.	20HTM00AA204	50	5.7	80	7.5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
9.	30HTM00AA201	50	1	80	5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
10.	30HTM00AA202	50	5.7	80	7.5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
11.	30HTM00AA203	50	1	80	5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
12.	30HTM00AA204	50	5.7	80	7.5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1

15.0 SLURRY PARAMETERS

Sl.No	Item	Limestone Slurry Absorber
1.	Maximum solid particle size	150mesh (104micron)
2.	Distribution of above size particle,d20	20%(max)
3.	Normal solid particle size,d50	325 mesh(43micron)
4.	Solid to be handled	Absorbers and other impurities
5.	Sp Gravity of Slurry	1.224
6.	PPM of heavier particle (Silica, Aluminium Oxide, Ferric Oxide and Columbium)	23290
7.	Hardness of particle	5-7 (Mho scale)
8.	Concentration of slurry	30% by weight
9.	Sp Gravity of Lime Stone	2.80
10.	Sp gravity of heaviest particles (Columbium and Iron oxide)	5.9
11.	Concentration of Chlorine	20000ppm
12.	Viscosity of Slurry	20-30cp
13.	Maximum operating temperature of Slurry	60 deg C

ANNEXURE II

16.0 DATA SHEET FOR VALVES (TO BE FILLED SEPARATELY FOR EACH TYPE OF VALVE)

Sl No	DESCRIPTION	TO BE FILLED BY VENDOR
I	**Valve Size**	
a.	Make	
b.	Model/ Type	
c.	Fluid details - Medium handled	
	Temperature range (°C)	
d.	Rated flow (m^3/hr.)	
e.	Design Cv of the valve	
f.	Valve rating	
g.	Valve operation- (Lever/ Gear box)	
h.	Pressure Drop for rated flow (bar(g))	
i.	Design pressure (bar(g))	
j.	Hydraulic test pressure	
	➢ Body (bar(g))	
	➢ Seat (bar(g))	
k.	Max. Shut off pressure (bar(g))	
II	**CONSTRUCTION DETAILS**	
a.	Material of construction	
	➢ Body	
	➢ Stem	
	➢ Disc	
	➢ Seat	
	➢ Bushing	
	➢ Handle	
b.	Fasteners	
c.	End Connection / Rating / Standard	
d.	Recommended minimum pipe ID mm	
e.	Details of Gearbox if applicable	
III	**GENERAL**	
a.	Weight per valve	
b.	Applicable standards	
c.	Valve GA Drawing / Cross Sectional Drg.	
d.	Enquiry / PO reference	

ANNEXURE III

17.0 FORMS 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

18.0 PAINTING PROCEDURE:

Primer Coat		**Intermediate Coat**		**Finish coat**			**Total DFT µm (min)**
Paint	No of Coats /DFT	Paint	No of Coats	Paint	No of Coats	Shade	
HB Chlorinated Rubber based Zinc Phosphate Primer DFT= 50 µm per coat (Solid by Volume min 60%)	2	--	--	Chlorinated Rubber Based Finish paint DFT= 30 µm per coat (Solid by Volume min 60%)	2	Gray shade to R9002	160

BONGAIGAON– 3X250 MW
FLUE GAS DESULFURIZATION SYSTEM

TECHNICAL SPECIFICATION FOR MANUALLY OPERATED BUTTERFLY VALVES FOR SLURRY APPLICATION

CUSTOMER : NATIONAL THERMAL POWER CORPORATION LIMITED

NTPC: BONG: FGD: WVALVES-BUTTERFLY VALVE SPEC-030: REV-01

Flue Gas Desulphurization Group
Air Quality Control Systems
BAP:: BHEL :: Ranipet

TECHNICAL SPECIFICATION FOR MANUALLY OPERATED BUTTERFLY VALVES FOR SLURRY APPLICATION

Prepared	Checked	Approved
N SRIDHAR Asst. Engineer-FGD	ASHWIN R Engineer Trainee- FGD	SASHI KUMAR Senior Engineer-FGD
R01 dated 30 03 2013		

CONTENTS

1.0	**PROJECT INFORMATION**	
	▪ Owner	NTPC
	▪ Buyer	BHEL, Ranipet
	▪ Process / application	Wet Lime Stone FGD system
1.1	**SITE CONDITIONS**	
	▪ Ambient temperature (Guarantee)	27 Deg C
	▪ Ambient temperature (Design)	50 Deg C
	▪ Height above sea level	47 m
	▪ Relative Humidity	60 %
1.2	**LOCATION AND APPROACH**	
	▪ Project location	
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	▪ District	Kokrajhar
	▪ Place	Kumkuri near Salakati, Bongaigaon
	▪ Height above sea level	47 m

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for Butterfly valves along with their accessories /auxiliaries for use in the process of Flue gas Desulphurization (FGD) system handling limestone slurry.

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e. API-598 Valves inspection test.
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4.10. The disc shall rotate from the full open to the tight shut position. The disc shall be contoured to ensure the least possible resistance to flow and shall be suitable for throttling operation. While the disc is in the throttled position, valve shall not create any noise or vibration. The operating mechanism shall be mounted directly on or supported from the valve body.

4.11. All valves shall be complete with: position indicator (located in a visible place), arrow indicating the flow direction; adjustable mechanical stop limiting devices to prevent over travel of valve disc in open/close position; all valves shall be "tight shut off"

4.12. Hand operated valves shall have the following

- Local hand controls

- The hand controls shall close the valve with clockwise rotation.
- The hand controls shall be dimensioned to guarantee an easy manoeuvre under most severe conditions.
- The hand controls shall be provided with locking systems suitable to avoid the disc assuming a non-desirable position during the operation.

4.13. Hand wheel shall be made of malleable iron with arms and rims of adequate strength. The hand wheel of diameters 300mm or less shall be provided with handles for ease of operation. The pulling force required on the hand wheel rim shall not exceed 25 Kgf when operating the valve under full flow and operating pressure.

4.14. Valves-350Nb and above shall have pressure equalizing bypass valves, wherever system parameters warrant the same.

4.15. Valves-350Nb and above shall also be provided with gear operator arrangement suitable for manual operation. Manual operation of valve shall be through worm and gear arrangement having totally enclosed gearing with hand wheel diameter and gear ratio designed to meet the required operating torque It shall be designed to hold the valve disc in intermediate position between full open and full closed position without creeping or fluttering. Adjustable stops shall be provided to prevent over travel in either direction.

4.16. Fabricated steel (IS:2062 Gr B) butterfly valves instead of cast Iron body valves are also acceptable for size above 300 mm NB diameter for water application other than Sea-water / corrosive water. In such a case, however, the bidder will have to necessarily submit thickness calculations, in order to establish the integrity of the fabricated valve body under the system operating pressure condition.Bidder has to clearly indicate the material offered in the bid. No change shall be entertained during detailed engg.

4.17. All valves shall be provided with embossed name plate giving details such as tag number, type, size etc.

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

5.0 MATERIAL OF CONSTRUCTION (BUTTERFLY VALVES)

Material of manually operated butterfly 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 the parts of the valve exposed to slurry must be rubber lined.

6.0 PROOF OF DESIGN TEST (TYPE TEST) FOR BUTTERFLY VALVES

Proof of Design (P.O.D.) test certificates shall be furnished by the bidder for all applicable size-ranges and classes of Butterfly valves supplied by him, in the absence of which actual P.O.D. test shall be conducted by the bidder in the presence of Employer's representative.

All valves that are designed and manufactured as per AWWA-C-504 shall be governed by the relevant clauses of P.O.D test in AWWA-C-504. For Butterfly valves designed and manufactured to EN-593 or equivalent, the P.O.D. test methods and procedures shall generally follow the guidelines of AWWA-C-504 in all respect except that Body & seat hydro test and disc-strength test shall be conducted at the pressures specified in EN-593 or the applicable code. Actuators shall also meet requirements of P.O.D. testof AWWA-C-504

7.0 PAINTING OF VALVES:

The detailed painting procedure is enclosed in Annexure-IV

8.0 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-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. Recommended spares list for 3 year O&M along with item wise price.
k. Any deviation shall be specifically mentioned in the enclosed deviation format **Annexure-III**.

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.

9.0 DOCUMENTS / SERVICE AFTER ORDER

9.1. 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

9.2. 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

10.0 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.

11.0 INSPECTION

Shall be done by BHEL inspector at Vendor's works.

ANNEXURE I

12.0 DETAILED LIST OF VALVES WITH OPERATING PARAMETERS

Indent no	**RFW00076**
Material Code	**RFW000760001**
Process Liquid	**LIME/GYPSUM SLURRY**
Service	**ISOLATION**
Type of valve	**BUTTERFLY VALVE**
Mode of Operation	**MANUAL**
Size	**2 INCH**

Sl No.	Valve / Instrument Tag No	Operating Conditions		Design Conditions		Material of Construction				End Connection	QTY
		T (°C)	P (Kg/cm^2)	T (°C)	P (Kg/cm^2)	Body Material	Disc	Stem	Lining		
1.	10HTM03CQ001	50	5.7	80	7.5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
2.	10HTM03CQ002	50	5.7	80	7.5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
3.	10HTM03CQ003	50	5.7	80	7.5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
4.	20HTM03CQ001	50	5.7	80	7.5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
5.	20HTM03CQ002	50	5.7	80	7.5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
6.	20HTM03CQ003	50	5.7	80	7.5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
7.	30HTM03CQ001	50	5.7	80	7.5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
8.	30HTM03CQ002	50	5.7	80	7.5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
9.	30HTM03CQ003	50	5.7	80	7.5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1

Indent no	**RFW00076**
Material Code	**RFW000760002**
Process Liquid	**WASTE WATER**
Service	**ISOLATION**
Type of valve	**BUTTERFLY VALVE**
Mode of Operation	**MANUAL**
Size	**3 INCH**

Sl No.	Valve / Instrument Tag No	Operating Conditions		Design Conditions		Material of Construction				End Connection	QTY
		T (°C)	P (Kg/cm^2)	T (°C)	P (Kg/cm^2)	Body Material	Disc	Stem	Lining		
1.	10HTT01AA001	50	ATM	80	5	A216 WCB	A217 CA15	A276-410	NATURAL RUBBER	WFR	1
2.	20HTT01AA001	50	ATM	80	5	A216 WCB	A217 CA15	A276-410	NATURAL RUBBER	WFR	1
3.	30HTT01AA001	50	ATM	80	5	A216 WCB	A217 CA15	A276-410	NATURAL RUBBER	WFR	1

Indent no	**RFW00076**
Material Code	**RFW000760003**
Process Liquid	**LIMESTONE SLURRY**
Service	**ISOLATION**
Type of valve	**BUTTERFLY VALVE**
Mode of Operation	**MANUAL**
Size	**8 INCH**

Sl No.	Valve / Instrument Tag No	Operating Conditions		Design Conditions		Material of Construction				End Connection	QTY
		T (°C)	P (Kg/cm²)	T (°C)	P (Kg/cm²)	Body Material	Disc	Stem	Lining		
1.	10HTT01AA002	50	ATM	80	5	A216 WCB	A217 CA15	A276-410	NATURAL RUBBER	WFR	1
2.	10HTT01AA003	50	ATM	80	5	A216 WCB	A217 CA15	A276-410	NATURAL RUBBER	WFR	1
3.	20HTT01AA002	50	ATM	80	5	A216 WCB	A217 CA15	A276-410	NATURAL RUBBER	WFR	1
4.	20HTT01AA003	50	ATM	80	5	A216 WCB	A217 CA15	A276-410	NATURAL RUBBER	WFR	1
5.	30HTT01AA002	50	ATM	80	5	A216 WCB	A217 CA15	A276-410	NATURAL RUBBER	WFR	1
6.	30HTT01AA003	50	ATM	80	5	A216 WCB	A217 CA15	A276-410	NATURAL RUBBER	WFR	1

13. SLURRY PROCESS PARAMETERS

Sl.No	Item	Limestone Slurry Absorber
1.	Maximum solid particle size	150mesh (104micron)
2.	Distribution of above size particle,d20	20%(max)
3.	Normal solid particle size,d50	325 mesh(43micron)
4.	Solid to be handled	Absorbers and other impurities
5.	Sp Gravity of Slurry	1.224
6.	PPM of heavier particle (Silica, Aluminium Oxide, Ferric Oxide and Columbium)	23290
7.	Hardness of particle	5-7 (Mho scale)
8.	Concentration of slurry	30% by weight
9.	Sp Gravity of Lime Stone	2.80
10.	Sp gravity of heaviest particles (Columbium and Iron oxide)	5.9
11.	Concentration of Chlorine	20000ppm
12.	Viscosity of Slurry	20-30cp
13.	Maximum operating temperature of Slurry	60 deg C

ANNEXURE II

14.0 DATA SHEET FOR VALVES (TO BE FILLED SEPARATELY FOR EACH TYPE OF VALVE)

Sl No	DESCRIPTION	TO BE FILLED BY VENDOR
I	**Valve Size**	
a.	Make	
b.	Model/ Type	
c.	Fluid details - Medium handled	
	Temperature range (°C)	
d.	Rated flow (m^3/hr.)	
e.	Design Cv of the valve	
f.	Valve rating	
g.	Valve operation- (Lever/ Gear box)	
h.	Pressure Drop for rated flow (bar(g))	
i.	Design pressure (bar(g))	
j.	Hydraulic test pressure	
	➢ Body (bar(g))	
	➢ Seat (bar(g))	
k.	Max. Shut off pressure (bar(g))	
II	**CONSTRUCTION DETAILS**	
a.	Material of construction	
	➢ Body	
	➢ Stem	
	➢ Disc	
	➢ Seat	
	➢ Bushing	
	➢ Handle	
b.	Fasteners	
c.	End Connection / Rating / Standard	
d.	Recommended minimum pipe ID mm	
e.	Details of Gearbox if applicable	
III	**GENERAL**	
a.	Weight per valve	
b.	Applicable standards	
c.	Valve GA Drawing / Cross Sectional Drg.	
d.	Enquiry / PO reference	

ANNEXURE III

15.0 FORMS 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

16.0 PAINTING PROCEDURE:

Primer Coat		**Intermediate Coat**		**Finish coat**			**Total DFT µm (min)**
Paint	No of Coats /DFT	Paint	No of Coats	Paint	No of Coats	Shade	
HB Chlorinated Rubber based Zinc Phosphate Primer DFT= 50 µm per coat (Solid by Volume min 60%)	2	--	--	Chlorinated Rubber Based Finish paint DFT= 30 µm per coat (Solid by Volume min 60%)	2	Gray shade to R9002	160

BONGAIGAON– 3X250 MW
FLUE GAS DESULFURIZATION SYSTEM

TECHNICAL SPECIFICATION FOR

PNEUMATICALLY OPERATED

PINCH VALVES

HANDLING SLURRY

CUSTOMER : NATIONAL THERMAL POWER CORPORATION LIMITED

NTPC: BONG: FGD: - SLVALVES-PINCHVALVES-SPEC- 031 A: REV-01

Flue Gas Desulphurization Group
Air Quality Control Systems
BAP :: BHEL :: Ranipet

TECHNICAL SPECIFICATION FOR PNEUMATICALLY OPERATED PINCH VALVES FOR SLURRY APPLICATION

Prepared	Checked	Approved
SRIDHAR Asst Engineer-FGD	ASHWIN Engineer - FGD	SASHI KUMAR SR.ENGINEER-FGD
R01 dated 22 03 2013		

CONTENTS

1.0	PROJECT INFORMATION	
	▪ Owner	NTPC
	▪ Buyer	BHEL, Ranipet
	▪ Process / application	Wet Lime Stone FGD system
1.1	**SITE CONDITIONS**	
	▪ Ambient temperature (Guarantee)	27 Deg C
	▪ Ambient temperature (Design)	50 Deg C
	▪ Height above sea level	47 m
	▪ Relative Humidity	60 %
1.2	**LOCATION AND APPROACH**	
	▪ Project location	
	▪ State	Assam
	▪ District	Kokrajhar
	▪ Place	Kumkuri near Salakati, Bongaigaon
	▪ Height above sea level	47 m

2.0 INTENT OF SPECIFICATION

This specification together with the attendant Technical Data Sheet and other specifications/attachments to inquiry / order defines the minimum requirements for pinch valves along with their accessories /auxiliaries for use in the process of Flue gas Desulphurization (FGD) system using slurry.

Bidder shall make all possible efforts to comply strictly with the requirements of this specification and other specifications/attachments to inquiry/order.

In case, deviations are considered essential by the Bidder (after exhausting all possible efforts), these shall be separately listed in the Bidder's proposal under separate section, titled as "List of Deviations/Exceptions to the Enquiry Document (Annexure-IV)". Deviation shall be listed separately for each document with cross reference to Page No./Section/Clause No./Para etc. of the respective document supported with proper reasons for the deviation for purchaser's consideration. Any deviation, not listed under the above section, even if reflected in any other portion of the proposal, shall not be considered applicable. No deviation or exception shall be permitted without the written approval of the purchaser.

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. The valves shall conform to the latest editions of applicable codes and standards as mentioned elsewhere. Nothing in this specification shall be construed to relieve the Bidder of his responsibility. 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.

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.

3.0 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:

ANSI B 16.34 Standard for valves.

ANSI-B-16.10 Valves face to face and other relevant dimension.

API-598 Valves inspection test.

ANSI-B-16.5 Standard for Valve flange dimension.

4.0 GENERAL SPECIFICATION FOR DESIGN/CONSTRUCTION/MATERIAL PARTICULARS OF PINCH VALVE

a. All valves shall be suitable for the service conditions i.e flow, temperature and pressure, at which they are required to operate.
b. The valves as well as all accessories shall be designed for easy disassembly and maintenance.
c. Valves to be installed outside shall be required to have the stem properly protected against atmospheric corrosion.
d. 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.
e. All valves shall have indicators or direction clearly marked so that the valves opening/ closing can be readily determined.
f. 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. The slurry parameters are provided in Annexure VI.
g. All pinch valves shall be pneumatically operated and will be used for regulation of slurry flow. These 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.
h. All valves except those with rising stems shall be provided with continuous mechanical position indicators; rising stem valves shall have only visual indication through plastic/metallic stem cover for sizes above 50 mm nominal bore. Valves of 65 mm Nb & above with rising stem shall be provided with position indicator/ visual indication either through plastic stem covers or through metallic stem covers. All diaphragm valves of size 50 mm and below in vacuum service shall have extra deep gland packing without requiring water gland sealing. All valves of size 65 mm Nb and above in vacuum services shall have adequately deep gland packing and shall be equipped with lantern rings to admit pressurized water for gland sealing.
i. All pinch valves shall be provided with bonnet-back seating arrangement to enable on line changing of gland packing.
j. All pinch 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 pinch 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.

5.0 MATERIAL OF CONSTRUCTION

5.1 PINCH VALVE

Material of Pinch 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

Valve Type	Pinch
Valve Size & Quantity	Refer Annexure I
Body Material	Refer Annexure I
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	TEFLON/GRAPHITE
Max Sound Level	<80 dBA
Stem Material	Refer Annexure I

5.2 SPECIFICATION FOR PNEUMATIC ACTUATOR

a.	Quantity	01 No. for each valve
b.	Type	Rotary actuator, Pneumatic (spring return)
c.	Action	Air to Open
d.	Failure position (air failure)	Close
e.	Close/open at air Pressure	4 to 6 Kg/sq.cm
f.	Air Connection	¼" NPT(F)
g.	Local Position Indicator	To be provided.
h.	Hand wheel for manual opn	Required (for valves greater than 8 inch)
i.	Actuator travel time	Vendor to specify
j.	Actuator Protection Class	IP-65 (Min)
k.	Actuator Thrust	Vendor to specify
l.	Spring range (kg/cm2)	Vendor to specify
m.	Speed adjustment for actuator operation	To be provided to facilitate speed adjustments both during opening &closing by means of flow control valve
n.	Solenoid valve type	3/2 way, 24V DC power supply, ex. proof, 1/4" NPT pneumatic connection, 1/2" NPT Electrical connection. Solenoid Valve Energised for valve to open & Solenoid valve De-energised for valve to close.
o.	Air filter regulator	Size of filter shall be 5 Micron, Filter material shall be sintered bronze/equivalent, Body shall be aluminium, 1/4" NPT Pneumatic connection shall be envisaged

5.3 LIMIT SWITCHES:

a) Quantity /valve : One for Open & one for Close position
b) No. of Contacts : Two normally open & two normally closed potential free contacts in each limit switch corresponding to open & close positions of the valve.
c) Contact Rating : 24 V DC
d) Protection : Weather proof IP 55.
e) Limit Switch Box : Limit Switch terminals shall be brought out to a Terminal Box

6.0 ELECTRONIC POSITIONER:

MODEL	VTS
TYPE	ELECTRO PNEUMATIC, MICROPROCESSOR BASED, LOOP POWERED.
INPUT (MA) OUTPUT (KG/CM2)	4-20MA VTS
VALVE POSITION SENSING OUTPUT	4-20 M A 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

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 PAINTING

The detailed painting procedure is enclosed in **Annexure-V.**

9.0 INSPECTION

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

10.0 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-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. Recommended spares list for 3 year O&M along with item wise price.
k. Any deviation shall be specifically mentioned in the enclosed deviation format **Annexure-IV**.

In case of any deviation, the Bidder shall indicate the deviation, clause by clause in the deviation format attached in **Annexure-IV**. If there is no deviation "**NIL**" statement shall be furnished. In the absence of **Annexure- IV**, 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.

11.0 DOCUMENTS / SERVICE AFTER ORDER

11.1. 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

11.2. 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

12.0 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.

ANNEXURE-I

13.0 DETAILED LIST OF VALVES WITH OPERATING PARAMETERS

Indent no	**RFW00077**
Material Code	**RFW000770001**
Process Liquid	**Lime slurry**
Service	**Regulating**
Type of valve	**Pinch Valve**
Mode of Operation	**Pneumatic**
Size	**6 Inch**

Valve / Instrument Tag No	Operating Conditions		Design Conditions		Material of Construction(As indicated below or its equivalent)				End Connection (FLD-FLANGED)	QTY
	T (°C)	P (Kg/cm^2)	T (°C)	P (Kg/cm^2)	Body Material	Disc	Stem	Lining		
10HTM01AA201	50	5.7	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD	1
10HTM03AA201	50	5.7	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD	1
20HTM01AA201	50	5.7	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD	1
20HTM03AA201	50	5.7	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD	1
30HTM01AA201	50	5.7	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD	1
30HTM03AA201	50	5.7	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD	1

Indent no	**RFW00077**
Material Code	**RFW000770002**
Process Liquid	**Lime slurry**
Service	**Regulating**
Type of valve	**Pinch Valve**
Mode of Operation	**Pneumatic**
Size	**8 Inch**

Valve / Instrument Tag No	Operating Conditions		Design Conditions		Material of Construction(As indicated below or its equivalent)				End Connection (FLD-FLANGED)	QTY
	T (°C)	P (Kg/cm^2)	T (°C)	P (Kg/cm^2)	Body Material	Disc	Stem	Lining		
10HTM02AA201	50	5.7	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD	1
20HTM02AA201	50	5.7	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD	1
30HTM02AA201	50	5.7	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD	1

ANNEXURE-II

14.0 DATA SHEET FOR VALVES (TO BE FILLED SEPARATELY FOR EACH TYPE OF VALVE)

Sl No	DESCRIPTION	TO BE FILLED BY VENDOR
I	**Valve Size**	
a.	Make	
b.	Model/ Type	
c.	Fluid details - Medium handled	
	Temperature range (°C)	
d.	Rated flow (m^3/hr.)	
e.	Design Cv of the valve	
f.	Valve rating	
g.	Valve operation- (Lever/ Gear box)	
h.	Pressure Drop for rated flow (bar(g))	
i.	Design pressure (bar(g))	
j.	Hydraulic test pressure	
	➢ Body (bar(g))	
	➢ Seat (bar(g))	
k.	Max. Shut off pressure (bar(g))	
II	**CONSTRUCTION DETAILS**	
a.	Material of construction	
	➢ Body	
	➢ Stem	
	➢ Disc	
	➢ Seat	
	➢ Bushing	
	➢ Handle	
b.	Fasteners	
c.	End Connection / Rating / Standard	
d.	Recommended minimum pipe ID mm	
e.	Details of Gearbox if applicable	
III	**GENERAL**	
a.	Weight per valve	
b.	Applicable standards	
c.	Valve GA Drawing / Cross Sectional Drg.	
d.	Enquiry / PO reference	

ANNEXURE-III

15.0 DATA SHEET FOR ACTUATOR (TO BE FILLED SEPARATELY FOR EACH TYPE OF VALVE)

1)	Actuator	
	➢ Make	
	➢ Model	
	➢ Type	
	➢ Torque Rating	
	➢ Air Consumption	
	➢ Operating Time For Opening	
	➢ Operating Time For Closing	
	➢ Accessories Offered	
	➢ Type Of Stay Put	
	➢ Air Connection	
2)	Limit Switch	
	➢ Make	
	➢ Type	
	➢ Quantity	
	➢ Contact Rating	
	➢ Reset Type	
3)	Electronic Positioner	
	➢ Make	
	➢ Type	
	➢ Quantity	
	➢ Connection	

Vendor's Signature & Seal

ANNEXURE-IV

16.0 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-V

17.0 PAINTING PROCEDURE:

Primer Coat		Intermediate Coat		Finish coat			Total DFT µm (min)
Paint	No of Coats /DFT	Paint	No of Coats	Paint	No of Coats	Shade	
HB Chlorinated Rubber based Zinc Phosphate Primer DFT= 50 µm per coat (Solid by Volume min 60%)	2	--	--	Chlorinated Rubber Based Finish paint DFT= 30 µm per coat (Solid by Volume min 60%)	2	Gray shade to R9002	160

ANNEXURE-VI

18.0 SLURRY PARAMETERS:

	Parameter	Lime slurry characteristics
1.	Maximum solid particle size	150mesh (104 micron)
2.	Distribution of above size particle,d20	20%(max)
3.	Normal solid particle size,d50	325 mesh(43micron)
4.	Solid to be handled	Absorbers and other impurities
5.	Sp Gravity of Slurry	1.224
6.	PPM of heavier particle (Silica, Aluminium Oxide, Ferric Oxide and Columbium)	23290
7.	Hardness of particle	5-7 (Mho scale)
8.	Concentration of slurry	30% by weight
9.	Sp Gravity of Lime Stone	2.80
10.	Sp gravity of heaviest particles (Columbium and Iron oxide)	5.9
11.	Concentration of Chlorine	20000 ppm
12.	Viscosity of Slurry	20-30cp
13.	Maximum operating temperature of Slurry	60 deg C

BONGAIGAON– 3X250 MW
FLUE GAS DESULFURIZATION SYSTEM

TECHNICAL SPECIFICATION FOR

MANUALLY OPERATED DIAPHRAGM VALVES

HANDLING SLURRY

CUSTOMER : NATIONAL THERMAL POWER CORPORATION LIMITED

NTPC: BONG: FGD: WVALVES-DIAPHRAGM VALVE -SPEC-032: REV-01

Flue Gas Desulphurization Group
Air Quality Control Systems
BAP:: BHEL :: Ranipet

TECHNICAL SPECIFICATION FOR MANUALLY OPERATED DIAPHRAGM VALVES FOR HANDLING SLURRY

Prepared	Checked	Approved
SRIDHAR Asst. Engineer-FGD	ASHWIN R Engineer- FGD	SASHI KUMAR Senior Engineer-FGD
R01 dated 31 03 2013		

CONTENTS

1.0	**PROJECT INFORMATION**	
	▪ Owner	NTPC
	▪ Buyer	BHEL, Ranipet
	▪ Process / application	Wet Lime Stone FGD system
1.1	**SITE CONDITIONS**	
	▪ Ambient temperature (Guarantee)	27 Deg C
	▪ Ambient temperature (Design)	50 Deg C
	▪ Height above sea level	47 m
	▪ Relative Humidity	60 %
1.2	**LOCATION AND APPROACH**	
	▪ Project location	
	▪ State	Assam
	▪ District	Kokrajhar
	▪ Place	Kumkuri near Salakati, Bongaigaon
	▪ Height above sea level	47 m

2.0 INTENT OF SPECIFICATION

This specification together with the attendant Technical Data Sheet and other specifications/attachments to inquiry / order defines the minimum requirements for diaphragm valves along with their accessories /auxiliaries for use in the process of Flue gas Desulphurization (FGD) system using slurry.

Bidder shall make all possible efforts to comply strictly with the requirements of this specification and other specifications/attachments to inquiry/order.

In case, deviations are considered essential by the Bidder (after exhausting all possible efforts), these shall be separately listed in the Bidder's proposal under separate section, titled as "List of Deviations/Exceptions to the Enquiry Document (Annexure-III)". Deviation shall be listed separately for each document with cross reference to Page No./Section/Clause No./Para etc. of the respective document supported with proper reasons for the deviation for purchaser's consideration. Any deviation, not listed under the above section, even if reflected in any other portion of the proposal, shall not be considered applicable. No deviation or exception shall be permitted without the written approval of the purchaser.

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. The valves shall conform to the latest editions of applicable codes and standards as mentioned elsewhere. Nothing in this specification shall be construed to relieve the Bidder of his responsibility. 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.

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.

3.0 STANDARDS AND CODES

Valves in general shall conform to the requirements of the following standards:

a. ANSI B 16.34 Standard for valves.
b. ANSI-B-16.10 Valves face to face and other relevant dimension.
c. API-598 Valves inspection test
d. ANSI-B-16.5 specification for flange dimension

4.0 GENERAL SPECIFICATION FOR DESIGN/CONSTRUCTION/MATERIAL PARTICULARS OF DIAPHRAGM VALVE

a) All valves shall be suitable for the service conditions i.e flow, temperature and pressure, at which they are required to operate.

b) The valves as well as all accessories shall be designed for easy disassembly and maintenance.

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

d) 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.

e) All valves shall be closed by rotating the hand wheel in the clockwise direction when looking at the face of the hand wheel. In case where the hand wheel is not directly attached to the valve spindle suitable gearing shall be introduced.

f) All valves shall have indicators or direction clearly marked on the hand-wheel 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.

h) Diaphragm valves shall be used for isolation of flow. These valves shall be provided with the following accessories in addition to other standard items :

- Hand wheel
- Draining arrangement wherever required.

i) All valves except those with rising stems shall be provided with continuous mechanical position indicators; rising stem valves shall have only visual indication through plastic/metallic stem cover for sizes above 50 mm nominal bore. Valves of 65 mm Nb & above with rising stem shall be provided with position indicator/ visual indication either through plastic stem covers or through metallic stem covers. All diaphragm valves of size 50 mm and below in vacuum service shall have extra deep gland packing without requiring water gland sealing. All diaphragm valves of size 65 mm Nb and above in vacuum services shall have adequately deep gland packing and shall be equipped with lantern rings to admit pressurized water for gland sealing.

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

k) Hand wheels for all the valves shall close the valve in clockwise direction when viewing from the top. All hand wheels shall be clearly marked indicating the direction of opening/closing. Manual gear operators shall be provided to open/close the valve against the maximum differential pressure across the valve such that the effort required to operate the valve does not exceed 25 kgf.

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

m) All valves shall be provided with embossed name plate giving details such as tag number, type, size etc.

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

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

5.0 MATERIAL OF CONSTRUCTION

Material of Diaphragm 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

6.0 TESTING OF VALVES:

- Applicable Standard BS-5156s
- Test pressure: As per BS-5166
- Duration of test: 30minutes (minimum)
- Rated flow and Pressure Drop Rated flow at rated pressure is to be indicated for
- Manual and open/close valves and flow characteristics for modulating valves.
- Differential pressure at rated flow is to be indicated across the valve.

7.0 RATING PLATE, NAME PLATES AND LABELS:

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

8.0 PAINTING OF VALVES:

The detailed painting procedure is enclosed in **Annexure-IV**.

9.0 INSPECTION

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

10.0 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-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 (if applicable).
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. Recommended spares list for 3 year O&M along with item wise price.
k. Any deviation shall be specifically mentioned in the enclosed deviation format **Annexure-III**.

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.

11.0 DOCUMENTS / SERVICE AFTER ORDER

11.1. 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 (if applicable)
- Quality plan

11.2. 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

12.0 DOCUMENTATION

The documentation during bid and post order stage shall meet the following requirements:

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

ANNEXURE I

13.0 DETAILED LIST OF VALVES WITH OPERATING PARAMETERS

Indent no	**RFW00078**
Material Code	**RFW000780001**
Process Liquid	**LIME/GYPSUM SLURRY**
Service	**ISOLATION**
Type of valve	**DIAPHRAGM VALVE**
Mode of Operation	**MANUAL**
Size	**1 INCH**

Sl No	Valve / Instrument Tag No	Operating Conditions		Design Conditions		Material of Construction				End Connection	QTY
		T (°C)	P (Kg/ cm^2)	T (°C)	P (Kg/ cm^2)	Body Material	Disc	Stem	Lining		
1.	10HTM00CP001	50	5.7	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
2.	10HTM00CP002	50	5.7	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
3.	10HTM00CP502	50	5.7	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
4.	10HTM01CP001	50	5.7	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
5.	10HTM03CP501	50	5.7	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
6.	10HTM03CP001	50	5.7	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
7.	10HTM03CP002	50	5.7	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
8.	20HTM00CP001	50	5.7	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
9.	20HTM00CP002	50	5.7	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
10.	20HTM00CP502	50	5.7	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
11.	20HTM01CP001	50	5.7	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
12.	20HTM03CP501	50	5.7	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1

13.	20HTM03CP001	50	5.7	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
14.	20HTM03CP002	50	5.7	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
15.	30HTM00CP001	50	5.7	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
16.	30HTM00CP002	50	5.7	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
17.	30HTM00CP502	50	5.7	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
18.	30HTM01CP001	50	5.7	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
19.	30HTM03CP501	50	5.7	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
20.	30HTM03CP001	50	5.7	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
21.	30HTM03CP002	50	5.7	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
22.	10HTT01CP001	50	3	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
23.	10HTT01CP501	50	3	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
24.	20HTT01CP001	50	3	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
25.	20HTT01CP501	50	3	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
26.	30HTT01CP001	50	3	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
27.	30HTT01CP501	50	3	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1

Indent no	**RFW00078**
Material Code	**RFW000780002**
Process Liquid	**LIME/GYPSUM SLURRY**
Service	**ISOLATION**
Type of valve	**DIAPHRAGM VALVE**
Mode of Operation	**MANUAL**
Size	**2 INCH**

Sl No	Valve / Instrument Tag No	Operating Conditions		Design Conditions		Material of Construction				End Connection	QTY
		T (°C)	P (Kg/cm²)	T (°C)	P (Kg/cm²)	Body Material	Disc	Stem	Lining		
1.	10HTD01CP001	50	2.85	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
2.	10HTD01CP501	50	2.85	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
3.	10HTD01CP002	50	2.85	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
4.	10HTD01CP003	50	2.85	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
5.	10HTD01CP004	50	2.85	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
6.	10HTD01CP502	50	2.85	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
7.	10HTD01CP503	50	2.85	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
8.	10HTD02CP001	50	2.85	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
9.	10HTD02CP501	50	2.85	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
10.	10HTD02CP002	50	2.85	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
11.	10HTD02CP003	50	2.85	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
12.	10HTD02CP004	50	2.85	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
13.	10HTD02CP502	50	2.85	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
14.	10HTD02CP503	50	2.85	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1

15.	10HTD03CP001	50	2.85	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
16.	10HTD03CP501	50	2.85	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
17.	10HTD03CP002	50	2.85	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
18.	10HTD03CP003	50	2.85	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
19.	10HTD03CP004	50	2.85	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
20.	10HTD03CP502	50	2.85	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
21.	10HTD03CP503	50	2.85	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
22.	10HTD04CP001	50	2.85	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
23.	10HTD04CP501	50	2.85	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
24.	10HTD04CP002	50	2.85	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
25.	10HTD04CP003	50	2.85	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
26.	10HTD04CP004	50	2.85	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
27.	10HTD04CP502	50	2.85	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
28.	10HTD04CP503	50	2.85	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
29.	20HTD01CP001	50	2.85	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
30.	20HTD01CP501	50	2.85	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
31.	20HTD01CP002	50	2.85	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
32.	20HTD01CP003	50	2.85	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
33.	20HTD01CP004	50	2.85	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
34.	20HTD01CP502	50	2.85	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
35.	20HTD01CP503	50	2.85	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
36.	20HTD02CP001	50	2.85	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
37.	20HTD02CP501	50	2.85	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
38.	20HTD02CP002	50	2.85	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
39.	20HTD02CP003	50	2.85	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1

40.	20HTD02CP004	50	2.85	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
41.	20HTD02CP502	50	2.85	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
42.	20HTD02CP503	50	2.85	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
43.	20HTD03CP001	50	2.85	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
44.	20HTD03CP501	50	2.85	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
45.	20HTD03CP002	50	2.85	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
46.	20HTD03CP003	50	2.85	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
47.	20HTD03CP004	50	2.85	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
48.	20HTD03CP502	50	2.85	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
49.	20HTD03CP503	50	2.85	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
50.	20HTD04CP001	50	2.85	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
51.	20HTD04CP501	50	2.85	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
52.	20HTD04CP002	50	2.85	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
53.	20HTD04CP003	50	2.85	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
54.	20HTD04CP004	50	2.85	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
55.	20HTD04CP502	50	2.85	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
56.	20HTD04CP503	50	2.85	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
57.	30HTD01CP001	50	2.85	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
58.	30HTD01CP501	50	2.85	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
59.	30HTD01CP002	50	2.85	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
60.	30HTD01CP003	50	2.85	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
61.	30HTD01CP004	50	2.85	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
62.	30HTD01CP502	50	2.85	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
63.	30HTD01CP503	50	2.85	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
64.	30HTD02CP001	50	2.85	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1

65.	30HTD02CP501	50	2.85	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
66.	30HTD02CP002	50	2.85	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
67.	30HTD02CP003	50	2.85	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
68.	30HTD02CP004	50	2.85	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
69.	30HTD02CP502	50	2.85	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
70.	30HTD02CP503	50	2.85	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
71.	30HTD03CP001	50	2.85	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
72.	30HTD03CP501	50	2.85	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
73.	30HTD03CP002	50	2.85	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
74.	30HTD03CP003	50	2.85	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
75.	30HTD03CP004	50	2.85	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
76.	30HTD03CP502	50	2.85	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
77.	30HTD03CP503	50	2.85	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
78.	30HTD04CP001	50	2.85	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
79.	30HTD04CP501	50	2.85	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
80.	30HTD04CP002	50	2.85	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
81.	30HTD04CP003	50	2.85	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
82.	30HTD04CP004	50	2.85	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
83.	30HTD04CP502	50	2.85	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
84.	30HTD04CP503	50	2.85	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
85.	10HTM00CP501	50	5.7	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
86.	10HTM02AA006	50	5.7	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
87.	10HTM02AA007	50	5.7	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
88.	10HTM01AA005	50	5.7	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
89.	10HTM01AA006	50	5.7	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1

90.	10HTM03AA006	50	5.7	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
91.	10HTM03AA007	50	5.7	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
92.	20HTM00CP501	50	5.7	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
93.	20HTM02AA006	50	5.7	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
94.	20HTM02AA007	50	5.7	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
95.	20HTM01AA005	50	5.7	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
96.	20HTM01AA006	50	5.7	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
97.	20HTM03AA006	50	5.7	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
98.	20HTM03AA007	50	5.7	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
99.	30HTM00CP501	50	5.7	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
100.	30HTM02AA006	50	5.7	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
101.	30HTM02AA007	50	5.7	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
102.	30HTM01AA005	50	5.7	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
103.	30HTM01AA006	50	5.7	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
104.	30HTM03AA006	50	5.7	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
105.	30HTM03AA007	50	5.7	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1

Indent no	**RFW00078**
Material Code	**RFW000780003**
Process Liquid	**LIME/GYPSUM SLURRY**
Service	**ISOLATION**
Type of valve	**DIAPHRAGM VALVE**
Mode of Operation	**MANUAL**
Size	**4 INCH**

Sl No	Valve / Instrument Tag No	Operating Conditions		Design Conditions		Material of Construction				End Connection	QTY
		T (°C)	P (Kg/ cm^2)	T (°C)	P (Kg/ cm^2)	Body Material	Disc	Stem	Lining		
1.	10HTD01AA001	50	ATM	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
2.	10HTD02AA001	50	ATM	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
3.	10HTD03AA001	50	ATM	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
4.	10HTD04AA001	50	ATM	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
5.	10–DFM–SL– MN – 4–1	50	0.9	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
6.	10–DFM–SL–MN – 4–2	50	0.9	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
7.	10–DFM–SL–MN – 4–3	50	0.9	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
8.	20HTD01AA001	50	ATM	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
9.	20HTD02AA001	50	ATM	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
10.	20HTD03AA001	50	ATM	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
11.	20HTD04AA001	50	ATM	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
12.	20– DFM–SL–MN– 4– 1	50	0.9	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
13.	20– DFM–SL–MN– 4– 2	50	0.9	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
14.	20– DFM–SL–MN– 4– 3	50	0.9	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1

15.	30HTD01AA001	50	ATM	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
16.	30HTD02AA001	50	ATM	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
17.	30HTD03AA001	50	ATM	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
18.	30HTD04AA001	50	ATM	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
19.	30– DFM–SL–MN– 4 –1	50	0.9	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
20.	30– DFM–SL–MN– 4 –2	50	0.9	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
21.	30– DFM–SL–MN– 4 –3	50	0.9	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1

Indent no	**RFW00078**
Material Code	**RFW000780004**
Process Liquid	**LIME/GYPSUM SLURRY**
Service	**ISOLATION**
Type of valve	**DIAPHRAGM VALVE**
Mode of Operation	**MANUAL**
Size	**6 INCH**

Sl No	Valve / Instrument Tag No	Operating Conditions		Design Conditions		Material of Construction				End Connection	QTY
		T (°C)	P (Kg/cm^2)	T (°C)	P (Kg/cm^2)	Body Material	Disc	Stem	Lining		
1.	10HTM01AA001	50	1.5	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD	1
2.	20HTM01AA001	50	1.5	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD	1
3.	30HTM01AA001	50	1.5	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD	1
4.	10HTM01AA001	50	5.7	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
5.	10HTM01AA002	50	5.7	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
6.	10HTM01AA003	50	5.7	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
7.	10HTM01AA004	50	5.7	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
8.	10HTM03AA001	50	5.7	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
9.	10HTM03AA002	50	5.7	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
10.	10HTM03AA003	50	5.7	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
11.	10HTM03AA004	50	5.7	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
12.	10HTM03AA005	50	5.7	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
13.	20HTM01AA001	50	5.7	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
14.	20HTM01AA002	50	5.7	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
15.	20HTM01AA003	50	5.7	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1

16.	20HTM01AA004	50	5.7	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
17.	20HTM03AA001	50	5.7	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
18.	20HTM03AA002	50	5.7	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
19.	20HTM03AA003	50	5.7	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
20.	20HTM03AA004	50	5.7	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
21.	20HTM03AA005	50	5.7	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
22.	30HTM01AA001	50	5.7	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
23.	30HTM01AA002	50	5.7	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
24.	30HTM01AA003	50	5.7	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
25.	30HTM01AA004	50	5.7	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
26.	30HTM03AA001	50	5.7	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
27.	30HTM03AA002	50	5.7	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
28.	30HTM03AA003	50	5.7	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
29.	30HTM03AA004	50	5.7	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
30.	30HTM03AA005	50	5.7	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1

Indent no	**RFW00078**
Material Code	**RFW000780005**
Process Liquid	**LIME/GYPSUM SLURRY**
Service	**ISOLATION**
Type of valve	**DIAPHRAGM VALVE**
Mode of Operation	**MANUAL**
Size	**8 INCH**

Sl No	Valve / Instrument Tag No	Operating Conditions		Design Conditions		Material of Construction				End Connection	QTY
		T (°C)	P (Kg/ cm^2)	T (°C)	P (Kg/ cm^2)	Body Material	Disc	Stem	Lining		
1.	10HTM02AA001A	50	5.7	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
2.	10HTM02AA001B	50	5.7	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
3.	10HTM02AA001C	50	5.7	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
4.	10HTM02AA001D	50	5.7	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
5.	10HTM02AA002	50	5.7	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
6.	10HTM02AA003	50	5.7	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
7.	10HTM02AA004	50	5.7	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
8.	10HTM02AA005	50	5.7	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
9.	20HTM02AA001A	50	5.7	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
10.	20HTM02AA001B	50	5.7	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
11.	20HTM02AA001C	50	5.7	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
12.	20HTM02AA001D	50	5.7	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
13.	20HTM02AA002	50	5.7	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
14.	20HTM02AA003	50	5.7	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
15.	20HTM02AA004	50	5.7	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1

16.	20HTM02AA005	50	5.7	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
17.	30HTM02AA001A	50	5.7	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
18.	30HTM02AA001B	50	5.7	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
19.	30HTM02AA001C	50	5.7	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
20.	30HTM02AA001D	50	5.7	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
21.	30HTM02AA002	50	5.7	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
22.	30HTM02AA003	50	5.7	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
23.	30HTM02AA004	50	5.7	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
24.	30HTM02AA005	50	5.7	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1

Annexure II

14.0 DATA SHEET FOR VALVES (TO BE FILLED SEPARATELY FOR EACH TYPE OF VALVE)

Sl No	DESCRIPTION	TO BE FILLED BY VENDOR
I	**Valve Size**	
a.	Make	
b.	Model/ Type	
c.	Fluid details - Medium handled	
	Temperature range (°C)	
d.	Rated flow (m^3/hr.)	
e.	Design Cv of the valve	
f.	Valve rating	
g.	Valve operation- (Lever/ Gear box)	
h.	Pressure Drop for rated flow (bar(g))	
i.	Design pressure (bar(g))	
j.	Hydraulic test pressure	
	➢ Body (bar(g))	
	➢ Seat (bar(g))	
k.	Max. Shut off pressure (bar(g))	
II	**CONSTRUCTION DETAILS**	
a.	Material of construction	
	➢ Body	
	➢ Stem	
	➢ Disc	
	➢ Seat	
	➢ Bushing	
	➢ Handle	
b.	Fasteners	
c.	End Connection / Rating / Standard	
d.	Recommended minimum pipe ID mm	
e.	Details of Gearbox if applicable	
III	**GENERAL**	
a.	Weight per valve	
b.	Applicable standards	
c.	Valve GA Drawing / Cross Sectional Drg.	
d.	Enquiry / PO reference	

ANNEXURE III

15.0 FORMS 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

16.0 PAINTING PROCEDURE:

Primer Coat		Intermediate Coat		Finish coat			Total DFT µm (min)
Paint	No of Coats /DFT	Paint	No of Coats	Paint	No of Coats	Shade	
HB Chlorinated Rubber based Zinc Phosphate Primer DFT= 50 µm per coat (Solid by Volume min 60%)	2	--	--	Chlorinated Rubber Based Finish paint DFT= 30 µm per coat (Solid by Volume min 60%)	2	Gray shade to R9002	160

ANNEXURE-V

18.0 SLURRY PARAMETERS:

	Parameter	Lime slurry characteristics
1.	Maximum solid particle size	150mesh (104 micron)
2.	Distribution of above size particle,d20	20%(max)
3.	Normal solid particle size,d50	325 mesh(43micron)
4.	Solid to be handled	Absorbers and other impurities
5.	Sp Gravity of Slurry	1.224
6.	PPM of heavier particle (Silica, Aluminium Oxide, Ferric Oxide and Columbium)	23290
7.	Hardness of particle	5-7 (Mho scale)
8.	Concentration of slurry	30% by weight
9.	Sp Gravity of Lime Stone	2.80
10.	Sp gravity of heaviest particles (Columbium and Iron oxide)	5.9
11.	Concentration of Chlorine	20000 ppm
12.	Viscosity of Slurry	20-30cp
13.	Maximum operating temperature of Slurry	60 deg C

BONGAIGAON– 3X250 MW
FLUE GAS DESULFURIZATION SYSTEM

TECHNICAL SPECIFICATION FOR MOTORIZED OPERATED BUTTERFLY VALVES FOR HANDLING SLURRY

CUSTOMER : NATIONAL THERMAL POWER CORPORATION LIMITED

NTPC: BONG: FGD: SLVALVES-BUTTERFLY VALVE -SPEC-038: REV-01

Flue Gas Desulphurization Group
Air Quality Control Systems
BAP:: BHEL :: Ranipet

TECHNICAL SPECIFICATION FOR MOTORIZED OPERATED BUTTERFLY VALVES FOR SLURRY APPLICATION

Prepared	Checked	Approved
N SRIDHAR Asst. Engineer-FGD	MANOJ KUMAR THAKUR Engineer - FGD	SASHI KUMAR Senior Engineer-FGD
R01 Dated 15 04 2013		

CONTENTS

1.0	**PROJECT INFORMATION**	
	▪ Owner	NTPC
	▪ Buyer	BHEL, Ranipet
	▪ Process / application	Wet Lime Stone FGD system
1.1	**SITE CONDITIONS**	
	▪ Ambient temperature (Guarantee)	27 Deg C
	▪ Ambient temperature (Design)	50 Deg C
	▪ Height above sea level	47 m
	▪ Relative Humidity	60 %
1.2	**LOCATION AND APPROACH**	
	▪ Project location	
	▪ State	Assam
	▪ District	Kokrajhar
	▪ Place	Kumkuri near Salakati, Bongaigaon
	▪ Height above sea level	47 m

2.0 INTENT OF SPECIFICATION

This specification together with the attendant Technical Data Sheet and other specifications/attachments to inquiry / order defines the minimum requirements for motorized butterfly valves along with their accessories /auxiliaries for use in the process of Flue gas Desulphurization (FGD) system handling limestone slurry.

Bidder shall make all possible efforts to comply strictly with the requirements of this specification and other specifications/attachments to inquiry/order.

In case, deviations are considered essential by the Bidder (after exhausting all possible efforts), these shall be separately listed in the Bidder's proposal under separate section, titled as "List of Deviations/Exceptions to the Enquiry Document (Annexure-III)". Deviation shall be listed separately for each document with cross reference to Page No./Section/Clause No./Para etc. of the respective document supported with proper reasons for the deviation for purchaser's consideration. Any deviation, not listed under the above section, even if reflected in any other portion of the proposal, shall not be considered applicable. No deviation or exception shall be permitted without the written approval of the purchaser.

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. The valves shall conform to the latest editions of applicable codes and to relieve the Bidder of his responsibility. Compliance to this specification shall not relieve the Bidder of the responsibility of furnishing equipment and specified start up and operating conditions.

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.

3.0 STANDARDS AND CODES

Valves in general shall conform to the requirements of the following standards:

a. ANSI B 16.34 Standard for valves.
b. AWWA-C-504 Rubber seated butterfly valves.
c. BS-5155/EN-593 Cast iron and carbon steel butterfly valves for general purpose.
d. ANSI-B-16.10 Valves face to face and other relevant dimension.
e. API-598 Valves inspection test.
f. ANSI-B-16.5 specification for flange dimension

4.0 DESIGN/CONSTRUCTION OF BUTTERFLY VALVES

4.1. All valves shall be suitable for the service conditions i.e flow, temperature and pressure at which they are required to operate.

4.2. The valves as well as all accessories shall be designed for easy disassembly and maintenance.

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

4.4. The valves supplied shall be suitable for limestone slurry application (slurry parameters are listed in Annexure-I)

4.5. The valves shall be designed for the design pressure/temperature of the system on which it is installed and in accordance with AWWA-C-504, EN-593 or any other approved equivalent standard latest edition.

4.6. The valves shall be suitable for installation in any position (horizontal/ vertical etc.) and shall be of double-flanged construction. However for sizes 150 NB and below the valves may be lugged Wafer construction.

4.7. The seals, both on the body (sleeve) and on the disc shall be of the material specified. Necessary shaft seal shall be provided and adequately designed to ensure no leakage across the seal. This seal shall be designed so that they will allow replacement without removal of the valve shaft. The sealing ring on the disk shall be continuous type and easily replaceable.

4.8. For all types of valves, the design with shaft eccentric to the disc is preferred. The shaft shall be solid type and shall pivot on bushings. Bushings/sleeve type bearings shall be contained in the hub of valve body. The bearing shall be self-lubricated type with low coefficient of friction and should not have any harmful effect on water and on valve components.

4.9. The design of the shaft shall be such that it will safely sustain maximum differential pressure across the closed valve. The shaft and any key (taper pin etc.) for transmitting the torque between shaft and disc shall be capable of withstanding the maximum torque required to operate the valve. However, the shaft diameter shall not be less than the minimum shaft diameter specified in relevant code. Necessary Torque Calculation and the torque class selected on the basis of the same shall be furnished to the Employer for information.

4.10. The disc shall rotate from the full open to the tight shut position. The disc shall be contoured to ensure the least possible resistance to flow and shall be suitable for throttling operation. While the disc is in the throttled position, valve shall not create any noise or vibration. The operating mechanism shall be mounted directly on or supported from the valve body.

4.11. All valves shall be complete with: position indicator (located in a visible place), arrow indicating the flow direction; adjustable mechanical stop limiting devices to

prevent over travel of valve disc in open/close position; all valves shall be "tight shut off"

4.12. Valves-350Nb and above shall have pressure equalizing bypass valves, wherever system parameters warrant the same.

4.13. Valves-350Nb and above shall also be provided with gear operator arrangement suitable for manual operation. Manual operation of valve shall be through worm and gear arrangement having totally enclosed gearing with hand wheel diameter and gear ratio designed to meet the required operating torque It shall be designed to hold the valve disc in intermediate position between full open and full closed position without creeping or fluttering. Adjustable stops shall be provided to prevent over travel in either direction.

4.14. Fabricated steel (IS:2062 Gr B) butterfly valves instead of cast Iron body valves are also acceptable for size above 300 mm NB diameter for water application other than Sea-water / corrosive water. In such a case, however, the bidder will have to necessarily submit thickness calculations, in order to establish the integrity of the fabricated valve body under the system operating pressure condition. Bidder has to clearly indicate the material offered in the bid. No change shall be entertained during detailed engg.

4.15. Limit and torque switches (if applicable) shall be enclosed in water tight enclosures along with suitable space heaters for motor actuated valves, which may be either for on-off operation or inching operation with position transmitter.

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

4.17. All valves shall be provided with embossed name plate giving details such as tag number, type, size etc.

4.18. The actuator-operated valves shall be designed on the basis of the following :

a. The internal parts shall be suitable to support the pressure caused by the actuators;
b. The valve-actuator unit shall be suitably stiff so as not to cause vibrations, misalignments, etc.
c. All actuator operated valves shall be provided with hand operated gearing mechanism also.
d. All actuators operated valves shall open/ close fully within time required by the process but not later than 60 seconds after actuators starts.

5.0 MATERIAL OF CONSTRUCTION (BUTTERFLY VALVES)

Material of Motorized operated butterfly 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 the parts of the valve exposed to slurry must be rubber lined.

6.0 SCOPE OF SUPPLY

a. Valves as per specification (Annexure-I)
b. Motorized actuator as per the specification.
c. Limit switch – 2 Nos. for each valves as per the spec.

7.0 PROOF OF DESIGN TEST (TYPE TEST) FOR BUTTERFLY VALVES

Proof of Design (P.O.D.) test certificates shall be furnished by the bidder for all applicable size-ranges and classes of Butterfly valves supplied by him, in the absence of which actual P.O.D. test shall be conducted by the bidder in the presence of Employer's representative.

All valves that are designed and manufactured as per AWWA-C-504 shall be governed by the relevant clauses of P.O.D test in AWWA-C-504. For Butterfly valves designed and manufactured to EN-593 or equivalent, the P.O.D. test methods and procedures shall generally follow the guidelines of AWWA-C-504 in all respect except that Body & seat hydro test and disc-strength test shall be conducted at the pressures specified in EN-593 or the applicable code. Actuators shall also meet requirements of P.O.D. test of AWWA-C-504

8.0 SPECIFICATION FOR ACTUATOR

1.	Quantity	01 No. for each valve
2.	Type	Linear electrical actuator/Rotex/Elomatic/Virgo
3.	Failure position (power failure)	Close
4.	Local Position Indicator	To be provided.
5.	Hand wheel for manual opn	Required (> 8 inch)
6.	Actuator torque	Vendor to specify
7.	Actuator Protection Class	IP-65 (Min)
8.	Actuator Thrust	Vendor to specify
9.	Actuator travel time for 90 degree	Vendor to specify
10	Power supply	Vendor to specify
11	Working current of actuator	Vendor to specify
12	Stall current of actuator	Vendor to specify
13	Torque switch / rating	2 NOS, 2 NO+2NC contacts suitable for 24V DC/230V AC, min 5A for 24 V DC
14	Potentiometer	Required for 0 to 100% valve opening indication
15	Control box (3ϕ)	Integral starter required with PLC, remote manual operation from operator work stn.

8.1 LIMIT SWITCHES:

a) Quantity /valve : 2 nos for close / open indication, ,
b) No. of Contacts : 2NO+2NC contacts
c) Contact Rating : 24V DC / 230V AC
d) Protection : Weather proof IP 55.
e) Limit Switch Box : Limit Switch terminals shall be brought out to a Terminal Box

9.0 PAINTING OF VALVES:

The detailed painting procedure is enclosed in Annexure-IV

10.0 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-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. List of applicable standards for shop test.
f. Reference list for the offered model.
g. Typical Quality plan for supply of the above equipments.
h. Valves Catalogues.
i. Recommended spares list for 3 year O&M along with item wise price.
j. Any deviation shall be specifically mentioned in the enclosed deviation format **Annexure-III**.

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.

11.0 DOCUMENTS / SERVICE AFTER ORDER

11.1. 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.

- Quality plan

11.2. 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

12.0 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.

13.0 INSPECTION

Shall be done by BHEL inspector at Vendor's works.

14.0 DETAILED LIST OF VALVES WITH OPERATING PARAMETERS

ANNEXURE I

Indent no	**RFW00084**
Material Code	**RFW000840001**
Process Liquid	**LIME SLURRY**
Service	**ISOLATION**
Type of valve	**BUTTERFLY VALVE**
Mode of Operation	**MOTORIZED**
Size	**32 INCH**

Sl No.	Valve / Instrument Tag No	Operating Conditions		Design Conditions		Material of Construction				End Connection	QTY
		T (°C)	P (Kg/cm^2)	T (°C)	P (Kg/cm^2)	Body Material	Disc	Stem	Lining		
1.	10HTD01AA102	50	2.85	80	5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
2.	10HTD02AA102	50	2.85	80	5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
3.	10HTD03AA102	50	2.85	80	5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
4.	10HTD04AA102	50	2.85	80	5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
5.	20HTD01AA102	50	2.85	80	5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
6.	20HTD02AA102	50	2.85	80	5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
7.	20HTD03AA102	50	2.85	80	5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
8.	20HTD04AA102	50	2.85	80	5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
9.	30HTD01AA102	50	2.85	80	5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
10.	30HTD02AA102	50	2.85	80	5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
11.	30HTD03AA102	50	2.85	80	5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
12.	30HTD04AA102	50	2.85	80	5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1

Indent no	**RFW00084**
Material Code	**RFW000840002**
Process Liquid	**LIME SLURRY**
Service	**ISOLATION**
Type of valve	**BUTTERFLY VALVE**
Mode of Operation	**MOTORIZED**
Size	**36 INCH**

Sl No.	Valve / Instrument Tag No	Operating Conditions		Design Conditions		Material of Construction				End Connection	QTY
		T (°C)	P (Kg/ cm^2)	T (°C)	P (Kg/cm^2)	Body Material	Disc	Stem	Lining		
1.	10HTD01AA101	50	1	80	5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
2.	10HTD02AA101	50	1	80	5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
3.	10HTD03AA101	50	1	80	5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
4.	10HTD04AA101	50	1	80	5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
5.	20HTD01AA101	50	1	80	5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
6.	20HTD02AA101	50	1	80	5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
7.	20HTD03AA101	50	1	80	5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
8.	20HTD04AA101	50	1	80	5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
9.	30HTD01AA101	50	1	80	5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
10.	30HTD02AA101	50	1	80	5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
11.	30HTD03AA101	50	1	80	5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
12.	30HTD04AA101	50	1	80	5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1

MANDATORY SPARES

Indent no	**RFW20120**
Material Code	**RFW201200001**
Process Liquid	**LIME SLURRY**
Service	**ISOLATION**
Type of valve	**BUTTERFLY VALVE**
Mode of Operation	**MOTORIZED**
Size	**32 INCH**

Sl No.	Valve / Instrument Tag No	Operating Conditions		Design Conditions		Material of Construction				End Connection	QTY
		T (°C)	P (Kg/ cm^2)	T (°C)	P (Kg/ cm^2)	Body Material	Disc	Stem	Lining		
1.	M1-BFV-MT-SL-32	50	2.85	80	5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
2.	M2-BFV-MT-SL-32	50	2.85	80	5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1

Indent no	**RFW20120**
Material Code	**RFW201200002**
Process Liquid	**LIME SLURRY**
Service	**ISOLATION**
Type of valve	**BUTTERFLY VALVE**
Mode of Operation	**MOTORIZED**
Size	**36 INCH**

Sl No.	Valve / Instrument Tag No	Operating Conditions		Design Conditions		Material of Construction				End Connection	QTY
		T (°C)	P (Kg/ cm^2)	T (°C)	P (Kg/ cm^2)	Body Material	Disc	Stem	Lining		
1.	M1-BFV-MT-SL-36	50	1	80	5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
2.	M2-BFV-MT-SL-36	50	1	80	5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1

15.0 SLURRY PROCESS PARAMETERS

Sl.No	Item	Limestone Slurry Absorber
1.	Maximum solid particle size	150mesh (104micron)
2.	Distribution of above size particle,d20	20%(max)
3.	Normal solid particle size,d50	325 mesh(43micron)
4.	Solid to be handled	Absorbers and other impurities
5.	Sp Gravity of Slurry	1.224
6.	PPM of heavier particle (Silica, Aluminium Oxide, Ferric Oxide and Columbium)	23290
7.	Hardness of particle	5-7 (Mho scale)
8.	Concentration of slurry	30% by weight
9.	Sp Gravity of Lime Stone	2.80
10.	Sp gravity of heaviest particles (Columbium and Iron oxide)	5.9
11.	Concentration of Chlorine	20000ppm
12.	Viscosity of Slurry	20-30cp
13.	Maximum operating temperature of Slurry	60 deg C

ANNEXURE II

16.0 DATA SHEET FOR VALVES(TO BE FILLED SEPARATELY FOR EACH TYPE OF VALVE)

Sl No	DESCRIPTION	TO BE FILLED BY VENDOR
I	**Valve Size**	
a.	Make	
b.	Model/ Type	
c.	Fluid details - Medium handled	
	Temperature range (°C)	
d.	Rated flow (m^3/hr.)	
e.	Design Cv of the valve	
f.	Valve rating	
g.	Valve operation- (Lever/ Gear box)	
h.	Pressure Drop for rated flow (bar(g))	
i.	Design pressure (bar(g))	
j.	Hydraulic test pressure	
	➢ Body (bar(g))	
	➢ Seat (bar(g))	
k.	Max. Shut off pressure (bar(g))	
II	**CONSTRUCTION DETAILS**	
a.	Material of construction	
	➢ Body	
	➢ Stem	
	➢ Disc	
	➢ Seat	
	➢ Bushing	
	➢ Handle	
b.	Fasteners	
c.	End Connection / Rating / Standard	
d.	Recommended minimum pipe ID mm	
e.	Details of Gearbox if applicable	
III	**GENERAL**	
a.	Weight per valve	
b.	Applicable standards	
c.	Valve GA Drawing / Cross Sectional Drg.	
d.	Enquiry / PO reference	

17.0 DATA SHEET FOR MOTORIZED ACTUATOR

1) ACTUATOR

a)	Make	:
b)	Model	:
c)	Type	:
d)	Torque rating	:
f)	Operating time for opening	:
	Operating time for closing	:
g)	Accessories offered	:
h)	Type of stay put	:
i)	Actuator torque	:
j)	Actuator Protection Class	:
k)	Actuator Thrust	:
l)	Actuator travel time for 90	:
m)	Power supply	:
n)	Working current of actuator	:
o)	Stall current of actuator	:

2) LIMIT SWITCH

a)	Make	:
b)	Type	:
c)	Quantity	:
d)	Contact rating	:
e)	Reset type	:

NOTE:

Vendor should fill up the "Vendor's Confirmation column" and submit a signed copy of this specification with his offer.

Vendor's Signature & Seal

ANNEXURE III

18.0 FORMS 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

19.0 PAINTING PROCEDURE:

Primer Coat		**Intermediate Coat**		**Finish coat**			**Total DFT µm (min)**
Paint	No of Coats /DFT	Paint	No of Coats	Paint	No of Coats	Shade	
HB Chlorinated Rubber based Zinc Phosphate Primer DFT= 50 µm per coat (Solid by Volume min 60%)	2	--	--	Chlorinated Rubber Based Finish paint DFT= 30 µm per coat (Solid by Volume min 60%)	2	Gray shade to R9002	160

BONGAIGAON– 3X250 MW
FLUE GAS DESULFURIZATION SYSTEM

TECHNICAL SPECIFICATION FOR MANUALLY OPERATED BUTTERFLY VALVES FOR HANDLING SLURRY

CUSTOMER : NATIONAL THERMAL POWER CORPORATION LIMITED

NTPC: BONG: FGD: SL VALVES-BUTTERFLY VALVE SPEC-030: REV-01

Flue Gas Desulphurization Group
Air Quality Control Systems
BAP:: BHEL :: Ranipet

TECHNICAL SPECIFICATION FOR MANUALLY OPERATED BUTTERFLY VALVES FOR SLURRY APPLICATION

Prepared	Checked	Approved
N Sridhar Asst. Engineer-FGD	ASHWIN R Engineer Trainee- FGD	SASHI KUMAR Senior Engineer-FGD
R01 Dated 30 03 2013		

CONTENTS

1.0	**PROJECT INFORMATION**	
	▪ Owner	NTPC
	▪ Buyer	BHEL, Ranipet
	▪ Process / application	Wet Lime Stone FGD system
1.1	**SITE CONDITIONS**	
	▪ Ambient temperature (Guarantee)	27 Deg C
	▪ Ambient temperature (Design)	50 Deg C
	▪ Height above sea level	47 m
	▪ Relative Humidity	60 %
1.2	**LOCATION AND APPROACH**	
	▪ Project location	
	▪ State	Assam
	▪ District	Kokrajhar
	▪ Place	Kumkuri near Salakati, Bongaigaon
	▪ Height above sea level	47 m

2.0 INTENT OF SPECIFICATION

This specification together with the attendant Technical Data Sheet and other specifications/attachments to inquiry / order defines the minimum requirements for Butterfly valves along with their accessories /auxiliaries for use in the process of Flue gas Desulphurization (FGD) system handling limestone slurry.

Bidder shall make all possible efforts to comply strictly with the requirements of this specification and other specifications/attachments to inquiry/order.

In case, deviations are considered essential by the Bidder (after exhausting all possible efforts), these shall be separately listed in the Bidder's proposal under separate section, titled as "List of Deviations/Exceptions to the Enquiry Document (Annexure-III)". Deviation shall be listed separately for each document with cross reference to Page No./Section/Clause No./Para etc. of the respective document supported with proper reasons for the deviation for purchaser's consideration. Any deviation, not listed under the above section, even if reflected in any other portion of the proposal, shall not be considered applicable. No deviation or exception shall be permitted without the written approval of the purchaser.

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. The valves shall conform to the latest editions of applicable codes and standards as mentioned elsewhere. Nothing in this specification shall be construed to relieve the Bidder of his responsibility. 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.

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.

3.0 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:

a. ANSI B 16.34 Standard for valves.
b. AWWA-C-504 Rubber seated butterfly valves.
c. BS-5155/EN-593 Cast iron and carbon steel butterfly valves for general purpose.
d. ANSI-B-16.10 Valves face to face and other relevant dimension.
e. API-598 Valves inspection test.
f. ANSI-B-16.5 specification for flange dimension

4.0 DESIGN/CONSTRUCTION OF BUTTERFLY VALVES

4.1. All valves shall be suitable for the service conditions i.e flow, temperature and pressure at which they are required to operate.

4.2. The valves as well as all accessories shall be designed for easy disassembly and maintenance.

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

4.4. The valves supplied shall be suitable for limestone slurry application (slurry parameters are listed in Annexure-I)

4.5. The valves shall be designed for the design pressure/temperature of the system on which it is installed and in accordance with AWWA-C-504, EN-593 or any other approved equivalent standard latest edition.

4.6. The valves shall be suitable for installation in any position (horizontal/ vertical etc.) and shall be of double-flanged construction. However for sizes 150 NB and below the valves may be lugged Wafer construction.

4.7. The seals, both on the body (sleeve) and on the disc shall be of the material specified. Necessary shaft seal shall be provided and adequately designed to ensure no leakage across the seal. This seal shall be designed so that they will allow replacement without removal of the valve shaft. The sealing ring on the disk shall be continuous type and easily replaceable.

4.8. For all types of valves, the design with shaft eccentric to the disc is preferred. The shaft shall be solid type and shall pivot on bushings. Bushings/sleeve type bearings shall be contained in the hub of valve body. The bearing shall be self-lubricated type with low coefficient of friction and should not have any harmful effect on water and on valve components.

4.9. The design of the shaft shall be such that it will safely sustain maximum differential pressure across the closed valve. The shaft and any key (taper pin etc.) for transmitting the torque between shaft and disc shall be capable of withstanding the maximum torque required to operate the valve. However, the shaft diameter shall not be less than the minimum shaft diameter specified in relevant code. Necessary Torque Calculation and the torque class selected on the basis of the same shall be furnished to the Employer for information.

4.10. The disc shall rotate from the full open to the tight shut position. The disc shall be contoured to ensure the least possible resistance to flow and shall be suitable for throttling operation. While the disc is in the throttled position, valve shall not create any noise or vibration. The operating mechanism shall be mounted directly on or supported from the valve body.

4.11. All valves shall be complete with: position indicator (located in a visible place), arrow indicating the flow direction; adjustable mechanical stop limiting devices to prevent over travel of valve disc in open/close position; all valves shall be "tight shut off"

4.12. Hand operated valves shall have the following

a) Local hand controls
b) The hand controls shall close the valve with clockwise rotation.
c) The hand controls shall be dimensioned to guarantee an easy manoeuvre under most severe conditions.
d) The hand controls shall be provided with locking systems suitable to avoid the disc assuming a non-desirable position during the operation.

4.13. Hand wheel shall be made of malleable iron with arms and rims of adequate strength. The hand wheel of diameters 300mm or less shall be provided with handles for ease of operation. The pulling force required on the hand wheel rim shall not exceed 25 Kgf when operating the valve under full flow and operating pressure.

4.14. Valves-350Nb and above shall have pressure equalizing bypass valves, wherever system parameters warrant the same.

4.15. Valves-350Nb and above shall also be provided with gear operator arrangement suitable for manual operation. Manual operation of valve shall be through worm and gear arrangement having totally enclosed gearing with hand wheel diameter and gear ratio designed to meet the required operating torque It shall be designed to hold the valve disc in intermediate position between full open and full closed position without creeping or fluttering. Adjustable stops shall be provided to prevent over travel in either direction.

4.16. Fabricated steel (IS:2062 Gr B) butterfly valves instead of cast Iron body valves are also acceptable for size above 300 mm NB diameter for water application other than Sea-water / corrosive water. In such a case, however, the bidder will have to necessarily submit thickness calculations, in order to establish the integrity of the fabricated valve body under the system operating pressure condition. Bidder has to clearly indicate the material offered in the bid. No change shall be entertained during detailed engg.

4.17. All valves shall be provided with embossed name plate giving details such as tag number, type, size etc.

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

5.0 MATERIAL OF CONSTRUCTION (BUTTERFLY VALVES)

Material of pneumatically operated butterfly valves for slurry application shall be as per enclosed **Annexure – I** its equivalent.

Vendor shall provide the counter flange along with necessary nuts, bolts, gaskets etc.

Note: All the parts of the valve exposed to slurry must be rubber lined.

6.0 PROOF OF DESIGN TEST (TYPE TEST) FOR BUTTERFLY VALVES

Proof of Design (P.O.D.) test certificates shall be furnished by the bidder for all applicable size-ranges and classes of Butterfly valves supplied by him, in the absence

of which actual P.O.D. test shall be conducted by the bidder in the presence of Employer's representative.

All valves that are designed and manufactured as per AWWA-C-504 shall be governed by the relevant clauses of P.O.D test in AWWA-C-504. For Butterfly valves designed and manufactured to EN-593 or equivalent, the P.O.D. test methods and procedures shall generally follow the guidelines of AWWA-C-504 in all respect except that Body & seat hydro test and disc-strength test shall be conducted at the pressures specified in EN-593 or the applicable code. Actuators shall also meet requirements of P.O.D. testof AWWA-C-504.

7.0 PAINTING OF VALVES:

The detailed painting procedure is enclosed in Annexure-IV.

8.0 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-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. List of applicable standards for shop test.
f. Reference list for the offered model.
g. Typical Quality plan for supply of the above equipments.
h. Valves Catalogues.
i. Recommended spares list for 3 year O&M along with item wise price.
j. Any deviation shall be specifically mentioned in the enclosed deviation format **Annexure-III**.

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.

9.0 DOCUMENTS / SERVICE AFTER ORDER

9.1. 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

9.2. 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

10.0 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.

11.0 INSPECTION

Shall be done by BHEL inspector at Vendor's works.

ANNEXURE I

12.0 DETAILED LIST OF VALVES WITH OPERATING PARAMETERS

Indent no	RFW00089
Material Code	RFW000890001
Process Liquid	FILTRATE WATER/ WASTE WATER
Service	ISOLATION
Type of valve	BUTTERFLY VALVE
Mode of Operation	MANUAL
Size	3 INCH

Sl No	Valve / Instrument Tag No	Operating Conditions		Design Conditions		Material of Construction				End Connection (WFR-WAFER)	QTY
		T (°C)	P (Kg/cm^2)	T (°C)	P (Kg/cm^2)	Body Material	Disc	Stem	Lining		
1	00HTM01AA012	50	4	80	7.5	A216 WCB	A217 CA15	A276 -410	NATURAL RUBBER	WFR	1
2	00HTT01AA001	50	ATM	80	5	A216 WCB	A217 CA15	A276 -410	NATURAL RUBBER	WFR	1
3	00HTT01AA002	50	ATM	80	5	A216 WCB	A217 CA15	A276 -410	NATURAL RUBBER	WFR	1

Indent no	RFW00089
Material Code	RFW000890002
Process Liquid	WASTE WATER
Service	ISOLATION
Type of valve	BUTTERFLY VALVE
Mode of Operation	MANUAL
Size	4 INCH

Sl No.	Valve / Instrument Tag No	Operating Conditions		Design Conditions		Material of Construction				End Connection (WFR-WAFER)	QTY
		T (°C)	P (Kg/cm^2)	T (°C)	P (Kg/cm^2)	Body Material	Disc	Stem	Lining		
1	00HTM03AA001	50	Atm	80	5	A216 WCB	A217 CA15	A276 -410	NATURAL RUBBER	WFR	1

Indent no	**RFW00089**
Material Code	**RFW000890003**
Process Liquid	**FILTRATE WATER / LIME/GYPSUM SLURRY**
Service	**ISOLATION**
Type of valve	**BUTTERFLY VALVE**
Mode of Operation	**MANUAL**
Size	**6 INCH**

Sl No.	Valve / Instrument Tag No	Operating Conditions		Design Conditions		Material of Construction				End Connection (WFR-WAFER)	QTY
		T (°C)	P (Kg/ cm^2)	T (°C)	P (Kg/ cm^2)	Body Material	Disc	Stem	Lining		
1	00HTM01AA018	50	ATM	80	7.5	A216 WCB	A217 CA15	A276-410	NATURAL RUBBER	WFR	1
2	00HTM01AA015	50	4	80	7.5	A216 WCB	A217 CA15	A276-410	NATURAL RUBBER	WFR	1
3	00HTM04AA001	50	ATM	80	5	A216 WCB	A217 CA15	A276-410	NATURAL RUBBER	WFR	1
4	00HTK01AA001A	50	Atm	80	5	A216 WCB	A217 CA15	A276-410	NATURAL RUBBER	WFR	1
5	00HTK01AA001B	50	Atm	80	5	A216 WCB	A217 CA15	A276-410	NATURAL RUBBER	WFR	1
6	00HTK01AA002A	50	Atm	80	5	A216 WCB	A217 CA15	A276-410	NATURAL RUBBER	WFR	1
7	00HTK01AA002B	50	Atm	80	5	A216 WCB	A217 CA15	A276-410	NATURAL RUBBER	WFR	1
8	00HTK02AA001A	50	Atm	80	5	A216 WCB	A217 CA15	A276-410	NATURAL RUBBER	WFR	1
9	00HTK02AA001B	50	Atm	80	5	A216 WCB	A217 CA15	A276-410	NATURAL RUBBER	WFR	1
10	00HTK02AA002A	50	Atm	80	5	A216 WCB	A217 CA15	A276-410	NATURAL RUBBER	WFR	1
11	00HTK02AA002B	50	Atm	80	5	A216 WCB	A217 CA15	A276-410	NATURAL RUBBER	WFR	1

Indent no	**RFW00089**
Material Code	**RFW000890004**
Process Liquid	**FILTRATE WATER**
Service	**ISOLATION**
Type of valve	**BUTTERFLY VALVE**
Mode of Operation	**MANUAL**
Size	**8 INCH**

Sl No.	Valve / Instrument Tag No	Operating Conditions		Design Conditions		Material of Construction				End Connection (WFR-WAFER)	QTY
		T (°C)	P (Kg/ cm^2)	T (°C)	P (Kg/ cm^2)	Body Material	Disc	Stem	Lining		
1	00HTM01AA001	50	ATM	80	7.5	A216 WCB	A217 CA15	A276-410	NATURAL RUBBER	WFR	1
2	00HTM01AA008	50	4	80	7.5	A216 WCB	A217 CA15	A276-410	NATURAL RUBBER	WFR	1

Mandatory Spares:

Indent no	**RFW20122**
Material Code	**RFW201220001**
Process Liquid	**FILTRATE WATER/ WASTE WATER**
Service	**ISOLATION**
Type of valve	**BUTTERFLY VALVE**
Mode of Operation	**MANUAL**
Size	**3 INCH**

Sl No	Valve / Instrument Tag No	Operating Conditions		Design Conditions		Material of Construction				End Connection (WFR-WAFER)	QTY
		T (°C)	P (Kg/ cm^2)	T (°C)	P (Kg/cm^2)	Body Material	Disc	Stem	Lining		
1	M1- BFV-SL-MN-3	50	4	80	7.5	A216 WCB	A217 CA15	A276 -410	NATURAL RUBBER	WFR	1
2	M2- BFV-SL-MN-3	50	ATM	80	5	A216 WCB	A217 CA15	A276 -410	NATURAL RUBBER	WFR	1

Indent no	**RFW20122**
Material Code	**RFW201220002**
Process Liquid	**WASTE WATER**
Service	**ISOLATION**
Type of valve	**BUTTERFLY VALVE**
Mode of Operation	**MANUAL**
Size	**4 INCH**

Sl No.	Valve / Instrument Tag No	Operating Conditions		Design Conditions		Material of Construction				End Connection (WFR-WAFER)	QTY
		T (°C)	P (Kg/ cm^2)	T (°C)	P (Kg/ cm^2)	Body Material	Disc	Stem	Lining		
1	M1- BFV-SL-MN-4	50	Atm	80	5	A216 WCB	A217 CA15	A276 -410	NATURAL RUBBER	WFR	1
2	M2- BFV-SL-MN-4	50	Atm	80	5	A216 WCB	A217 CA15	A276 -410	NATURAL RUBBER	WFR	1

Indent no	**RFW20122**
Material Code	**RFW201220003**
Process Liquid	**FILTRATE WATER / LIME/GYPSUM SLURRY**
Service	**ISOLATION**
Type of valve	**BUTTERFLY VALVE**
Mode of Operation	**MANUAL**
Size	**6 INCH**

Sl No.	Valve / Instrument Tag No	Operating Conditions		Design Conditions		Material of Construction				End Connection (WFR-WAFER)	QTY
		T (°C)	P (Kg/ cm^2)	T (°C)	P (Kg/ cm^2)	Body Material	Disc	Stem	Lining		
1	M1- BFV-SL-MN-6	50	ATM	80	7.5	A216 WCB	A217 CA15	A276 -410	NATURAL RUBBER	WFR	1
2	M2- BFV-SL-MN-6	50	4	80	7.5	A216 WCB	A217 CA15	A276 -410	NATURAL RUBBER	WFR	1

Indent no	**RFW20122**
Material Code	**RFW201220004**
Process Liquid	**FILTRATE WATER**
Service	**ISOLATION**
Type of valve	**BUTTERFLY VALVE**
Mode of Operation	**MANUAL**
Size	**8 INCH**

Sl No	Valve / Instrument Tag No	Operating Conditions		Design Conditions		Material of Construction				End Connection (WFR-WAFER)	QTY
		T (°C)	P (Kg/ cm^2)	T (°C)	P (Kg/ cm^2)	Body Material	Disc	Stem	Lining		
1	M1- BFV-SL-MN-8	50	ATM	80	7.5	A216 WCB	A217 CA15	A276-410	NATURAL RUBBER	WFR	1
2	M2- BFV-SL-MN-8	50	4	80	7.5	A216 WCB	A217 CA15	A276-410	NATURAL RUBBER	WFR	1

Indent no	**RFW20122**
Material Code	**RFW201220005**
Process Liquid	**FILTRATE WATER/ WASTE WATER**
Service	**ISOLATION**
Type of valve	**BUTTERFLY VALVE**
Mode of Operation	**MANUAL**
Size	**2 INCH**

Sl No.	Valve / Instrument Tag No	Operating Conditions		Design Conditions		Material of Construction				End Connection (WFR-WAFER)	QTY
		T (°C)	P (Kg/ cm^2)	T (°C)	P (Kg/ cm^2)	Body Material	Disc	Stem	Lining		
1	M1-BFV-SL-MN-2	50	5.7	80	7.5	A216WCB	A217 CA15	A479-410	Natural Rubber	WFR	1
2	M2- BFV-SL-MN-2	50	5.7	80	7.5	A216WCB	A217 CA15	A479-410	Natural Rubber	WFR	1

13.0 SLURRY PROCESS PARAMETERS

Sl.No	Item	Limestone Slurry Absorber
1.	Maximum solid particle size	150mesh (104micron)
2.	Distribution of above size particle,d20	20%(max)
3.	Normal solid particle size,d50	325 mesh(43micron)
4.	Solid to be handled	Absorbers and other impurities
5.	Sp Gravity of Slurry	1.224
6.	PPM of heavier particle (Silica, Aluminium Oxide, Ferric Oxide and Columbium)	23290
7.	Hardness of particle	5-7 (Mho scale)
8.	Concentration of slurry	30% by weight
9.	Sp Gravity of Lime Stone	2.80
10.	Sp gravity of heaviest particles (Columbium and Iron oxide)	5.9
11.	Concentration of Chlorine	20000ppm
12.	Viscosity of Slurry	20-30cp
13.	Maximum operating temperature of Slurry	60 deg C

ANNEXURE II

14.0 DATA SHEET FOR VALVES (TO BE FILLED SEPARATELY FOR EACH TYPE OF VALVE)

Sl No	DESCRIPTION	TO BE FILLED BY VENDOR
I	**Valve Size**	
a.	Make	
b.	Model/ Type	
c.	Fluid details - Medium handled	
	Temperature range (°C)	
d.	Rated flow (m^3/hr.)	
e.	Design Cv of the valve	
f.	Valve rating	
g.	Valve operation- (Lever/ Gear box)	
h.	Pressure Drop for rated flow (bar(g))	
i.	Design pressure (bar(g))	
j.	Hydraulic test pressure	
	➢ Body (bar(g))	
	➢ Seat (bar(g))	
k.	Max. Shut off pressure (bar(g))	
II	**CONSTRUCTION DETAILS**	
a.	Material of construction	
	➢ Body	
	➢ Stem	
	➢ Disc	
	➢ Seat	
	➢ Bushing	
	➢ Handle	
b.	Fasteners	
c.	End Connection / Rating / Standard	
d.	Recommended minimum pipe ID mm	
e.	Details of Gearbox if applicable	
III	**GENERAL**	
a.	Weight per valve	
b.	Applicable standards	
c.	Valve GA Drawing / Cross Sectional Drg.	
d.	Enquiry / PO reference	

ANNEXURE III

15.0 FORMS 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

16.0 PAINTING PROCEDURE:

Primer Coat		Intermediate Coat		Finish coat			Total DFT µm (min)
Paint	No of Coats /DFT	Paint	No of Coats	Paint	No of Coats	Shade	
HB Chlorinated Rubber based Zinc Phosphate Primer DFT= 50 µm per coat (Solid by Volume min 60%)	2	--	--	Chlorinated Rubber Based Finish paint DFT= 30 µm per coat (Solid by Volume min 60%)	2	Gray shade to R9002	160

BONGAIGAON– 3X250 MW
FLUE GAS DESULFURIZATION SYSTEM

TECHNICAL SPECIFICATION FOR PNEUMATICALLY OPERATED PINCH VALVES HANDLING SLURRY

CUSTOMER : NATIONAL THERMAL POWER CORPORATION LIMITED

NTPC: BONG: FGD: - SLVALVES-PINCHVALVES-SPEC-031: REV-01

Flue Gas Desulphurization Group
Air Quality Control Systems
BAP :: BHEL :: Ranipet

TECHNICAL SPECIFICATION FOR PNEUMATICALLY OPERATED PINCH VALVES FOR SLURRY APPLICATION

Prepared	Checked	Approved
SRIDHAR Asst. Engineer-FGD	MANOJ KUMAR THAKUR Engineer - FGD	SASHI KUMAR Sr. Engineer-FGD
R01 dated 15 04 2013		

CONTENTS

1.0	**PROJECT INFORMATION**	
	▪ Owner	NTPC
	▪ Buyer	BHEL, Ranipet
	▪ Process / application	Wet Lime Stone FGD system
1.1	**SITE CONDITIONS**	
	▪ Ambient temperature (Guarantee)	27 Deg C
	▪ Ambient temperature (Design)	50 Deg C
	▪ Height above sea level	47 m
	▪ Relative Humidity	60 %
1.2	**LOCATION AND APPROACH**	
	▪ Project location	
	▪ State	Assam
	▪ District	Kokrajhar
	▪ Place	Kumkuri near Salakati, Bongaigaon
	▪ Height above sea level	47 m

2.0 INTENT OF SPECIFICATION

This specification together with the attendant Technical Data Sheet and other specifications/attachments to inquiry / order defines the minimum requirements for pinch valves along with their accessories /auxiliaries for use in the process of Flue gas Desulphurization (FGD) system using slurry.

Bidder shall make all possible efforts to comply strictly with the requirements of this specification and other specifications/attachments to inquiry/order.

In case, deviations are considered essential by the Bidder (after exhausting all possible efforts), these shall be separately listed in the Bidder's proposal under separate section, titled as "List of Deviations/Exceptions to the Enquiry Document (Annexure-V)". Deviation shall be listed separately for each document with cross reference to Page No./Section/Clause No./Para etc. of the respective document supported with proper reasons for the deviation for purchaser's consideration. Any deviation, not listed under the above section, even if reflected in any other portion of the proposal, shall not be considered applicable. No deviation or exception shall be permitted without the written approval of the purchaser.

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. The valves shall conform to the latest editions of applicable codes and standards as mentioned elsewhere. Nothing in this specification shall be construed to relieve the Bidder of his responsibility. 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.

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.

3.0 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:

ANSI B 16.34 Standard for valves.

ANSI-B-16.10 Valves face to face and other relevant dimension.

ANSI-B-16.5 Specification for flange dimension

API-598 Valves inspection test.

4.0 GENERAL SPECIFICATION FOR DESIGN/CONSTRUCTION/MATERIAL PARTICULARS OF PINCH VALVE

a) All valves shall be suitable for the service conditions i.e flow, temperature and pressure, at which they are required to operate.

b) The valves as well as all accessories shall be designed for easy disassembly and maintenance.

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

d) 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.

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

f) 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

g) All pinch valves shall be pneumatically operated and will be used for regulation of slurry flow. These 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.

h) All valves except those with rising stems shall be provided with continuous mechanical position indicators; rising stem valves shall have only visual indication through plastic/metallic stem cover for sizes above 50 mm nominal bore. Valves of 65 mm Nb & above with rising stem shall be provided with position indicator/ visual indication either through plastic stem covers or through metallic stem covers. All diaphragm valves of size 50 mm and below in vacuum service shall have extra deep gland packing without requiring water gland sealing. All valves of size 65 mm Nb and above in vacuum services shall have adequately deep gland packing and shall be equipped with lantern rings to admit pressurized water for gland sealing.

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

j) All pinch 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 pinch 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.

5.0 MATERIAL OF CONSTRUCTION

5.1 PINCH VALVE

Material of Pinch valves for slurry application shall be as per enclosed **Annexure I & II** 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

Valve Type	Pinch
Valve Size & Quantity	Refer Annexure
Body Material	Refer Annexure
Bonnet Type & Material	Refer Annexure
End Connection	Refer Annexure
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	TEFLON/GRAPHITE
Max Sound Level	<80 dBA
Stem Material	Refer Annexure

5.2 SPECIFICATION FOR PNEUMATIC ACTUATOR

a.	Quantity	01 No. for each valve
b.	Type	Rotary actuator, Pneumatic (spring return)
c.	Action	Air to Open
d.	Failure position (air failure)	Close
e.	Close/open at air Pressure	4 to 6 Kg/sq.cm
f.	Air Connection	¼" NPT(F)
g.	Local Position Indicator	To be provided.
h.	Hand wheel for manual opn	Required (for valves greater than 8 inch)
i.	Actuator travel time	Vendor to specify
j.	Actuator Protection Class	IP-65 (Min)
k.	Actuator Thrust	Vendor to specify
l.	Spring range (kg/cm2)	Vendor to specify
m.	Speed adjustment for actuator operation	To be provided to facilitate speed adjustments both during opening &closing by means of flow control valve
n.	Solenoid valve type	3/2 way, 24V DC power supply, ex. proof, 1/4" NPT pneumatic connection, 1/2" NPT Electrical connection. Solenoid Valve Energised for valve to open & Solenoid valve De-energised for valve to close.
o.	Air filter regulator	Size of filter shall be 5 Micron, Filter material shall be sintered bronze/equivalent, Body shall be aluminium, 1/4" NPT Pneumatic connection shall be envisaged

5.3 LIMIT SWITCHES:

a) Quantity /valve : One for Open & one for Close position
b) No. of Contacts : Two normally open & two normally closed potential free contacts in each limit switch corresponding to open & close positions of the valve.
c) Contact Rating : 24 V DC
d) Protection : Weather proof IP 55.
e) Limit Switch Box : Limit Switch terminals shall be brought out to a Terminal Box

6.0 ELECTRONIC POSITIONER:

MODEL	VTS
TYPE	ELECTRO PNEUMATIC, MICROPROCESSOR BASED, LOOP POWERED.
INPUT (mA) OUTPUT (KG/CM2)	4-20mA VTS
VALVE POSITION SENSING OUTPUT	4-20 m A O/P Signal for Control Syster
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

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 PAINTING

The detailed painting procedure is enclosed in Annexure-VI.

9.0 INSPECTION

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

10.0 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-III** 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-V**.

In case of any deviation, the Bidder shall indicate the deviation, clause by clause in the deviation format attached in **Annexure-V**. If there is no deviation "**NIL**" statement shall be furnished. In the absence of **Annexure-V**, 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.

11.0 DOCUMENTS / SERVICE AFTER ORDER

11.1. 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

11.2. 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

12.0 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.

ANNEXURE-I

13.0 DETAILED LIST OF VALVES WITH OPERATING PARAMETERS

Indent no	**RFW00090**
Material Code	**RFW000900001**
Process Liquid	**Lime slurry**
Service	**Regulating**
Type of valve	**Pinch Valve**
Mode of Operation	**Pneumatic**
Size	**1 1/2 Inch**

Valve / Instrument Tag No	Operating Conditions		Design Conditions		Material of Construction(As indicated below or its equivalent)				End Connection (FLD-FLANGED)	QTY
	T (°C)	P (Kg/ cm^2)	T (°C)	P (Kg/cm^2)	Body Material	Disc	Stem	Lining		
00HTM37AA201	50	1	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD	1
00HTM38AA201	50	1	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD	1

Indent no	**RFW00090**
Material Code	**RFW000900002**
Process Liquid	**Lime slurry**
Service	**Regulating**
Type of valve	**Pinch Valve**
Mode of Operation	**Pneumatic**
Size	**3 Inch**

Valve / Instrument Tag No	**Operating Conditions**		**Design Conditions**		**Material of Construction(As indicated below or its equivalent)**				**End Connection (FLD-FLANGED)**	**QTY**
	T (°C)	**P (Kg/ cm^2)**	**T (°C)**	**P (Kg/ cm^2)**	**Body Material**	**Disc**	**Stem**	**Lining**		
00HTM37AA202	50	1	80	5	A216 WCB	NATURAL RUBBER	A276 -410	NATURAL RUBBER	FLD	1
00HTM38AA202	50	1	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD	1

Indent no	**RFW00090**
Material Code	**RFW000900003**
Process Liquid	**Lime slurry**
Service	**Regulating**
Type of valve	**Pinch Valve**
Mode of Operation	**Pneumatic**
Size	**4 Inch**

Valve / Instrument Tag No	**Operating Conditions**		**Design Conditions**		**Material of Construction(As indicated below or its equivalent)**				**End Connection (FLD-FLANGED)**	**QTY**
	T (°C)	**P (Kg/cm^2)**	**T (°C)**	**P (Kg/cm^2)**	**Body Material**	**Disc**	**Stem**	**Lining**		
00HTK01AA203	50	3.65	80	7.5	A216 WCB	NATURAL RUBBER	A276 -410	NATURAL RUBBER	FLD	1
00HTK01AA206	50	3.65	80	7.5	A216 WCB	NATURAL RUBBER	A276 -410	NATURAL RUBBER	FLD	1
00HTK01AA209	50	3.65	80	7.5	A216 WCB	NATURAL RUBBER	A276 -410	NATURAL RUBBER	FLD	1
00HTK02AA203	50	3.65	80	7.5	A216 WCB	NATURAL RUBBER	A276 -410	NATURAL RUBBER	FLD	1
00HTK02AA206	50	3.65	80	7.5	A216 WCB	NATURAL RUBBER	A276 -410	NATURAL RUBBER	FLD	1
00HTK02AA209	50	3.65	80	7.5	A216 WCB	NATURAL RUBBER	A276 -410	NATURAL RUBBER	FLD	1

Indent no			**RFW00090**							
Material Code			**RFW000900004**							
Process Liquid			**Lime slurry**							
Service			**Regulating**							
Type of valve			**Pinch Valve**							
Mode of Operation			**Pneumatic**							
Size			**8 Inch**							
Valve / Instrument Tag No	**Operating Conditions**		**Design Conditions**		**Material of Construction(As indicated below or its equivalent)**				**End Connection (FLD-FLANGED)**	**QTY**
	T (°C)	**P (Kg/cm^2)**	**T (°C)**	**P (Kg/cm²)**	**Body Material**	**Disc**	**Stem**	**Lining**		
00HTM01AA207	50	4	80	7.5	A216 WCB	NATURAL RUBBER	A276 -410	NATURAL RUBBER	FLD	1

ANNEXURE-II

14.0 DETAILED LIST OF MANDATORY SPARE VALVES WITH OPERATING PARAMETERS

Indent no	**RFW20118**
Material Code	**RFW201180001**
Process Liquid	**Lime slurry**
Service	**Regulating**
Type of valve	**Pinch Valve**
Mode of Operation	**Pneumatic**
Size	**1 1/2 Inch**

Valve / Instrument Tag No	Operating Conditions		Design Conditions		Material of Construction(As indicated below or its equivalent)				End Connection (FLD-FLANGED)	QTY
	T (°C)	P (Kg/cm^2)	T (°C)	P (Kg/cm^2)	Body Material	Disc	Stem	Lining		
M1-PV-SL-PN-1.5	50	1	80	5	A216 WCB	NATURAL RUBBER	A276 -410	NATURAL RUBBER	FLD	1
M2-PV-SL-PN-1.5	50	1	80	5	A216 WCB	NATURAL RUBBER	A276 -410	NATURAL RUBBER	FLD	1

Indent no	**RFW20118**
Material Code	**RFW201180002**
Process Liquid	**Lime slurry**
Service	**Regulating**
Type of valve	**Pinch Valve**
Mode of Operation	**Pneumatic**
Size	**3 Inch**

Valve / Instrument Tag No	Operating Conditions		Design Conditions		Material of Construction(As indicated below or its equivalent)				End Connection (FLD-FLANGED)	QTY
	T (°C)	P (Kg/ cm^2)	T (°C)	P (Kg/ cm^2)	Body Material	Disc	Stem	Lining		
M1-PV-SL-PN-3	50	1	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD	1
M2-PV-SL-PN-3	50	1	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD	1

Indent no	**RFW20118**
Material Code	**RFW201180003**
Process Liquid	**Lime slurry**
Service	**Regulating**
Type of valve	**Pinch Valve**
Mode of Operation	**Pneumatic**
Size	**4 Inch**

Valve / Instrument Tag No	Operating Conditions		Design Conditions		Material of Construction(As indicated below or its equivalent)				End Connection (FLD-FLANGED)	QTY
	T (°C)	P (Kg/ cm^2)	T (°C)	P (Kg/ cm^2)	Body Material	Disc	Stem	Lining		
M1-PV-SL-PN-4	50	3.65	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD	1
M2-PV-SL-PN-4	50	3.65	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD	1

Indent no	**RFW20118**
Material Code	**RFW201180005**
Process Liquid	**Lime slurry**
Service	**Regulating**
Type of valve	**Pinch Valve**
Mode of Operation	**Pneumatic**
Size	**6 Inch**

Valve / Instrument Tag No	Operating Conditions		Design Conditions		Material of Construction(As indicated below or its equivalent)				End Connection (FLD-FLANGED)	QTY
	T (°C)	P (Kg/ cm^2)	T (°C)	P (Kg/ cm^2)	Body Material	Disc	Stem	Lining		
M1-PV-SL-PN-6	50	5.7	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	Natural Rubber	FLD	1
M2-PV-SL-PN-6	50	5.7	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	Natural Rubber	FLD	1

Indent no	**RFW20118**
Material Code	**RFW201180005**
Process Liquid	**Lime slurry**
Service	**Regulating**
Type of valve	**Pinch Valve**
Mode of Operation	**Pneumatic**
Size	**8 Inch**

Valve / Instrument Tag No	Operating Conditions		Design Conditions		Material of Construction(As indicated below or its equivalent)				End Connection (FLD-FLANGED)	QTY
	T (°C)	P (Kg/ cm^2)	T (°C)	P (Kg/ cm^2)	Body Material	Disc	Stem	Lining		
M1-PV-SL-PN-8	50	4	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD	1
M2-PV-SL-PN-8	50	4	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD	1

ANNEXURE-III

15.0 DATA SHEET FOR VALVES (SEPARATELY FOR EACH TYPE OF VALVE)

I. TECHNICAL PARAMETERS

Sl No	DESCRIPTION	TO BE FILLED BY VENDOR
I	**Valve Size**	
a.	Make	
b.	Model/ Type	
c.	Fluid details - Medium handled	
	Temperature range (°C)	
d.	Rated flow (m^3/hr.)	
e.	Design Cv of the valve	
f.	Valve rating	
g.	Valve operation- (Lever/ Gear box)	
h.	Pressure Drop for rated flow (bar(g))	
i.	Design pressure (bar(g))	
j.	Hydraulic test pressure	
	➢ Body (bar(g))	
	➢ Seat (bar(g))	
k.	Max. Shut off pressure (bar(g))	
II	**CONSTRUCTION DETAILS**	
a.	Material of construction Body	
	➢ Stem	
	➢ Disc	
	➢ Seat	
	➢ Bushing	
	➢ Handle	
b.	Fasteners	
c.	End Connection / Rating / Standard	
d.	Recommended minimum pipe ID mm	
e.	Details of Gearbox if applicable	
III	**GENERAL**	
a.	Weight per valve	
b.	Applicable standards	
c.	Valve GA Drawing / Cross Sectional Drg.	
d.	Enquiry / PO reference	

ANNEXURE-IV

16.0 DATA SHEET FOR ACTUATOR (TO BE FILLED SEPARATELY FOR EACH TYPE OF VALVE)

1)	Actuator	
	➢ Make	
	➢ Model	
	➢ Type	
	➢ Torque Rating	
	➢ Air Consumption	
	➢ Operating Time For Opening	
	➢ Operating Time For Closing	
	➢ Accessories Offered	
	➢ Type Of Stay Put	
	➢ Air Connection	
2)	Limit Switch	
	➢ Make	
	➢ Type	
	➢ Quantity	
	➢ Contact Rating	
	➢ Reset Type	
3)	Electronic Positioner	
	➢ Make	
	➢ Type	
	➢ Quantity	
	➢ Connection	

Vendor's Signature & Seal

ANNEXURE-V

17.0 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-VI

18.0 PAINTING PROCEDURE:

Primer Coat		Intermediate Coat		Finish coat			Total DFT µm (min)
Paint	No of Coats /DFT	Paint	No of Coats	Paint	No of Coats	Shade	
HB Chlorinated Rubber based Zinc Phosphate Primer DFT= 50 µm per coat (Solid by Volume min 60%)	2	--	--	Chlorinated Rubber Based Finish paint DFT= 30 µm per coat (Solid by Volume min 60%)	2	Gray shade to R9002	160

ANNEXURE-VII

18.0 SLURRY PARAMETERS:

Sl.No	Parameter	Lime slurry characteristics
1.	Maximum solid particle size	150mesh (104 micron)
2.	Distribution of above size particle,d20	20%(max)
3.	Normal solid particle size,d50	325 mesh(43micron)
4.	Solid to be handled	Absorbers and other impurities
5.	Sp Gravity of Slurry	1.224
6.	PPM of heavier particle (Silica, Aluminum Oxide, Ferric Oxide and Columbium)	23290
7.	Hardness of particle	5-7 (Mho scale)
8.	Concentration of slurry	30% by weight
9.	Sp Gravity of Lime Stone	2.80
10.	Sp gravity of heaviest particles (Columbium and Iron oxide)	5.9
11.	Concentration of Chlorine	20000 ppm
12.	Viscosity of Slurry	20-30cp
13.	Maximum operating temperature of Slurry	60 deg C

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BONGAIGAON– 3X250 MW
FLUE GAS DESULFURIZATION SYSTEM

TECHNICAL SPECIFICATION FOR

MANUALLY OPERATED DIAPHRAGM VALVES

HANDLING SLURRY

CUSTOMER : NATIONAL THERMAL POWER CORPORATION LIMITED

NTPC: BONG: FGD: WVALVES-DIAPHRAGM VALVE -SPEC-032A: REV-01

Flue Gas Desulphurization Group
Air Quality Control Systems
BAP:: BHEL :: Ranipet

TECHNICAL SPECIFICATION FOR MANUALLY OPERATED DIAPHRAGM VALVES HANDLING SLURRY

Prepared	Checked	Approved
SRIDHAR Asst. Engineer-FGD	ASHWIN R Engineer- FGD	SASHI KUMAR Senior Engineer-FGD
R01 dated 30 03 2013		

CONTENTS

1.0	**PROJECT INFORMATION**	
	▪ Owner	NTPC
	▪ Buyer	BHEL, Ranipet
	▪ Process / application	Wet Lime Stone FGD system
1.1	**SITE CONDITIONS**	
	▪ Ambient temperature (Guarantee)	27 Deg C
	▪ Ambient temperature (Design)	50 Deg C
	▪ Height above sea level	47 m
	▪ Relative Humidity	60 %
1.2	**LOCATION AND APPROACH**	
	▪ Project location	
	▪ State	Assam
	▪ District	Kokrajhar
	▪ Place	Kumkuri near Salakati, Bongaigaon
	▪ Height above sea level	47 m

2.0 INTENT OF SPECIFICATION

This specification together with the attendant Technical Data Sheet and other specifications/attachments to inquiry / order defines the minimum requirements for diaphragm valves along with their accessories /auxiliaries for use in the process of Flue gas Desulphurization (FGD) system using slurry.

Bidder shall make all possible efforts to comply strictly with the requirements of this specification and other specifications/attachments to inquiry/order.

In case, deviations are considered essential by the Bidder (after exhausting all possible efforts), these shall be separately listed in the Bidder's proposal under separate section, titled as "List of Deviations/Exceptions to the Enquiry Document (Annexure-III)". Deviation shall be listed separately for each document with cross reference to Page No./Section/Clause No./Para etc. of the respective document supported with proper reasons for the deviation for purchaser's consideration. Any deviation, not listed under the above section, even if reflected in any other portion of the proposal, shall not be considered applicable. No deviation or exception shall be permitted without the written approval of the purchaser.

The design, material, construction, manufacture, inspection, testing and performanceof valves shall comply with all currently applicable statutes, regulations and safetycodes in the locality where the valves will be installed. The valves shall conform to thelatest editions of applicable codes and standards as mentioned elsewhere. Nothing in this specification shall be construed to relieve the Bidder of hisresponsibility. Compliance to this specification shall not relieve the Bidder of theresponsibility of furnishing equipment and accessories/auxiliaries of proper design, materials and workmanship to meet the specified start up and operating conditions.

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.

3.0 STANDARDS AND CODES

Valves ingeneral shall conform to the requirements of the following standards:

a. ANSI B 16.34 Standard for valves.
b. ANSI-B-16.10 Valves face to face and other relevant dimension.
c. API-598 Valves inspection test
d. ANSI-B-16.5 specification for flange dimension

4.0 GENERAL SPECIFICATION FOR DESIGN/CONSTRUCTION/MATERIAL PARTICULARS OF DIAPHRAGM VALVE

a. All valves shall be suitable for the service conditions i.e. flow, temperature and pressure, at which they are required to operate.
b. The valves as well as all accessories shall be designed for easy disassembly and maintenance.
c. Valves to be installed outside shall be required to have the stem properly protected against atmospheric corrosion.
d. 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.
e. All valves shall be closed by rotating the hand wheel in the clockwise direction when looking at the face of the hand wheel. In case where the hand wheel is not directly attached to the valve spindle suitable gearing shall be introduced.
f. All valves shall have indicators or direction clearly marked on the hand-wheel 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. Parameters of slurry are provided in Annexure V.
h. Diaphragm valves shall be used for isolation of flow. These valves shall be provided with the following accessories in addition to other standard items :
    a. Hand wheel
    b. Draining arrangement wherever required.
i. All valves except those with rising stems shall be provided with continuous mechanical position indicators; rising stem valves shall have only visual indication through plastic/metallic stem cover for sizes above 50 mm nominal bore. Valves of 65 mm Nb & above with rising stem shall be provided with position indicator/ visual indication either through plastic stem covers or through metallic stem covers. All diaphragm valves of size 50 mm and below in vacuum service shall have extra deep gland packing without requiring water gland sealing. All diaphragm valves of size 65 mm Nb and above in vacuum services shall have adequately deep gland packing and shall be equipped with lantern rings to admit pressurized water for gland sealing.
j. All diaphragm valves shall be provided with bonnet-back seating arrangement to enable on line changing of gland packing.
k. Hand wheels for all the valves shall close the valve in clockwise direction whenviewing from the top. All hand wheels shall be clearly marked indicating the direction of opening/closing. Manual gear operators shall be provided to open/close the valve against the maximum differential pressure across the valve such that the effort required to operate the valve does not exceed 25 kgf.
l. All diaphragm valves shall be designed for reconditioning seating surfaces and replacement of stem and disc without removing the valve body from the line

m. All valves shall be provided with embossed name plate giving details such astag number, type, size etc.
n. For diaphragm valves wherever thickness of body/bonnet is not mentioned in the valves standards, thickness mentioned in IS- 1538 for fitting shall be applicable.
o. All valves shall be provided with proper name plates indicating complete information about the valves.

5.0 MATERIAL OF CONSTRUCTION (DIAPHRAGM VALVE)

Material of Diaphragm 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 the parts of the valve exposed to slurry must be rubber lined.

6.0 TESTING OF VALVES:

- Applicable Standard BS-5156s
- Test pressure: As per BS-5166
- Duration of test: 30minutes (minimum)
- Rated flow and Pressure Drop Rated flow at rated pressure is to be indicated for
- Manual and open/close valves and flow characteristics for modulating valves.
- Differential pressure at rated flow is to be indicated across the valve.

7.0 RATING PLATE, NAME PLATES AND LABELS:

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

8.0 PAINTING OF VALVES:

The detailed painting procedure is enclosed in **Annexure-IV**.

9.0 INSPECTION

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

10.0 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-2** 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**.

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.

11 DOCUMENTS / SERVICE AFTER ORDER

11.1. 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

11.2. 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

12.0 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.

ANNEXURE I

13.0 DETAILED LIST OF VALVES WITH OPERATING PARAMETERS

Indent no	**RFW0091**
Material Code	**RFW000910001**
Process Liquid	**LIME/GYPSUM SLURRY**
Service	**ISOLATION**
Type of valve	**DIAPHRAGM VALVE**
Mode of Operation	**MANUAL**
Size	**1 INCH**

Sl No	Valve / Instrument Tag No	Operating Conditions		Design Conditions		Material of Construction				End Connection	QTY
		T (°C)	P (Kg/cm^2)	T (°C)	P (Kg/ cm^2)	Body Material	Disc	Stem	Lining		
1.	00HTM07CP502	50	(-)0.86	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
2.	00HTM08CP502	50	(-)0.86	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
3.	00HTM04CP001	50	3	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
4.	00HTM04CP002	50	3	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
5.	00HTM04CP003	50	3	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
6.	00HTM04CP501	50	3	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
7.	00HTT02CP001	50	3	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
8.	00HTT02CP501	50	3	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
9.	00HTT01CP001	50	3	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
10.	00HTT01CP501	50	3	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1

Indent no	**RFW0091**
Material Code	**RFW000910001**
Process Liquid	**LIMESTONE SLURRY**
Service	**ISOLATION**
Type of valve	**DIAPHRAGM VALVE**
Mode of Operation	**MANUAL**
Size	**1 INCH**

Sl No.	Valve / Instrument Tag No	Operating Conditions		Design Conditions		Material of Construction				End Connection	QTY
		T (°C)	P (Kg/ cm^2)	T (°C)	P (Kg/ cm^2)	Body Material	Disc	Stem	Lining		
1.	00HTK01CP001	50	3.65	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
2.	00HTK01CP501	50	3.65	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
3.	00HTK01CP504	50	3.65	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
4.	00HTK01CP002	50	3.65	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
5.	00HTK01CP502	50	3.65	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
6.	00HTK01CP505	50	3.65	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
7.	00HTK01CP003	50	3.65	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
8.	00HTK01CP503	50	3.65	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
9.	00HTK01CP506	50	3.65	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
10.	00HTK02CP001	50	3.65	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
11.	00HTK02CP501	50	3.65	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1

12.	00HTK02CP504	50	3.65	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
13.	00HTK02CP002	50	3.65	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
14.	00HTK02CP502	50	3.65	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
15.	00HTK02CP505	50	3.65	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
16.	00HTK02CP003	50	3.65	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
17.	00HTK02CP503	50	3.65	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
18.	00HTK02CP506	50	3.65	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1

Indent no	**RFW00091**
Material Code	**RFW000910001**
Process Liquid	**FILTERATE WATER**
Service	**ISOLATION**
Type of valve	**DIAPHRAGM VALVE**
Mode of Operation	**MANUAL**
Size	**1 INCH**

Sl No.	Valve / Instrument Tag No	Operating Conditions		Design Conditions		Material of Construction				End Connection	QTY
		T (°C)	P (Kg/ cm^2)	T (°C)	P (Kg/ cm^2)	Body Material	Disc	Stem	Lining		
1.	00HTM02CP503	50	4	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
2.	00HTM02CP003	50	4	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
3.	00HTM02CP504	50	4	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
4.	00HTM02CP004	50	4	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1

5.	00HTM02CP505	50	4	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
6.	00HTM02CP005-8	50	4	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	4
7.	00HTM02CP501	50	1.5	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
8.	00HTM02CP001	50	1.5	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
9.	00HTM01CP501	50	4	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
10.	00HTM01CP001	50	4	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
11.	00HTM01CP502	50	4	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
12.	00HTM01CP002	50	4	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
13.	00HTM01CP003-5	50	4	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	3

Indent no	**RFW00091**
Material Code	**RFW000910001**
Process Liquid	**WASTE WATER**
Service	**ISOLATION**
Type of valve	**DIAPHRAGM VALVE**
Mode of Operation	**MANUAL**
Size	**1 INCH**

Sl No.	Valve / Instrument Tag No	Operating Conditions		Design Conditions		Material of Construction				End Connection	QTY
		T (°C)	P (Kg/ cm^2)	T (°C)	P (Kg/ cm^2)	Body Material	Disc	Stem	Lining		
1.	00HTM03CP501	50	1.37	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
2.	00HTM03CP001	50	1.37	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1

3.	00HTM03CP502	50	1.37	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
4.	00HTM03CP002	50	1.37	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
5.	00HTM03CP503	50	1.37	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
6.	00HTM03CP003	50	1.37	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1

Indent no	**RFW00091**
Material Code	**RFW000910004**
Process Liquid	**LIMESTONE SLURRY**
Service	**ISOLATION**
Type of valve	**DIAPHRAGM VALVE**
Mode of Operation	**MANUAL**
Size	**1 ½ INCH**

Sl No	Valve / Instrument Tag No	Operating Conditions		Design Conditions		Material of Construction				End Connection	QTY
		T (°C)	P (Kg/ cm^2)	T (°C)	P (Kg/ cm^2)	Body Material	Disc	Stem	Lining		
1.	00HTM37AA001-4	50	1	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	4
2.	00HTM37AA005-6	50	1	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	2
3.	00HTM38AA001-4	50	1	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	4
4.	00HTM38AA005-6	50	1	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	2

Indent No	**RFW00091**
Material Code	**RFW000910005**
Process Liquid	**FILTRATE WATER**
Service	**ISOLATION**
Type of valve	**DIAPHRAGM VALVE**
Mode of Operation	**MANUAL**
Size	**2 INCH**

Sl No	Valve / Instrument Tag No	Operating Conditions		Design Conditions		Material of Construction				End Connection	QTY
		T (°C)	P (Kg/ cm^2)	T (°C)	P (Kg/ cm^2)	Body Material	Disc	Stem	Lining		
1.	00HTM02CP502	50	1.5	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
2.	00HTM02CP002	50	1.5	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
3.	00HTM01AA006-7	50	4	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	2

Indent no	**RFW00091**
Material Code	**RFW000910005**
Process Liquid	**GYPSUM SLURRY**
Service	**ISOLATION**
Type of valve	**DIAPHRAGM VALVE**
Mode of Operation	**MANUAL**
Size	**2 INCH**

Sl No	Valve / Instrument Tag No	Operating Conditions		Design Conditions		Material of Construction				End Connection	QTY
		T (°C)	P (Kg/cm^2)	T (°C)	P (Kg/cm^2)	Body Material	Disc	Stem	Lining		
1.	00HTM04CP004	50	3	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
2.	00HTM04CP005	50	3	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
3.	00HTM04CP006	50	3	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1

Indent no	**RFW00091**
Material Code	**RFW000910005**
Process Liquid	**LIMESTONE SLURRY**
Service	**ISOLATION**
Type of valve	**DIAPHRAGM VALVE**
Mode of Operation	**MANUAL**
Size	**2 INCH**

Sl No	Valve / Instrument Tag No	Operating Conditions		Design Conditions		Material of Construction				End Connection	QTY
		T (°C)	P (Kg/ cm^2)	T (°C)	P (Kg/ cm^2)	Body Material	Disc	Stem	Lining		
1.	00HTK01AA007-8	50	3.65	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	2
2.	00HTK01AA014A	50	3.65	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
3.	00HTK01AA014B	50	3.65	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
4.	00HTK01AA015A	50	3.65	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
5.	00HTK01AA015B	50	3.65	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
6.	00HTK01AA021-22	50	3.65	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	2
7.	00HTK02AA007-8	50	3.65	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	2
8.	00HTK02AA014A	50	3.65	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
9.	00HTK02AA014B	50	3.65	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
10.	00HTK02AA015A	50	3.65	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1

11.	00HTK02AA015B	50	3.65	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
12.	00HTK02AA021A	50	3.65	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
13.	00HTK02AA021B	50	3.65	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
14.	00HTK02AA022A	50	3.65	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
15.	00HTK02AA022B	50	3.65	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1

Indent no	**RFW00091**
Material Code	**RFW000910007**
Process Liquid	**LIMESTONE SLURRY**
Service	**ISOLATION**
Type of valve	**DIAPHRAGM VALVE**
Mode of Operation	**MANUAL**
Size	**3 INCH**

Sl No	Valve / Instrument Tag No	Operating Conditions		Design Conditions		Material of Construction				End Connection	QTY
		T (°C)	P (Kg/cm^2)	T (°C)	P (Kg/cm^2)	Body Material	Disc	Stem	Lining		
1.	00HTM37AA007-10	50	1	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	4
2.	00HTM37AA011-12	50	1	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	2
3.	00HTM38AA007-10	50	1	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	4
4.	00HTM38AA011-12	50	1	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	2

Indent no	RFW00091
Material Code	RFW000910007
Process Liquid	FILTERATE WATER
Service	ISOLATION
Type of valve	DIAPHRAGM VALVE
Mode of Operation	MANUAL
Size	3 INCH

Sl No	Valve / Instrument Tag No	Operating Conditions		Design Conditions		Material of Construction				End Connection	QTY
		T (°C)	P (Kg/cm^2)	T (°C)	P (Kg/cm^2)	Body Material	Disc	Stem	Lining		
1.	00HTM01AA013	50	4	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
2.	00HTM01AA014	50	4	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1

Indent no	RFW00091
Material Code	RFW000910009
Process Liquid	FILTERATE WATER
Service	ISOLATION
Type of valve	DIAPHRAGM VALVE
Mode of Operation	MANUAL
Size	4 INCH

Sl No	Valve / Instrument Tag No	Operating Conditions		Design Conditions		Material of Construction				End Connection	QTY
		T (°C)	P (Kg/cm^2)	T (°C)	P(Kg/cm^2)	Body Material	Disc	Stem	Lining		
1.	00HTM02AA003	50	4	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
2.	00HTM02AA004	50	4	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1

Indent no	**RFW00091**
Material Code	**RFW000910009**
Process Liquid	**FILTERATE WATER**
Service	**REGULATION**
Type of valve	**DIAPHRAGM VALVE**
Mode of Operation	**MANUAL**
Size	**4 INCH**

Sl No	Valve / Instrument Tag No	Operating Conditions		Design Conditions		Material of Construction				End Connection	QTY
		T (°C)	P (Kg/ cm^2)	T (°C)	P (Kg/ cm^2)	Body Material	Disc	Stem	Lining		
1.	00HTM02AA001	50	4	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1

Indent no	**RFW00091**
Material Code	**RFW000910009**
Process Liquid	**WASTE WATER**
Service	**REGULATION**
Type of valve	**DIAPHRAGM VALVE**
Mode of Operation	**MANUAL**
Size	**4 INCH**

Sl No	Valve / Instrument Tag No	Operating Conditions		Design Conditions		Material of Construction				End Connection	QTY
		T (°C)	P (Kg/ cm^2)	T (°C)	P (Kg/ cm^2)	Body Material	Disc	Stem	Lining		
1.	00HTM03AA002	50	1.37	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1

Indent no	**RFW00091**
Material Code	**RFW000910009**
Process Liquid	**WASTE WATER**
Service	**ISOLATION**
Type of valve	**DIAPHRAGM VALVE**
Mode of Operation	**MANUAL**
Size	**4 INCH**

Sl No	Valve / Instrument Tag No	Operating Conditions		Design Conditions		Material of Construction				End Connection	QTY
		T (°C)	P (Kg/ cm^2)	T (°C)	P (Kg/ cm^2)	Body Material	Disc	Stem	Lining		
1.	00HTK01AA003-6	50	3.65	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	4
2.	00HTK01AA009	50	3.65	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
3.	00HTK01AA010-13	50	3.65	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	4
4.	00HTK01AA016	50	3.65	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
5.	00HTK01AA017-20	50	3.65	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	4
6.	00HTK01AA023	50	3.65	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
7.	00HTK01CD001	50	1.5	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
8.	00HTK01CD002	50	1.5	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
9.	00HTK01CD003	50	1.5	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
10.	00HTK02AA003-6	50	3.65	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	4
11.	00HTK02AA009	50	3.65	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1

12.	00HTK02AA010-13	50	3.65	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	4
13.	00HTK02AA016	50	3.65	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
14.	00HTK02AA017-20	50	3.65	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	4
15.	00HTK02AA023	50	3.65	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
16.	00HTK02CD001	50	1.5	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
17.	00HTK02CD002	50	1.5	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
18.	00HTK02CD003	50	1.5	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1

Indent no	**RFW00091**
Material Code	**RFW0009100011**
Process Liquid	**FILTRATE WATER**
Service	**REGULATION**
Type of valve	**DIAPHRAGM VALVE**
Mode of Operation	**MANUAL**
Size	**6 INCH**

Sl No	**Valve / Instrument Tag No**	**Operating Conditions**		**Design Conditions**		**Material of Construction**				**End Connection**	**QTY**
		T (°C)	**P (Kg/ cm^2)**	**T (°C)**	**P (Kg/ cm^2)**	**Body Material**	**Disc**	**Stem**	**Lining**		
1.	00HTM02AA006A	50	1.5	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
2.	00HTM02AA006B	50	1.5	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1

Indent no	**RFW00091**
Material Code	**RFW0009100011**
Process Liquid	**FILTRATE WATER**
Service	**ISLATION**
Type of valve	**DIAPHRAGM VALVE**
Mode of Operation	**MANUAL**
Size	**6 INCH**

Sl No	Valve / Instrument Tag No	Operating Conditions		Design Conditions		Material of Construction				End Connection	QTY
		T (°C)	P (Kg/ cm^2)	T (°C)	P (Kg/ cm^2)	Body Material	Disc	Stem	Lining		
1.	00HTM01AA009	50	4	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
2.	00HTM01AA010	50	4	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
3.	00HTM01AA011	50	4	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
4.	00HTM01AA016	50	4	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
5.	00HTM01AA017	50	4	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1

Indent no	**RFW00091**
Material Code	**RFW0009100012**
Process Liquid	**FILTRATE WATER**
Service	**REGULATING**
Type of valve	**DIAPHRAGM VALVE**
Mode of Operation	**MANUAL**
Size	**8 INCH**

Sl No	Valve / Instrument Tag No	Operating Conditions		Design Conditions		Material of Construction				End Connection	QTY
		T (°C)	P (Kg/ cm^2)	T (°C)	P (Kg/ cm^2)	Body Material	Disc	Stem	Lining		
1.	00HTM02AA005A	50	1.5	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
2.	00HTM02AA005B	50	1.5	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1

Indent no	**RFW00091**
Material Code	**RFW0009100012**
Process Liquid	**FILTRATE WATER**
Service	**ISOLATION**
Type of valve	**DIAPHRAGM VALVE**
Mode of Operation	**MANUAL**
Size	**8 INCH**

Sl No	Valve / Instrument Tag No	Operating Conditions		Design Conditions		Material of Construction				End Connection	QTY
		T (°C)	P (Kg/ cm^2)	T (°C)	P (Kg/ cm^2)	Body Material	Disc	Stem	Lining		
1.	00HTM01AA002-5	50	4	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	4

Indent no	RFW00091
Material Code	RFW000910003
Process Liquid	PROCESS WATER
Service	ISOLATION
Type of valve	DIAPHRAGM VALVE
Mode of Operation	MANUAL
Size	1 INCH

Sl No	Valve / Instrument Tag No	Operating Conditions		Design Conditions		Material of Construction				End Connection	QTY
		T (°C)	P (Kg/ cm^2)	T (°C)	P (Kg/ cm^2)	Body Material	Disc	Stem	Lining		
1.	00HTM02AA002	50	3	100	10	A216 WCB	A217 CA15	A479-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1

MANDATORY SPARES

Indent no	RFW20104
Material Code	RFW201040001
Process Liquid	LIMESTONE SLURRY
Service	ISOLATION
Type of valve	DIAPHRAGM VALVE
Mode of Operation	MANUAL
Size	1 INCH

Sl No	Valve / Instrument Tag No	Operating Conditions		Design Conditions		Material of Construction				End Connection	QTY
		T (°C)	P (Kg/ cm^2)	T (°C)	P (Kg/ cm^2)	Body Material	Disc	Stem	Lining		
1.	M1-DFV-SL-MN-1	50	5.7	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
2.	M2-DFV-SL-MN-1	50	5.7	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1

Indent no	**RFW20104**
Material Code	**RFW201040002**
Process Liquid	**LIMESTONE SLURRY**
Service	**ISOLATION**
Type of valve	**DIAPHRAGM VALVE**
Mode of Operation	**MANUAL**
Size	**1 ½ INCH**

Sl No	Valve / Instrument Tag No	Operating Conditions		Design Conditions		Material of Construction				End Connection	QTY
		T (°C)	P (Kg/cm^2)	T (°C)	P (Kg/cm^2)	Body Material	Disc	Stem	Lining		
1.	M1-DFV-SL-MN-1.5	50	1	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
2.	M2-DFV-SL-MN-1.5	50	1	80	5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1

Indent no	**RFW20104**
Material Code	**RFW201040003**
Process Liquid	**LIMESTONE SLURRY**
Service	**ISOLATION**
Type of valve	**DIAPHRAGM VALVE**
Mode of Operation	**MANUAL**
Size	**2 INCH**

Sl No	Valve / Instrument Tag No	Operating Conditions		Design Conditions		Material of Construction				End Connection	QTY
		T (°C)	P (Kg/cm^2)	T (°C)	P (Kg/cm^2)	Body Material	Disc	Stem	Lining		
1.	M1-DFV-SL-MN-2	50	3.65	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
2.	M2-DFV-SL-MN-2	50	3.65	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1

Indent no	**RFW20104**
Material Code	**RFW201040004**
Process Liquid	**LIMESTONE SLURRY**
Service	**ISOLATION**
Type of valve	**DIAPHRAGM VALVE**
Mode of Operation	**MANUAL**
Size	**3 INCH**

Sl No	Valve / Instrument Tag No	Operating Conditions		Design Conditions		Material of Construction				End Connection	QTY
		T (°C)	P (Kg/ cm^2)	T (°C)	P (Kg/ cm^2)	Body Material	Disc	Stem	Lining		
1.	M1-DFV-SL-MN-3	50	4	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
2.	M2-DFV-SL-MN-3	50	4	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1

Indent no	**RFW20104**
Material Code	**RFW201040005**
Process Liquid	**LIMESTONE SLURRY**
Service	**ISOLATION**
Type of valve	**DIAPHRAGM VALVE**
Mode of Operation	**MANUAL**
Size	**4 INCH**

Sl No	Valve / Instrument Tag No	Operating Conditions		Design Conditions		Material of Construction				End Connection	QTY
		T (°C)	P (Kg/ cm^2)	T (°C)	P (Kg/ cm^2)	Body Material	Disc	Stem	Lining		
1.	M1-DFV-SL-MN-4	50	4	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
2.	M2-DFV-SL-MN-4	50	4	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1

Indent no	**RFW20104**
Material Code	**RFW201040006**
Process Liquid	**LIMESTONE SLURRY**
Service	**ISOLATION**
Type of valve	**DIAPHRAGM VALVE**
Mode of Operation	**MANUAL**
Size	**6 INCH**

Sl No	Valve / Instrument Tag No	Operating Conditions		Design Conditions		Material of Construction				End Connection	QTY
		T (°C)	P (Kg/ cm^2)	T (°C)	P (Kg/ cm^2)	Body Material	Disc	Stem	Lining		
1.	M1-DFV-SL-MN-6	50	4	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
2.	M2-DFV-SL-MN-6	50	4	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1

Indent no	**RFW20104**
Material Code	**RFW201040007**
Process Liquid	**LIMESTONE SLURRY**
Service	**ISOLATION**
Type of valve	**DIAPHRAGM VALVE**
Mode of Operation	**MANUAL**
Size	**8 INCH**

Sl No	Valve / Instrument Tag No	Operating Conditions		Design Conditions		Material of Construction				End Connection	QTY
		T (°C)	P (Kg/ cm^2)	T (°C)	P (Kg/ cm^2)	Body Material	Disc	Stem	Lining		
1.	M1-DFV-SL-MN-8	50	4	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1
2.	M2-DFV-SL-MN-8	50	4	80	7.5	A216 WCB	NATURAL RUBBER	A276-410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1

Indent no	**RFW20104**
Material Code	**RFW201040008**
Process Liquid	**PROCESS WATER**
Service	**ISOLATION**
Type of valve	**DIAPHRAGM VALVE**
Mode of Operation	**MANUAL**
Size	**1 INCH**

Sl No	Valve / Instrument Tag No	Operating Conditions		Design Conditions		Material of Construction				End Connection	QTY
		T (°C)	P (Kg/cm^2)	T (°C)	P (Kg/cm^2)	Body Material	Disc	Stem	Lining		
1.	M1-DFV-W-MN-1	50	3	100	10	A216 WCB	A217 CA15	A479 -410	NATURAL RUBBER	FLD/STRAIGHT THROUGH	1

ANNEXURE-II

14.0 DATA SHEET FOR VALVES (TO BE FILLED SEPARATELY FOR EACH TYPE OF VALVE)

Sl No	DESCRIPTION	TO BE FILLED BY VENDOR
I	**Valve Size**	
a.	Make	
b.	Model/ Type	
c.	Fluid details - Medium handled	
	Temperature range (°C)	
d.	Rated flow (m^3/hr.)	
e.	Design Cv of the valve	
f.	Valve rating	
g.	Valve operation- (Lever/ Gear box)	
h.	Pressure Drop for rated flow (bar(g))	
i.	Design pressure (bar(g))	
j.	Hydraulic test pressure	
	➢ Body (bar(g))	
	➢ Seat (bar(g))	
k.	Max. Shut off pressure (bar(g))	
II	**CONSTRUCTION DETAILS**	
a.	Material of construction	
	➢ Body	
	➢ Stem	
	➢ Disc	
	➢ Seat	
	➢ Bushing	
	➢ Handle	
b.	Fasteners	
c.	End Connection / Rating / Standard	
d.	Recommended minimum pipe ID mm	
e.	Details of Gearbox if applicable	
III	**GENERAL**	
a.	Weight per valve	
b.	Applicable standards	
c.	Valve GA Drawing / Cross Sectional Drg.	
d.	Enquiry / PO reference	

ANNEXURE-III

15.0 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

16.0 PAINTING PROCEDURE:

Primer Coat		**Intermediate Coat**		**Finish coat**			**Total DFT µm (min)**
Paint	No of Coats /DFT	Paint	No of Coats	Paint	No of Coats	Shade	
HB Chlorinated Rubber based Zinc Phosphate Primer DFT= 50 µm per coat (Solid by Volume min 60%)	2	--	--	Chlorinated Rubber Based Finish paint DFT= 30 µm per coat (Solid by Volume min 60%)	2	Gray shade to R9002	160

ANNEXURE-V

17.0 SLURRY PARAMETERS

	Parameter	**Lime slurry characteristics**
1.	Maximum solid particle size	150mesh (104 micron)
2.	Distribution of above size particle,d20	20%(max)
3.	Normal solid particle size,d50	325 mesh(43micron)
4.	Solid to be handled	Absorbers and other impurities
5.	Sp Gravity of Slurry	1.224
6.	PPM of heavier particle (Silica, Aluminium Oxide, Ferric Oxide and Columbium)	23290
7.	Hardness of particle	5-7 (Mho scale)
8.	Concentration of slurry	30% by weight
9.	Sp Gravity of Lime Stone	2.80
10.	Sp gravity of heaviest particles (Columbium and Iron oxide)	5.9
11.	Concentration of Chlorine	20000 ppm
12.	Viscosity of Slurry	20-30cp
13.	Maximum operating temperature of Slurry	60 deg C

TECHNICAL SPECIFICATION FOR PNEUMATICALLY OPERATED BUTTERFLY VALVES HANDLING SLURRY

CUSTOMER : NATIONAL THERMAL POWER CORPORATION LIMITED

NTPC: BONG: FGD: SL VALVES-BUTTERFLY VALVE SPEC-029: REV-01

Flue Gas Desulphurization Group
Air Quality Control Systems
BAP:: BHEL :: Ranipet

TECHNICAL SPECIFICATION FOR PNEUMATICALLY OPERATED BUTTERFLY VALVES FOR SLURRY APPLICATION

Prepared	Checked	Approved
SRIDHAR Asst. Engineer-FGD	ASHWIN R Engineer - FGD	SASHI KUMAR Senior Engineer-FGD
R01 dated 30 03 2013		

CONTENTS

1.0	**PROJECT INFORMATION**	
	▪ Owner	NTPC
	▪ Buyer	BHEL, Ranipet
	▪ Process / application	Wet Lime Stone FGD system
1.1	**SITE CONDITIONS**	
	▪ Ambient temperature (Guarantee)	27 Deg C
	▪ Ambient temperature (Design)	50 Deg C
	▪ Height above sea level	47 m
	▪ Relative Humidity	60 %
1.2	**LOCATION AND APPROACH**	
	▪ Project location	
	▪ State	Assam
	▪ District	Kokrajhar
	▪ Place	Kumkuri near Salakati, Bongaigaon
	▪ Height above sea level	47 m

2.0 INTENT OF SPECIFICATION

This specification together with the attendant Technical Data Sheet and other specifications/attachments to inquiry / order defines the minimum requirements for pneumatically operated butterfly valves along with their accessories /auxiliaries for use in the process of Flue gas Desulphurization (FGD) system handling limestone slurry.

Bidder shall make all possible efforts to comply strictly with the requirements of this specification and other specifications/attachments to inquiry/order. In case, deviations are considered essential by the Bidder (after exhausting all possible efforts), these shall be separately listed in the Bidder's proposal under separate section, titled as "List of Deviations/Exceptions to the Enquiry Document (Annexure-V)". Deviation shall be listed separately for each document with cross reference to Page No./Section/Clause No./Para etc. of the respective document supported with proper reasons for the deviation for purchaser's consideration. Any deviation, not listed under the above section, even if reflected in any other portion of the proposal, shall not be considered applicable. No deviation or exception shall be permitted without the written approval of the purchaser.

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. The valves shall conform to the latest editions of applicable codes and standards as mentioned elsewhere. Nothing in this specification shall be construed to relieve the Bidder of his responsibility. 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.

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.

3.0 STANDARDS AND CODES

Valves in general shall conform to the requirements of the following standards:

a. ANSI B 16.34 Standard for valves.
b. AWWA-C-504 Rubber seated butterfly valves.
c. BS-5155/EN-593 Cast iron and carbon steel butterfly valves for general purpose.

d. ANSI-B-16.10 Valves face to face and other relevant dimension.
e. API-598 Valves inspection test.
f. ANSI-B-16.5 specification for flange dimension

3.1 SCOPE OF SUPPLY

a. Valve as per specification
b. Pneumatic actuator as per the specification No.
c. Limit switch – 2 Nos. for each valves as per the spec.
d. Air filter Regulator -1 No. per valve as per the spec.
e. Solenoid valve – 1 No. for each valve as per the

4.0 DESIGN/CONSTRUCTION OF BUTTERFLY VALVES

4.1. All valves shall be suitable for the service conditions i.e flow, temperature and pressure at which they are required to operate.

4.2. The valves as well as all accessories shall be designed for easy disassembly and maintenance.

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

4.4. The valves supplied shall be suitable for limestone slurry application (slurry parameters are listed in **Annexure- I, II**

4.5. The valves shall be designed for the design pressure/temperature of the system on which it is installed and in accordance with AWWA-C-504, EN-593 or any other approved equivalent standard latest edition.

4.6. The valves shall be suitable for installation in any position (horizontal/ vertical etc.) and shall be of double-flanged construction. However for sizes 150 NB and below the valves may be lugged Wafer construction.

4.7. The seals, both on the body (sleeve) and on the disc shall be of the material specified. Necessary shaft seal shall be provided and adequately designed to ensure no leakage across the seal. This seal shall be designed so that they will allow replacement without removal of the valve shaft. The sealing ring on the disk shall be continuous type and easily replaceable.

4.8. For all types of valves, the design with shaft eccentric to the disc is preferred. The shaft shall be solid type and shall pivot on bushings. Bushings/sleeve type bearings shall be contained in the hub of valve body. The bearing shall be self-lubricated type with low coefficient of friction and should not have any harmful effect on water and on valve components.

4.9. The design of the shaft shall be such that it will safely sustain maximum differential pressure across the closed valve. The shaft and any key (taper pin etc.) for transmitting the torque between shaft and disc shall be capable of withstanding the maximum torque required to operate the valve. However, the shaft diameter shall

not be less than the minimum shaft diameter specified in relevant code. Necessary Torque Calculation and the torque class selected on the basis of the same shall be furnished to the Employer for information.

4.10. The disc shall rotate from the full open to the tight shut position. The disc shall be contoured to ensure the least possible resistance to flow and shall be suitable for throttling operation. While the disc is in the throttled position, valve shall not create any noise or vibration. The operating mechanism shall be mounted directly on or supported from the valve body.

4.11. All valves shall be complete with: position indicator (located in a visible place), arrow indicating the flow direction; adjustable mechanical stop limiting devices to prevent over travel of valve disc in open/close position; all valves shall be "tight shut off"

4.12. Valves-350Nb and above shall have pressure equalizing bypass valves, wherever system parameters warrant the same.

4.13. Valves-350Nb and above shall also be provided with gear operator arrangement suitable for manual operation. Manual operation of valve shall be through worm and gear arrangement having totally enclosed gearing with hand wheel diameter and gear ratio designed to meet the required operating torque It shall be designed to hold the valve disc in intermediate position between full open and full closed position without creeping or fluttering. Adjustable stops shall be provided to prevent over travel in either direction.

4.14. Fabricated steel (IS:2062 Gr B) butterfly valves instead of cast Iron body valves are also acceptable for size above 300 mm NB diameter for water application other than Sea-water / corrosive water. In such a case, however, the bidder will have to necessarily submit thickness calculations, in order to establish the integrity of the fabricated valve body under the system operating pressure condition. Bidder has to clearly indicate the material offered in the bid. No change shall be entertained during detailed engg.

4.15. Limit and torque switches (if applicable) shall be enclosed in water tight enclosures along with suitable space heaters for motor actuated valves, which may be either for On-Off operation or inching operation with position transmitter.

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

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

4.18. The actuator-operated valves shall be designed on the basis of the following :

a. The internal parts shall be suitable to support the pressure caused by the actuators;

b. The valve-actuator unit shall be suitably stiff so as not to cause vibrations, misalignments, etc.
c. All actuator operated valves shall be provided with hand operated gearing mechanism also.
d. All actuators operated valves shall open/ close fully within time required by the process but not later than 60 seconds after actuators starts.

5.0 MATERIAL OF CONSTRUCTION (BUTTERFLY VALVES)

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

Note: All the parts of the valve exposed to slurry must be rubber lined.

6.0 PROOF OF DESIGN TEST (TYPE TEST) FOR BUTTERFLY VALVES

Proof of Design (P.O.D.) test certificates shall be furnished by the bidder for all applicable size-ranges and classes of Butterfly valves supplied by him, in the absence of which actual P.O.D. test shall be conducted by the bidder in the presence of Employer's representative.
All valves that are designed and manufactured as per AWWA-C-504 shall be governed by the relevant clauses of P.O.D test in AWWA-C-504. For Butterfly valves designed and manufactured to EN-593 or equivalent, the P.O.D. test methods and procedures shall generally follow the guidelines of AWWA-C-504 in all respect except that Body & seat hydro test and disc-strength test shall be conducted at the pressures specified in EN-593 or the applicable code. Actuators shall also meet requirements of P.O.D. test of AWWA-C-504

7.0 SPECIFICATION FOR PNEUMATIC ACTUATOR

a) Quantity	01 No. for each valve
b) Type	Rotary actuator, Pneumatic (spring return)
c) Action	Air to Open (Valves shown in Annexure I,II except Annexure IB, Annexure IIB)
	Air to close (valves indicated in Annexure IB, Annexure IIB)
d) Failure position (air failure)	Close (Valves shown in Annexure I,II except Annexure IB, Annexure IIB)

	Open (valves indicated in Annexure IB, Annexure IIB)
e) Close/open at air Pressure	4 to 6 kg/cm^2 optg design for 4 kg/cm^2
e) Air Connection	¼" NPT(F) drawn copper tubing
f) Local Position Indicator	To be provided.
g) Hand wheel for manual opn	Required (> 8 inch)
h) Actuator travel time	Vendor to specify
i) Actuator Protection Class	IP-65 (Min)
j) Actuator Thrust	Vendor to specify
k) Spring range (kg/cm2)	Vendor to specify
l) Speed adjustment for actuator operation	Vendor to specify
m) Solenoid valve type	3/2 way, 24V DC power supply, ex. proof,
	1/4" NPT pneumatic connection, 1/2" NPT
	Electrical connection. Solenoid Valve Energised for valve to open & Solenoid valve De-energised for valve to close.
n) Air filter regulator	Size of filter shall be 5 Micron, Filter material shall be sintered bronze/equivalent, Body shall be aluminium, 1/4" NPT Pneumatic connection shall be envisaged. 2" Pressure gauge along with air filter to be provided.

8.0 LIMIT SWITCHES:

a) Quantity /valve : One for Open & one for Close position
b) No. of Contacts : Two normally open & two normally closed potential free contacts in each limit switch corresponding to open & close positions of the valve.
c) Contact Rating : 24 V DC
d) Protection : Weather proof IP 55.
e) Limit Switch Box : Limit Switch terminals shall be brought out to a Terminal Box

9.0 PAINTING OF VALVES:

The detailed painting procedure is enclosed in Annexure-VI

10.0 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 III & IV** 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. Recommended spares list for 3 year O&M along with item wise price.
k. Any deviation shall be specifically mentioned in the enclosed deviation format **Annexure-V**.

In case of any deviation, the Bidder shall indicate the deviation, clause by clause in the deviation format attached in **Annexure-V**. If there is no deviation "**NIL**" statement shall be furnished. In the absence of **Annexure-V**, 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.

11.0 DOCUMENTS / SERVICE AFTER ORDER

11.1. 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

11.2. 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

12.0 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.

13.0 INSPECTION

Shall be done by BHEL inspector at Vendor's works.

ANNEXURE I
ANNEXURE IA

14.0 DETAILED LIST OF VALVES WITH OPERATING PARAMETERS

Indent no	**RFW00093**
Material Code	**RFW000930001**
Process Liquid	**LIME/GYPSUM SLURRY**
Service	**ISOLATION**
Type of valve	**BUTTERFLY VALVE**
Mode of Operation	**PNEUMATIC**
Size	**2 INCH**

Sl No.	Valve / Instrument Tag No	Operating Conditions		Design Conditions		Material of Construction				End Connection (WFR-WAFER)	QTY
		T (°C)	P (Kg/cm^2)	T (°C)	P (Kg/cm^2)	Body Material	Disc	Stem	Lining		
1.	00HTQ03AA206	50	Atm	80	7.5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
2.	00HTQ03AA208	50	Atm	80	7.5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
3.	00HTQ03AA202	50	Atm	80	7.5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
4.	00HTQ03AA204	50	Atm	80	7.5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
5.	00HTQ03AA205	50	Atm	80	7.5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
6.	00HTQ03AA206	50	Atm	80	7.5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
7.	00HTQ06AA202	50	Atm	80	5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
8.	00HTQ06AA204	50	Atm	80	5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
9.	00HTQ06AA206	50	Atm	80	5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
10.	00HTQ07AA202	50	Atm	80	5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
11.	00HTQ07AA204	50	Atm	80	5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
12.	00HTQ07AA206	50	Atm	80	5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1

ANNEXURE IB

Indent no	**RFW00093**
Material Code	**RFW000930001**
Process Liquid	**LIME/GYPSUM SLURRY**
Service	**ISOLATION**
Type of valve	**BUTTERFLY VALVE**
Mode of Operation	**PNEUMATIC (Fail to Open design)**
Size	**2 INCH**

Sl No.	Valve / Instrument Tag No	Operating Conditions		Design Conditions		Material of Construction				End Connection (WFR-WAFER)	QTY
		T (°C)	P (Kg/cm^2)	T (°C)	P (Kg/cm^2)	Body Material	Disc	Stem	Lining		
1.	00HTQ05AA202	50	Atm	80	5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
2.	00HTQ05AA204	50	Atm	80	5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
3.	00HTQ04AA202	50	Atm	80	5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1

ANNEXURE IC

Indent no	**RFW00093**
Material Code	**RFW000930003**
Process Liquid	**LIME/GYPSUM SLURRY/ Filtrate Water / Waste water**
Service	**ISOLATION**
Type of valve	**BUTTERFLY VALVE**
Mode of Operation	**PNEUMATIC**
Size	**3 INCH**

Sl No.	Valve / Instrument Tag No	Operating Conditions		Design Conditions		Material of Construction				End Connection (WFR-WAFER)	QTY
		T (°C)	P (Kg/cm^2)	T (°C)	P (Kg/cm^2)	Body Material	Disc	Stem	Lining		
1	00HTT01AA201	50	3	80	5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
2	00HTT02AA203	50	3	80	5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
3	00HTT02AA202	50	3	80	5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1

ANNEXURE ID

Indent no	**RFW00093**
Material Code	**RFW000930004**
Process Liquid	**LIME/GYPSUM SLURRY**
Service	**ISOLATION**
Type of valve	**BUTTERFLY VALVE**
Mode of Operation	**PNEUMATIC**
Size	**4 INCH**

Sl No.	Valve / Instrument No	Operating Conditio		Design Condition		Material of Construction				End Connectio (WFR-WAFER)	QTY
		T (°C)	P (Kg/ cm^2)	T (°C)	P (Kg/cm^2)	Body Material	Disc	Stem	Lining		
1	00HTS01AA202	50	ATM	80	5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
2	00HTK01AA201	50	1	80	5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
3	00HTK01AA202	50	3.65	80	7.5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
4	00HTK01AA204	50	1	80	5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
5	00HTK01AA205	50	3.65	80	7.5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
6	00HTK01AA207	50	1	80	5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
7	00HTK01AA208	50	3.65	80	7.5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
8	00HTK02AA201	50	1	80	5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
9	00HTK02AA202	50	3.65	80	7.5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
10	00HTK02AA204	50	1	80	5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
11	00HTK02AA205	50	3.65	80	7.5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
12	00HTK02AA207	50	1	80	5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
13	00HTK02AA208	50	3.65	80	7.5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1

ANNEXURE IE

Indent no	**RFW00093**
Material Code	**RFW000930005**
Process Liquid	**LIME/GYPSUM SLURRY**
Service	**ISOLATION**
Type of valve	**BUTTERFLY VALVE**
Mode of Operation	**PNEUMATIC**
Size	**6 INCH**

Sl No.	Valve / Instrument Tag No	Operating Conditions		Design Conditions		Material of Construction				End Connection (WFR-WAFER)	QTY
		T (°C)	P (Kg/cm^2)	T (°C)	P (Kg/cm^2)	Body Material	Disc	Stem	Lining		
1	00HTM02AA205	50	1.3	80	7.5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
2	00HTM02AA206	50	4	80	7.5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
3	00HTM02AA207	50	1.3	80	7.5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
4	00HTM02AA208	50	4	80	7.5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
5	00HTM03AA201	50	0.95	80	5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
6	00HTM03AA202	50	1.37	80	5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
7	00HTM03AA203	50	0.95	80	5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
8	00HTM03AA204	50	1.37	80	5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
9	00HTM04AA202	50	3	80	5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
10	00HTM04AA203	50	3	80	5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
11	00HTM04AA204	50	3	80	5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1

ANNEXURE IF

Indent no	**RFW00093**
Material Code	**RFW000930006**
Process Liquid	**LIME/GYPSUM SLURRY/ Filtrate Water / Waste water**
Service	**ISOLATION**
Type of valve	**BUTTERFLY VALVE**
Mode of Operation	**PNEUMATIC**
Size	**8 INCH**

Sl No.	Valve / Instrument Tag No	Operating Conditions		Design Conditions		Material of Construction				End Connection (WFR-WAFER)	QTY
		T (°C)	P (Kg/cm^2)	T (°C)	P (Kg/cm^2)	Body Material	Disc	Stem	Lining		
1	00HTM02AA202	50	1.5	80	7.5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
2	00HTM02AA204	50	1.5	80	7.5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1

ANNEXURE IG

Indent no	**RFW00093**
Material Code	**RFW000930007**
Process Liquid	**LIME/GYPSUM SLURRY/ Filtrate Water / Waste water**
Service	**ISOLATION**
Type of valve	**BUTTERFLY VALVE**
Mode of Operation	**PNEUMATIC**
Size	**10 INCH**

Sl No.	Valve / Instrument Tag No	Operating Conditions		Design Conditions		Material of Construction				End Connection (WFR-WAFER)	QTY
		T (°C)	P (Kg/cm^2)	T (°C)	P (Kg/cm^2)	Body Material	Disc	Stem	Lining		
1	00HTM02AA201	50	1.3	80	7.5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
2	00HTM02AA203	50	1.3	80	7.5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
3	00HTM01AA202	50	1.3	80	7.5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
4	00HTM01AA204	50	4	80	7.5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
5	00HTM01AA201	50	1.3	80	7.5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
6	00HTM01AA203	50	4	80	7.5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1

15.0 Mandatory Spares:

ANNEXURE II
ANNEXURE IIA

Indent no	**RFW20121**
Material Code	**RFW201210001**
Process Liquid	**LIME/GYPSUM SLURRY/ Filtrate Water / Waste water**
Service	**ISOLATION**
Type of valve	**BUTTERFLY VALVE**
Mode of Operation	**PNEUMATIC**
Size	**2 INCH**

Sl No	Valve / Instrument Tag No	Operating Conditions		Design Conditions		Material of Construction				End Connection (WFR-WAFER)	QTY
		T (°C)	P (Kg/ cm^2)	T (°C)	P (Kg/cm^2)	Body Material	Disc	Stem	Lining		
1	M1-BFV-SL-PN-2	50	Atm	80	7.5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
2	M2-BFV-SL-PN-2	50	Atm	80	7.5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1

ANNEXURE IIB

Indent no	**RFW20121**
Material Code	**RFW201210002**
Process Liquid	**LIME/GYPSUM SLURRY/ Filtrate Water / Waste water**
Service	**ISOLATION**
Type of valve	**BUTTERFLY VALVE**
Mode of Operation	**PNEUMATIC (Fail to Open design)**
Size	**2 INCH**

Sl No.	Valve / Instrument Tag No	Operating Conditions		Design Conditions		Material of Construction				End Connection (WFR-WAFER)	QTY
		T (°C)	P (Kg/cm^2)	T (°C)	P (Kg/cm^2)	Body Material	Disc	Stem	Lining		
1	M3-BFV-SL-PN-2	50	Atm	80	7.5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
2	M4-BFV-SL-PN-2	50	Atm	80	7.5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1

ANNEXURE IIC

Indent no	**RFW20121**
Material Code	**RFW201210003**
Process Liquid	**LIME/GYPSUM SLURRY/ Filtrate Water / Waste water**
Service	**ISOLATION**
Type of valve	**BUTTERFLY VALVE**
Mode of Operation	**PNEUMATIC**
Size	**3 INCH**

Sl No.	Valve / Instrument Tag No	Operating Conditions		Design Conditions		Material of Construction				End Connection (WFR-WAFER)	QTY
		T (°C)	P (Kg/cm^2)	T (°C)	P (Kg/cm^2)	Body Material	Disc	Stem	Lining		
1	M1-BFV-SL-PN-3	50	3	80	5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
2	M2-BFV-SL-PN-3	50	3	80	5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1

ANNEXURE IID

Indent no	**RFW20121**
Material Code	**RFW201210004**
Process Liquid	**LIME/GYPSUM SLURRY/ Filtrate Water / Waste water**
Service	**ISOLATION**
Type of valve	**BUTTERFLY VALVE**
Mode of Operation	**PNEUMATIC**
Size	**4 INCH**

Sl No.	Valve / Instrument Tag No	Operating Conditions		Design Conditions		Material of Construction				End Connection (WFR-WAFER)	QTY
		T (°C)	P (Kg/cm^2)	T (°C)	P (Kg/cm^2)	Body Material	Disc	Stem	Lining		
1	M1-BFV-SL-PN-4	50	3.65	80	7.5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
2	M2-BFV-SL-PN-4	50	3.65	80	7.5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1

ANNEXURE IIE

Indent no	**RFW20121**
Material Code	**RFW201210005**
Process Liquid	**LIME/GYPSUM SLURRY/ Filtrate Water / Waste water**
Service	**ISOLATION**
Type of valve	**BUTTERFLY VALVE**
Mode of Operation	**PNEUMATIC**
Size	**6 INCH**

Sl No.	Valve / Instrument Tag No	Operating Conditions		Design Conditions		Material of Construction				End Connection (WFR-WAFER)	QTY
		T (°C)	P (Kg/cm^2)	T (°C)	P (Kg/cm^2)	Body Material	Disc	Stem	Lining		
1	M1-BFV-SL-PN-6	50	4	80	7.5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
2	M2-BFV-SL-PN-6	50	4	80	7.5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1

ANNEXURE IIF

Indent no	**RFW20121**
Material Code	**RFW201210006**
Process Liquid	**LIME/GYPSUM SLURRY/ Filtrate Water / Waste water**
Service	**ISOLATION**
Type of valve	**BUTTERFLY VALVE**
Mode of Operation	**PNEUMATIC**
Size	**8 INCH**

Sl No.	Valve / Instrument Tag No	Operating Conditions		Design Conditions		Material of Construction				End Connection (WFR-WAFER)	QTY
		T (°C)	P (Kg/cm^2)	T (°C)	P (Kg/cm^2)	Body Material	Disc	Stem	Lining		
1	M1-BFV-SL-PN-8	50	1.5	80	7.5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
2	M2-BFV-SL-PN-8	50	1.5	80	7.5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1

ANNEXURE IIG

Indent no	**RFW20121**
Material Code	**RFW201210007**
Process Liquid	**LIME/GYPSUM SLURRY/ Filtrate Water / Waste water**
Service	**ISOLATION**
Type of valve	**BUTTERFLY VALVE**
Mode of Operation	**PNEUMATIC**
Size	**10 INCH**

Sl No	Valve / Instrument Tag No	Operating Conditions		Design Conditions		Material of Construction				End Connection (WFR-WAFER)	QTY
		T (°C)	P (Kg/cm^2)	T (°C)	P (Kg/cm^2)	Body Material	Disc	Stem	Lining		
1	M1-BFV-SL-PN-10	50	4	80	7.5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1
2	M2-BFV-SL-PN-10	50	4	80	7.5	A216 WCB	A217 CA15	A276-410	Natural Rubber	WFR	1

Note: All valves shall be provided with embossed name plate giving details such as tag number, type, size etc.

16.0 SLURRY PROCESS PARAMETERS

Sl.No	Item	Limestone Slurry Absorber
1.	Maximum solid particle size	150mesh (104micron)
2.	Distribution of above size particle,d20	20%(max)
3.	Normal solid particle size,d50	325 mesh(43micron)
4.	Solid to be handled	Absorbers and other impurities
5.	Sp Gravity of Slurry	1.224
6.	PPM of heavier particle (Silica, Aluminium Oxide, Ferric Oxide and Columbium)	23290
7.	Hardness of particle	5-7 (Mho scale)
8.	Concentration of slurry	30% by weight
9.	Sp Gravity of Lime Stone	2.80
10.	Sp gravity of heaviest particles (Columbium and Iron oxide)	5.9
11.	Concentration of Chlorine	20000ppm
12.	Viscosity of Slurry	20-30cp
13.	Maximum operating temperature of Slurry	60 deg C

ANNEXURE III

17.0 DATA SHEET FOR kVALVES (TO BE FILLED SEPARATELY FOR EACH TYPE OF VALVE)

Sl No	DESCRIPTION	TO BE FILLED BY VENDOR
I	**Valve Size**	
a.	Make	
b.	Model/ Type	
c.	Fluid details - Medium handled	
	Temperature range (°C)	
d.	Rated flow (m^3/hr.)	
e.	Design Cv of the valve	
f.	Valve rating	
g.	Valve operation- (Lever/ Gear box)	
h.	Pressure Drop for rated flow (bar(g))	
i.	Design pressure (bar(g))	
j.	Hydraulic test pressure	
	➢ Body (bar(g))	
	➢ Seat (bar(g))	
k.	Max. Shut off pressure (bar(g))	
II	**CONSTRUCTION DETAILS**	
a.	Material of construction	
	➢ Body	
	➢ Stem	
	➢ Disc	
	➢ Seat	
	➢ Bushing	
	➢ Handle	
b.	Fasteners	
c.	End Connection / Rating / Standard	
d.	Recommended minimum pipe ID mm	
e.	Details of Gearbox if applicable	
III	**GENERAL**	
a.	Weight per valve	
b.	Applicable standards	
c.	Valve GA Drawing / Cross Sectional Drg.	
d.	Enquiry / PO reference	

ANNEXURE-IV

18.0 DATA SHEET FOR PNEUMATIC ACTUATOR

1) ACTUATOR

a) Make :
b) Model :
c) Type :
d) Torque rating :
e) Air consumption :
f) Operating time for opening :
Operating time for closing :
g) Accessories offered :
h) Type of stay put :
i) Air Connection :

2) LIMIT SWITCH

a) Make :
b) Type :
c) Quantity :
d) Contact rating :
e) Reset type :

NOTE:

Vendor should fill up the "Vendor's Confirmation column" and submit a signed copy of this specification with his offer.

Vendor's Signature & Seal

ANNEXURE V

19.0 FORMS 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-VI

20.0 PAINTING PROCEDURE:

Primer Coat		**Intermediate Coat**		**Finish coat**			**Total DFT µm (min)**
Paint	No of Coats /DFT	Paint	No of Coats	Paint	No of Coats	Shade	
HB Chlorinated Rubber based Zinc Phosphate Primer DFT= 50 µm per coat (Solid by Volume min 60%)	2	--	--	Chlorinated Rubber Based Finish paint DFT= 30 µm per coat (Solid by Volume min 60%)	2	Gray shade to R9002	160