






CLAUSE NO.	TECHNICAL REQUIREMENTS				
	Application		Type Of Termination		
	FROM (A)	TO (B)	END A	END B	
	Marshalling/ Termination System Cabinets	UCD mounted equipments	Cage clamp (Post mounted) type.	Plug in connector / Cage clamp type (rail mounted).	F,G (with plug-in connect or at one end)
	DDCMIS/PLC cabinets	PC, Printers etc.	Plug in connector	Plug in connector	Mfr.'s Standar d
	<p>Notes</p> <ol style="list-style-type: none"> 1 Normally 10% spare cores shall be provided when the numbers of pairs of cables are more than four pairs, except for pre-fabricated cables which shall be as per manufacturer's standard. 2 For analog signals, individual pair shielding & overall shielding & for Binary signals, only overall shielding of instrumentation cables shall be provided. 3 * For high temperature applications only. 4 . For connection between field/JB and DDCMIS marshalling cabinet Minimum 4 pair instrumentation cable shall be used. 5 All the spare cores of instrumentation cable have to be terminated in Marshalling cabinets/ DCS panel end. 6 Not used. 				
6.00.00	TERMINAL BLOCKS				
6.01.00	All terminal blocks shall be rail mounted/post mounted, cage clamp type with high quality non-flammable insulating material of melamine suitable for working temperature of 105 deg. C. The terminal blocks in field mounted junction boxes, temperature transmitters, instrument enclosures/racks, etc., shall be suitable for cage clamp connections. The terminal blocks in Control Equipment Room logic/termination/marshalling cubicles shall be suitable for post mounted cage clamp connection at the field input end. The exact type of terminal blocks to be provided by the Bidder and the technical details of the same including width etc. shall be subject to Employer's approval.				
6.02.00	All the terminal blocks shall be provided complete with all required accessories including assembly rail, locking pin and section, end brackets, partitions, small partitions, transparent covers, support brackets, distance sleeves, warning label, marking, etc.				
6.03.00	The marking on terminal strips shall correspond to the terminal numbering on wiring diagrams. At least 20% spare unused terminals shall be provided everywhere including local junction boxes, instrument racks/enclosures, termination/marshalling cabinets, etc. All terminal blocks shall be numbered for identification and grouped according to the function. Engraved labels shall be provided on the terminal blocks.				
LOT-2 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE		TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(2)-9		PART-B SUB-SECTION-III-C4 INSTRUMENTATION CABLES	
				PAGE 8 OF 12	

CLAUSE NO.	TECHNICAL REQUIREMENTS		
6.04.00	For terminating each process actuated switches, drive actuators, control valves, Thermocouple, RTD, etc. in Local Junction Boxes, etc, refer Drg no. 0000-999-POI-A-065.		
6.05.00	The terminal blocks shall be arranged with at least 100 mm clearance between two sets of terminal blocks and between terminal blocks and junction box walls.		
7.00.00	INTERNAL PANELS/ SYSTEM CABINETS WIRING		
7.01.00	Internal panel/cabinet wiring shall be of multi-stranded copper conductor with FRLS PVC insulation without shield and outer sheath meeting the requirements of VDE 0815.		
7.02.00	All internal wires shall be provided with tag and identification nos. etched on tightly fitted ferrules at both ends. All wires directly connected to trip devices shall be distinguished by one additional red colour ferrule.		
7.03.00	All external connection shall be made with one wire per termination point. Wires shall not be tapped or spliced between terminal points.		
7.04.00	All floor slots of desk/panels/cabinets used for cable entrance shall be provided with removable gasketed gland plates and sealing material. Split type grommets shall be used for prefabricated cables.		
7.05.00	All the special tools as may be required for solder less connections shall be provided by Bidder.		
7.06.00	Wire sizes to be utilised for internal wiring. (i) Current (4-20 mA), low voltage signals (48V); Ammeter/Voltmeter circuit, control switches etc. for electrical system. 0.5 Sq.mm. (ii) Power supply and internal illumination. 2.5Sq.mm. minimum (shall be as per load requirement.)		
8.00.00	INSTRUMENTATION CABLE INSTALLATION AND ROUTING		
8.01.00	All cables assigned to a particular duct/conduit shall be grouped and pulled in simultaneously using cable grips and suitable lubricants. Cables removed from one duct/conduit shall not be reused without approval of Employer.		
8.02.00	Cables shall be segregated as per IEEE Std.-422. In vertically stacked trays, the higher voltage cable shall be in higher position and instrumentation cable shall be in bottom tier of the tray stack. The distance between instrumentation cables and those of other system shall be as follows: From 11 kV/6.6 kV/3.3 kV tray system - 914 mm From 415V tray system - 610 mm From control cable tray system - 305 mm		
8.03.00	Cables shall terminate in the enclosure through cable glands. All cable glands shall be properly gasketed. Sealing (to prevent ingress of dust entry and propagation of fire) shall be provided for all floor slots used for cable entrance. Compression cable glands (double for armoured and single for other cables) shall be provided.		
<p align="center">LOT-2 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p align="center">TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(2)-9</p>	<p align="center">PART-B SUB-SECTION-III-C4 INSTRUMENTATION CABLES</p>	<p align="center">PAGE 9 OF 12</p>

CLAUSE NO.	TECHNICAL REQUIREMENTS		
8.04.00	Not in use		
8.05.00	The cables emanating from redundant equipment/devices shall be routed through different paths. The above segregation of cables & wiring for redundant equipments/devices shall be in accordance with IEEE-Std-422.		
9.00.00	CABLE LAYING AND ACCESSORIES		
9.01.00	CABLE LAYING		
	1 Cables shall be laid strictly in line with cable schedule.		
	2 Identification tags for cables.		
	Indelible tags to be provided at all terminations, on both sides of wall or floor crossing, on each conduit/duct/pipe entry/exit, and at every 20 m in cable trench/tray.		
	3 Cable tray numbering and marking.		
	To be provided at every 10m and at each end of cable way & branch connection.		
	4 No jointing is permissible for Instrumentation cables. For other cables Jointing for more than 250 Meters run of cable shall be permitted.		
	5 Buried cable protection		
	With concrete slabs; Route markers at every 20 Meters along the route & at every bend.		
	6 Road Crossings		
	Cables to pass through buried high density PE pipes encased in PCC. At least 300 mm clearance shall be provided between		
	- HT power & LT power cables,		
	- LT power & LT control/instrumentation cables,		
	Spacing between cables of same voltage grade shall be in accordance with the derating criteria adopted for cable sizing.		
	7 Segregation (physical isolation to prevent fire jumping)		
	a All cable associated with the unit shall be segregated from cables of other Units.		
	b Interplant cables of station auxiliaries and unit critical drives shall be segregated in such a way that not more than half of the drives are lost in case of single incident of fire.		
	8 Cable clamping		
	All cables laid on trays shall be neatly dressed up & suitably clamped/tied to the tray. For cables in trefoil formation, trefoil clamps shall be provided.		
<p align="center">LOT-2 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p align="center">TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(2)-9</p>	<p align="center">PART-B SUB-SECTION-III-C4 INSTRUMENTATION CABLES</p>	<p align="center">PAGE 10 OF 12</p>

CLAUSE NO.	TECHNICAL REQUIREMENTS		
<p>9.02.00</p> <p>9.03.00</p> <p>9.04.00</p> <p>9.05.00</p> <p>10.00.00</p>	<p>9 Optical fiber cables (OFCs) :</p> <p> Outside Building Area - to be laid necessarily inside GI conduit with support from cable tray/Trestle structure</p> <p> Inside Building Area – to be laid on separate cable sub-trays</p> <p> While buried- in separate burried trench approx.1.0 meter depth, to be laid in 2” rodent proof HDPE conduits covered with sand, brick, laid breadth-wise and soil along the pipe line route by contractor;</p> <p> While crossing roads - to be laid in GI/ rodent proof HDPE conduits with sand filling at bottom and sand, soil filling at top with cement concrete;</p> <p> While crossing canals/river- to be laid in rodent proof HDPE conduits within hume pipe.</p> <p>10 Laying of Network Cable (UTP/STP) :</p> <p> Out side Building Area- to be laid necessarily inside GI conduits with support from cable tray / Trestle structure.</p> <p> Inside Building Area- to be laid necessarily inside GI conduits on separate cable sub-trays.</p> <p>Bidder shall supply and install all cable accessories and fittings like Light Interface Units, Surge suppressors, Opto isolators, Interface Converters, Fibre Optic Card Cage, Fibre Optic Line Driver, Repeater / Modem (for Optical Fibre Cables), cable glands, grommets, lugs, termination kits etc. on as required basis.</p> <p>Cables, which terminate in cabinets of draw out sections shall have sufficient cable coiled in the bottom of the cabinet to permit full withdrawal of draw out sections without disconnecting the cables. When prefabricated cables with factory connectors on both ends are longer than required, the excess cable shall be coiled in the bottom of one or both termination cabinets.</p> <p>The Bidder shall be responsible for proper grounding of all equipment under this package. Further, proper termination of cable shields shall be verified and the grounding of the same shall be coordinated so as to achieve grounding of all instrumentation cable shields at same potential. This shall be completed prior to system tests.</p> <p>The Contractor shall take full care while laying / installing cables as recommended by cable manufacturers regarding pulling tensions and cable bends. Cables damaged in any way during installation shall be replaced at the expense of the Contractor.</p> <p>FIELD MOUNTED LOCAL JUNCTION BOXES</p> <p>(i) No. of ways 12/24/36/48/64/72/96/128 with 20% spares terminals.</p> <p>(ii) Material and 4mm thick Fiberglass Reinforced Polyester (FRP). Thickness</p> <p>(iii) Type Screwed at all four corners for door. Door gasket shall be of synthetic rubber.</p> <p>(iv) Mounting clamps Suitable for mounting on walls, columns, structures etc. The and accessories brackets, bolts, nuts, screws, glands required for erection shall</p>		
<p>LOT-2 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p>TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(2)-9</p>	<p>PART-B SUB-SECTION-III-C4 INSTRUMENTATION CABLES</p>	<p>PAGE 11 OF 12</p>

CLAUSE NO.	TECHNICAL REQUIREMENTS		
	<p>be of SS, included in Bidders scope of supply.</p> <p>(v) Type of terminal blocks Rail mounted cage-clamp type suitable for conductor size upto 2.5 mm². A M6 earthing stud shall be provided.</p> <p>(vi) Protection Class IP: 55 minimum for indoor & IP-65 minimum for outdoor applications.</p> <p>(vii) Grounding To be provided.</p> <p>(viii) Color RAL 7035</p>		
11.00.00	CONDUITS		
11.01.00	<p>Conduits shall be generally used for interconnecting cables from field instruments to Local JB's. All rigid conduits, couplings and elbows shall be hot dipped galvanised rigid mild steel in accordance with IS: 9537 Part-I (1980) and Part-II (1981). The conduit interior and exterior surfaces shall have continuous zinc coating with an overcoat of transparent enamel lacker or zinc chromate. Flexible conduit shall be heat resistant terne coated steel with , water leak, fire and rust proof protected <i>for the areas of Mills,Drum, Main Steam, RH steam Air Heaters and Furnace, BFPDT's</i> .</p> <p><i>And for remaining applications, water leak, fire and rust proof flexible GI conduits shall be provided.</i> The temperature rating of flexible conduit shall be suitable for actual application.</p>		
11.02.00	<p>All rigid conduit fittings shall conform to the requirements of IS: 2667, 1976. Galvanized steel fitting shall be used with steel conduit. All flexible conduit fittings shall be liquid tight, galvanized steel. The end fittings shall be compatible with the flexible conduit supplied.</p>		
11.03.00	<p>Conduit sealing, explosion proof, dust proof and other types of special fittings shall be provided as required by these specifications and shall be consistent with the area and equipment with which they are installed. Fittings installed outdoors and in damp locations shall be sealed and gasketed. Hazardous area fittings and conduits sealing shall conform with NEC requirements for the area classification.</p>		
11.04.00	<p>Contractor shall provide double locknuts on all conduit terminations not provided with threaded hubs and couplings. Water tight conduit unions and rain tight conduit hubs shall be utilised for all the application which shall be exposed to weather. Moisture pockets shall be eliminated from conduits.</p>		
11.05.00	<p>Conduits shall be securely fastened to all boxes and cabinets.</p>		
12.00.00	CABLE SUB-TRAY & SUPPORT		
12.01.00	<p>The cable sub-trays and the supporting system, to be generally used between Local/Group JB's and the main cable trays and the same shall be furnished and installed by the Contractor. It is the assembly of sections and associated fittings forming a rigid structural system used to support the cable from the equipment or instrument enclosure upto the main cable trays (trunk route).</p>		
12.02.00	<p>The covers on the cable sub-trays shall be used for protection of cables in areas where damage may occur from falling objects, welding spark, corrosive environment, etc. & shall be electrically continuous and solidly grounded.</p>		
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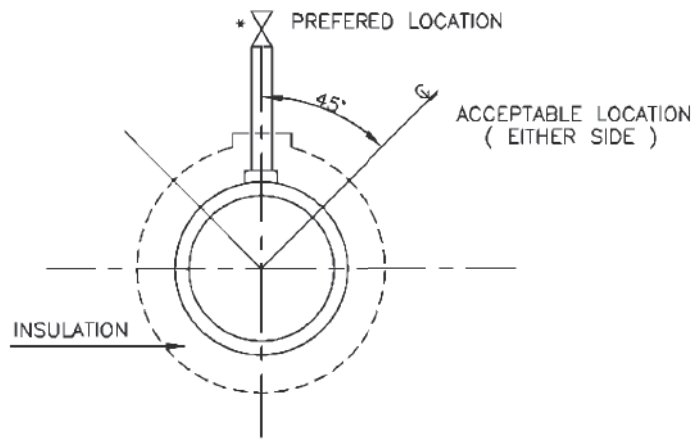
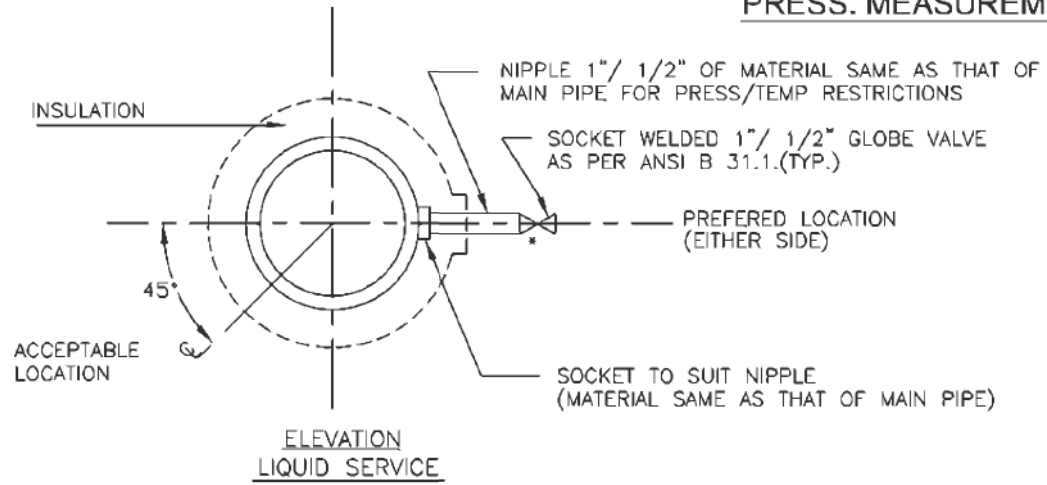
**C&I SPECIFICATION FOR
GYPSUM DEWATERING EQUIPMENT**

SECTION: C
SUB SECTION: C&I

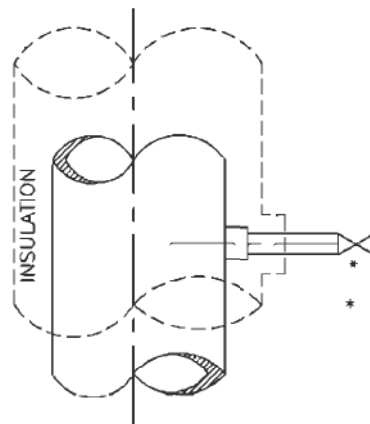
INSTRUMENT STUB DETAILS

THIS IS PART OF TECHNICAL SPECIFICATION PE-TS-468-571-A901 REV 00.

PRESS. MEASUREMENT



PRESSURE CONNECTION ON HORIZONTAL PIPE



PRESSURE CONNECTIONS ON VERTICAL PIPES

FOR TENDER PURPOSE ONLY



NTPC LIMITED
(A GOVERNMENT OF INDIA ENTERPRISE)
ENGINEERING DIVISION

PROJECT **TYPICAL THERMAL POWER PROJECT**

TITLE **INSTRUMENT SOURCE CONNECTION DETAILS**

REV. NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	E	C	O&I	ARCH.	APPD.	DATE
A	FIRST ISSUE									T.G.	07.08.12
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SIZE	SCALE	DRG. NO.	REV. NO.
A4	N.T.S.	0000-999-POI-A-035	A

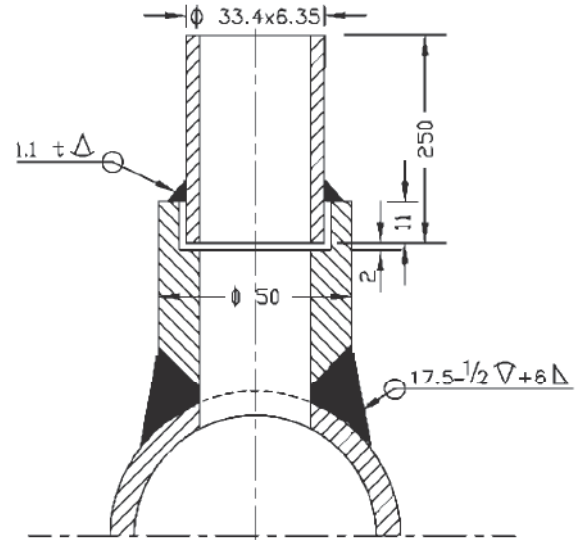
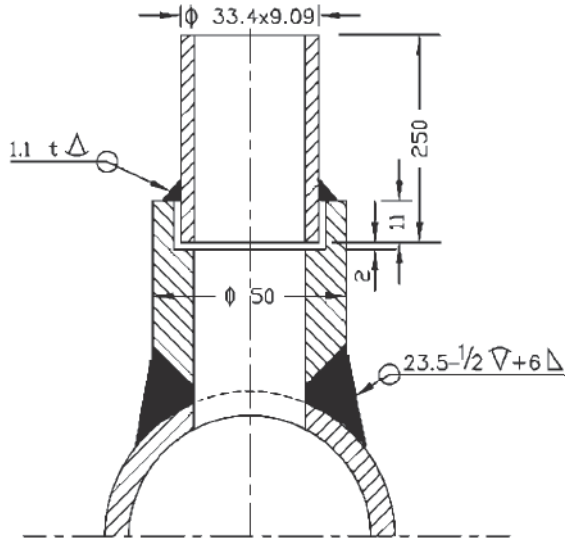
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PRESSURE MEASUREMENT

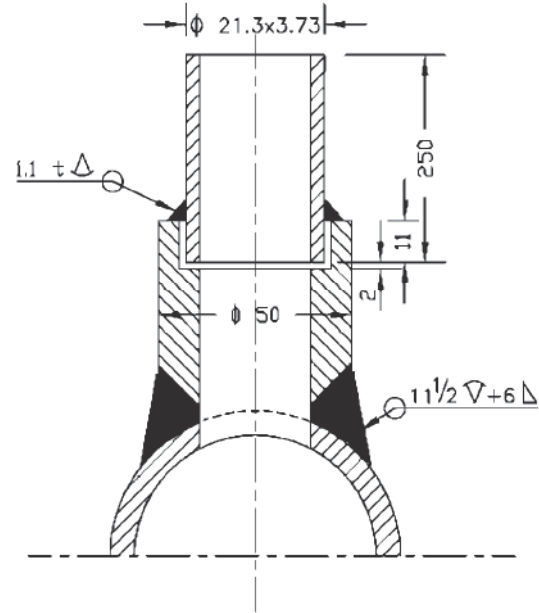
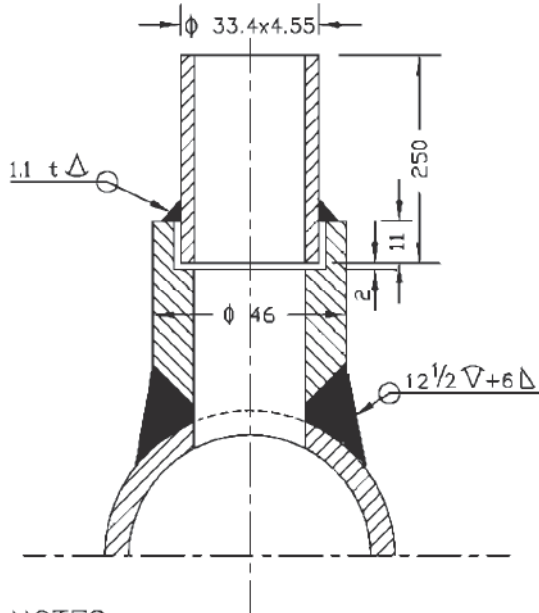
(SYSTEM PR. >40Kg/Sq Cm CL 9000)

(SYSTEM PR. >40Kg/Sq Cm CL 6000)



(SYSTEM PR. <40Kg/Sq cm Nb 25 CL 3000)

(SYSTEM PR. <40Kg/Sq cm Nb 15 CL 3000)




NOTES:-

1. MATERIAL OF THE BOSS AND NIPPLE SHALL BE THE SAME AS THE PIPE INTO WHICH IT IS WELDED AND CONFIRM TO ANSI B 16.11.
2. THE LENGTH OF THE NIPPLE SHOULD BE 250mm.
3. THE OTHER END OF THE NIPPLE SHALL BE SOCKET WELDED WITH 1" GLOBE VALVE OF MATERIAL AS PER ANSI B 16.1.
4. TWO ISOLATED VALVES ARE TO BE USED FOR PRESSURE = >40 Kg/Cm2.
5. EDGE HOLE MUST BE CLEAN AND SQUARE OR ROUNDED SLIGHTLY (1/64" RADIUS) FREE FROM BURRS, WIRE EDGES OR OTHER IRREGULARITIES.
6. ORIENTATION OF TAP WILL BE VARY WITH TYPE OF PROCESS FLUID AND NATURE OF RUN OF THE PIPE.
7. ACTIVITIES TO BE COMPLETED AT THE SHOP, WELD THE COUPLING (OR BOSS) ON THE PIPE AND DRILL PRESSURE CONNECTION HOLE (SAME AS I D OF NIPPLE) IN THE PIPE IN ALLIGNMENT WITH HOLE IN THE COUPLING.
8. ALL DIMENSIONS ARE IN mm UNLESS OTHERWISE STATED.

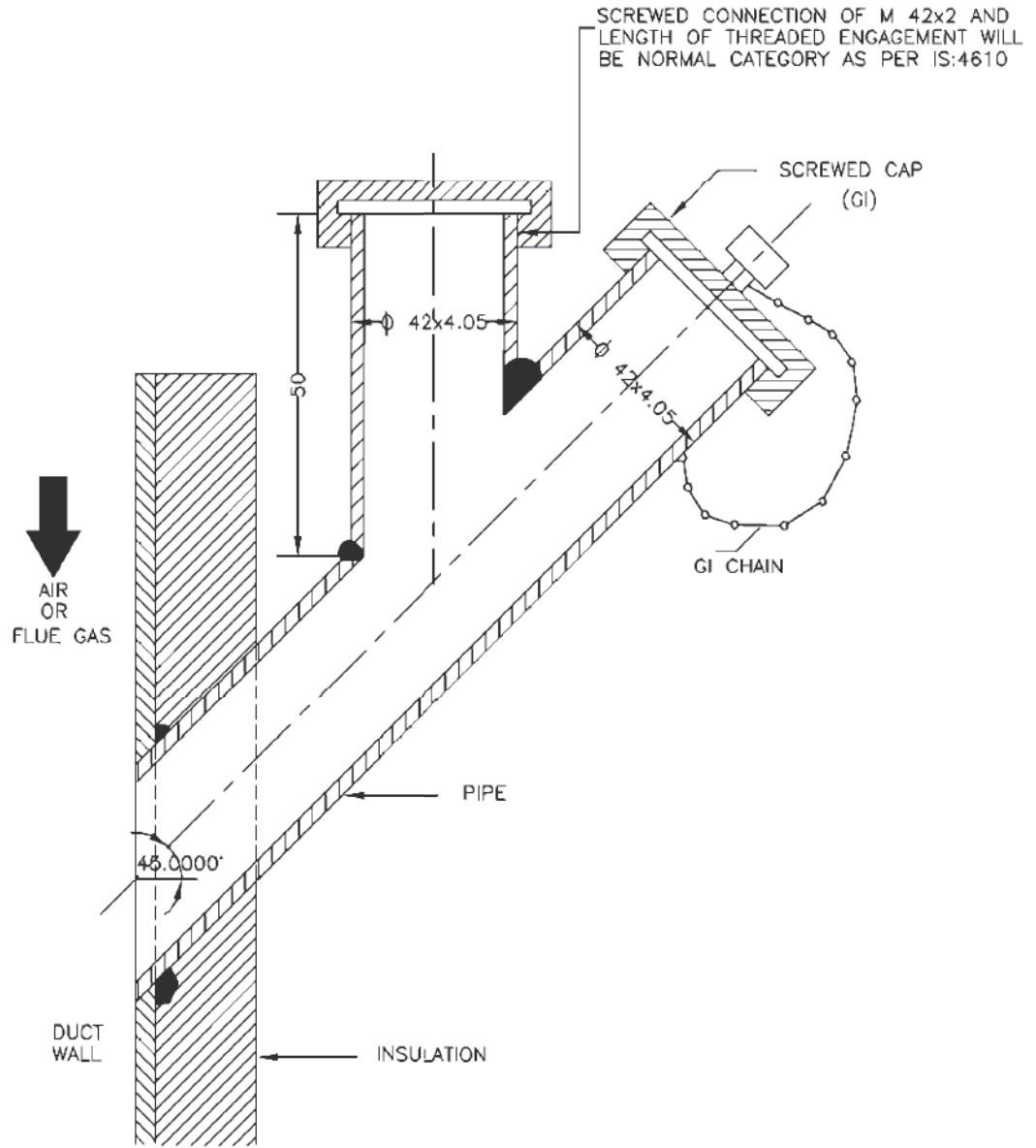
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PROJECT										TYPICAL THERMAL POWER PROJECT			
TITLE										INSTRUMENT SOURCE CONNECTION DETAILS			
REV. NO.										SIZE	SCALE	DRG. NO.	REV. NO.
DESCRIPTION										A4	N.T.S.	0000-999-POI-A-035	A
DRAWN/DESIGN										CLEARED BY		Sh-2 Of 14	
M										E		C	
O&I										ARCH.		APPD.	
DATE										DATE		DATE	


PRESS. MEASUREMENT



NOTES:-

1. THIS TYPE OF PRESSURE CONNECTON SHALL BE PROVIDED FOR PRESSURE MEASUREMENTS IN AIR AND FLUE GAS DUCT/FURNACE.
2. DIMENSIONS ARE INDICATIVE ONLY.

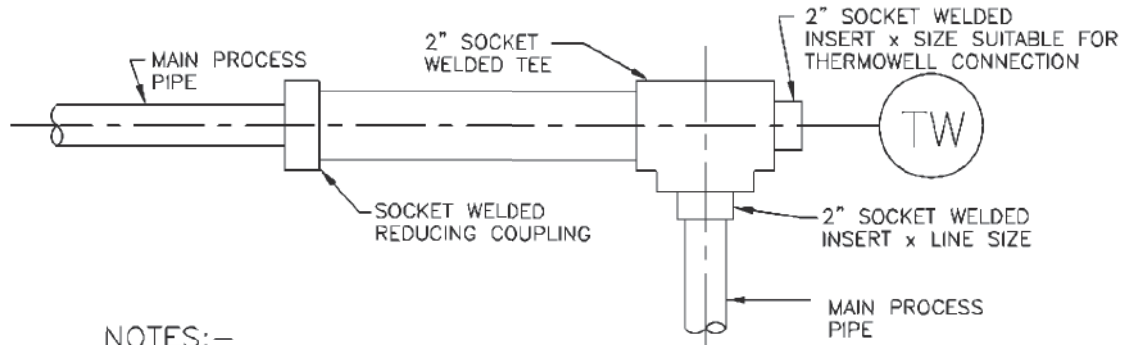
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PROJECT					TYPICAL THERMAL POWER PROJECT										
TITLE					INSTRUMENT SOURCE CONNECTION DETAILS										
REV. NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	E	C	O&I	ARCH.	APFD.	DATE	SIZE	SCALE	DRG. NO.	REV. NO.
A	FIRST ISSUE											A4	N.T.S.	0000-999-POI-A-035	A
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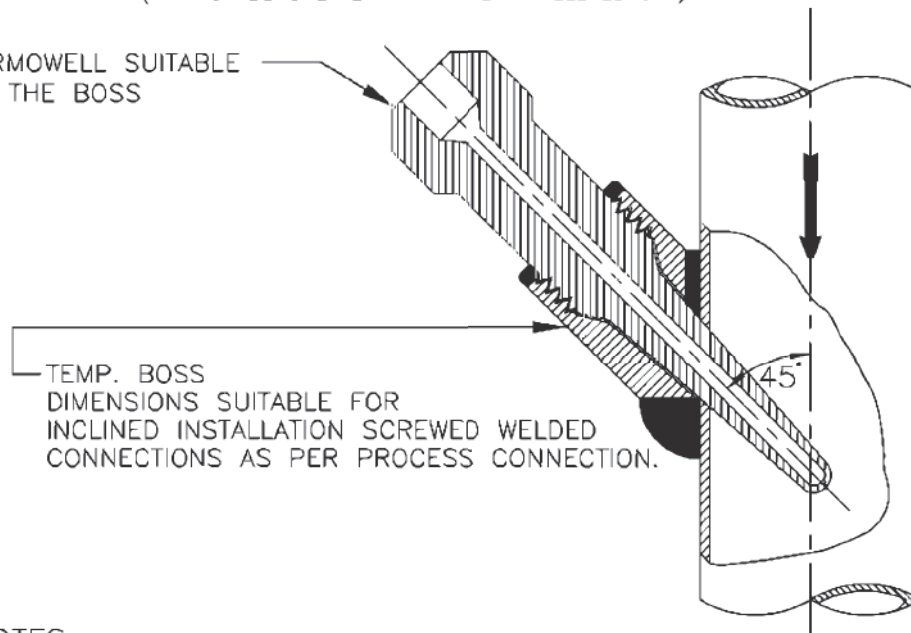
TEMP. MEASUREMENT



NOTES:-

1. THIS TYPE OF THERMOWELL INSTALLATION IS SUITABLE FOR THE PROCESS PIPE OF 2" NPS AND SMALLER.
2. FOR STEAM SERVICE THIS TYPE OF THERMOWELL INSTALLATION 90° BEND MAY BE USED ONLY IN VERTICAL PLANE.
3. THE LENGTH OF THE LARGER PIPE SECTION SHALL BE MINIMUM 150mm (IT MUST BE GREATER THAN THERMOWELL LENGTH).

THERMOWELL SUITABLE FOR THE BOSS




TEMP. BOSS DIMENSIONS SUITABLE FOR INCLINED INSTALLATION SCREWED WELDED CONNECTIONS AS PER PROCESS CONNECTION.

NOTES:-

1. INCLINED INSTALLATION OF THERMOWELL SHALL BE APPLICABLE FOR 4" AND SMALLER LINE SIZE BUT LIMITED TO MIN. 3" LINE SIZE.
2. FOR 2" AND SMALLER LINE SIZE NECESSARY EXPANDER OF MIN. 3" SIZE OF MAIN PIPING SPECIFICATION SHALL BE USED.
3. THIS TYPE OF INSTALLATION IS APPLICABLE FOR HORIZONTAL AND VERTICAL PIPE SECTION.
4. FOR STEAM SERVICES EXPANDER SECTION MAY BE USED ONLY IN VERTICAL RUN.
5. THE EXPANDER SECTION SHALL BE OF ADEQUATE LENGTH (ATLEAST 3-4 TIMES DIA OF THE MAIN PROCESS PIPE AT BOTH SIDE OF THE INSTALLED THERMOWELL).

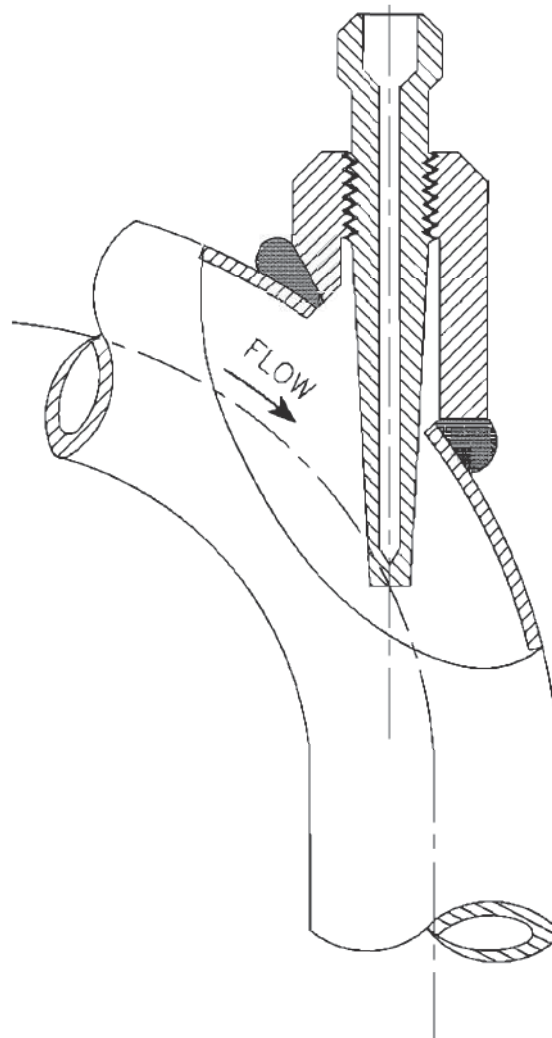
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PROJECT										TYPICAL THERMAL POWER PROJECT (SG PACKAGE)	
TITLE										INSTRUMENT SOURCE CONNECTION DETAILS	
A	FIRST ISSUE								T.G.	PLM/TP	
REV. NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	E	C	O&I	ARCH.	APFD.	DATE
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										SIZE	A4
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										DRG. NO.	0000-999/102-POI-A-035
										REV. NO.	A
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NOTES:—

1. FLOW INSTALLATION OF THERMOWELL SHALL BE APPLICABLE FOR 4" AND SMALLER LINE SIZE BUT LIMITED TO MINIMUM 3" LINE SIZE.
2. FOR 2" AND SMALLER LINE SIZE NECESSARY EXPANDER OF ELBOW FORM (AS SHOWN) OF MINIMUM 3" SIZE SHALL BE USED.
3. ELBOW EXPANDER SECTION IN HORIZONTAL PLANE MAY BE USED FOR LIQUID SERVICES. ONLY STEAM SERVICES EXPANDER SECTION MAY BE USED IN VERTICAL PLAN.

FOR TENDER PURPOSE ONLY



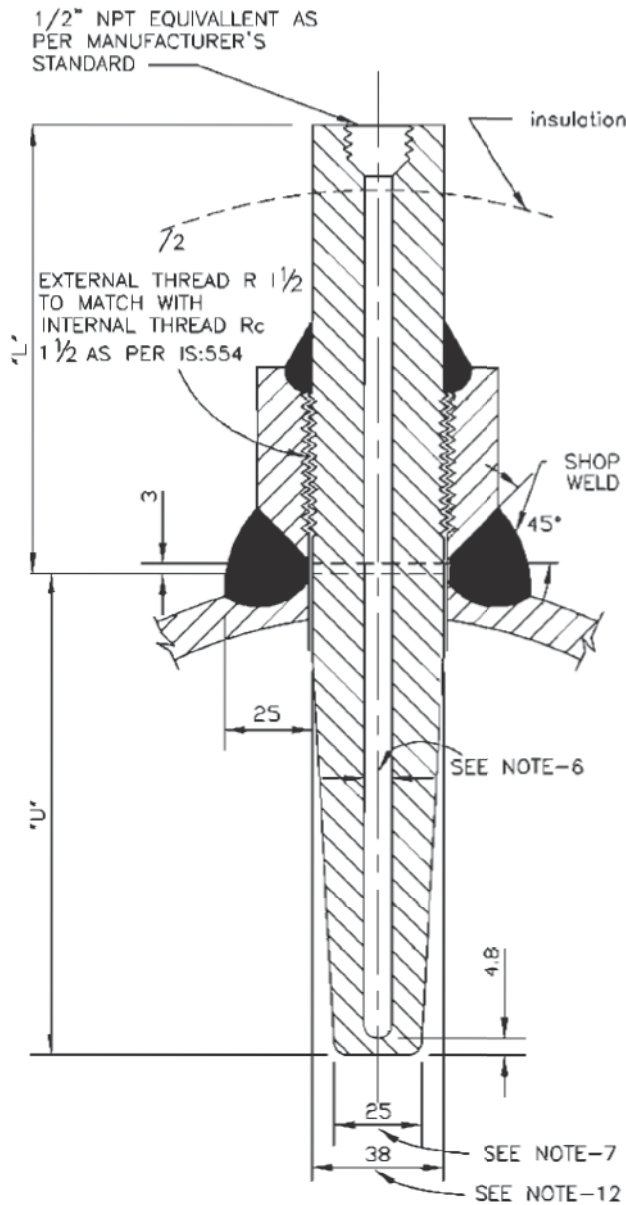
NTPC LIMITED
(A GOVERNMENT OF INDIA ENTERPRISE)
ENGINEERING DIVISION

PROJECT TYPICAL THERMAL POWER PROJECT

TITLE INSTRUMENT SOURCE CONNECTION DETAILS

REV. NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	E	C	O&I	ARCH.	APPD.	DATE	SIZE	SCALE	DRG. NO.	REV. NO.
A	FIRST ISSUE										21.08.16	A4	N.T.S.	0000-999-POI-A-035	A
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NOTES:-

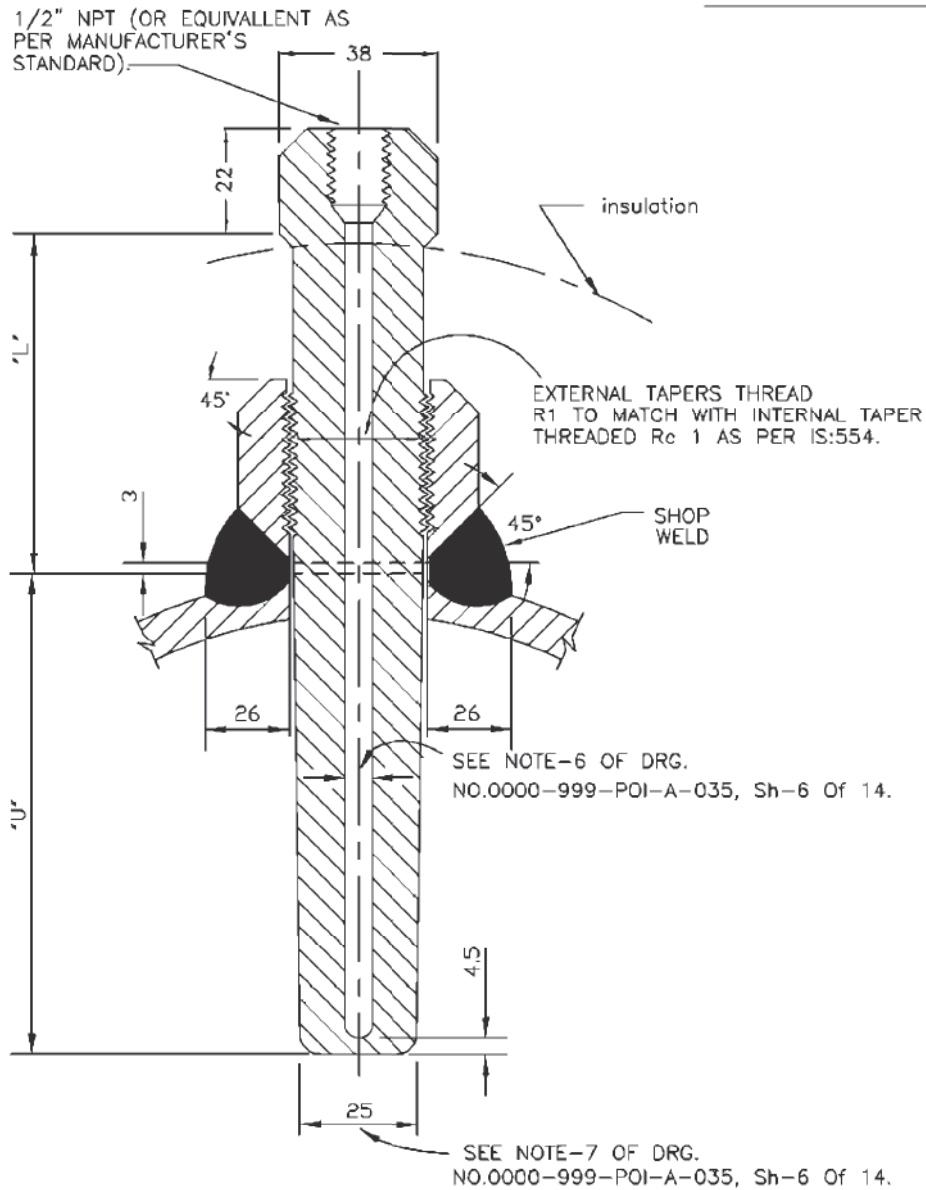
1. THIS TYPE OF TEMPERATURE BOSS SHALL BE USED FOR THE PROCESS PRESS EQUAL/ABOVE 40 Kg/Cm2(g).
2. THE MATERIAL OF THE BOSS SHOULD BE SIMILAR TO THAT OF PIPING MATERIAL OF SPECIFICATION.
3. ALL WELD TO BE TESTED IN ACCORDANCE WITH APPLICABLE CODES BY MANUFACTURER.
4. MATERIAL OF THE THERMOWELL SHALL BE OF 316SS.
5. THERMOWELL SHALL BE DRILLED BARSTOCK TYPE.
6. INTERNAL BORE OF THE THERMOWELL SHOULD BE SELECTED BASED ON THE NORMAL SIZE OF THE SENSING ELEMENT AS PER ASME,PTC-19.3.
7. THE BOTTOM DIAMETER OF THE THERMOWELL TYPICALLY SHOWN HERE SHALL BE SUBJECT TO VARIATION BASED ON THE INTERNAL BORE OF THERMOWELL AND THICKNESS OF THERMOWELL MATERIAL TO WITHSTAND THE PROCESS PRESS.AND TEMP.,AS PER ASME,PTC-19.3.
8. THE TYPE OF TAPERED THERMOWELL SHALL BE USED FOR LIQUID VELOCITIES UP TO 92M.P.S.(300F.T.P.S.).
9. THERMOWELL WITH THE INSULATION LAG EXTENSIONS SHALL BE USED WHEREVER APPLICABLE.
10. ACTIVITIES TO BE COMPLETED AT THE SHOP. WELD THE BOSS ON THE PIPE AND DRILL THE HOLE IN THE PIPE IN ALIGNMENT WITH HOLE IN THE BOSS. PROVIDE INTERNAL THREAD AS PER IS:554 TO MATCH WITH THE THERMOWELL EXTERNAL THREAD.
11. ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE STATED.
12. WILL BE SUITABLE TO MATCH THE STUB DIMENSIONS AS PER RC 1 1/2
13. THE "U" & "L" DIMENSIONS SHALL BE SELECTED BASED ON PARTICULAR APPLICATION AND THE SAME SHALL BE SUBJECT TO OWNER'S APPROVAL DURING DETAILED ENGINEERING.
14. ALL DIMENSIONS ARE INDICATIVE ONLY.

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										PROJECT		TYPICAL THERMAL POWER PROJECT			
										TITLE		INSTRUMENT SOURCE CONNECTION DETAILS			
REV. NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	E	C	CAI	ARCH.	APPD.	DATE	SIZE	SCALE	ORG. NO.	REV. NO.
A	FIRST ISSUE											A4	N.T.S.	0000-999-POI-A-035	A
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NOTES:-

1. THIS TYPE OF TEMPERATURE BOSS IS APPLICABLE FOR THE PROCESS PRESSURE/TEMPERATURE BELOW 40 Kg/Cm2(g)/400°C
2. FOR PRESSURE TIGHT JOINTS THE BOSS SHOULD HAVE INTERNAL TAPERED PIPE THREAD Rc 1 AS PER IS:554. THE LENGTH OF THREAD ENGAGEMENT SHOULD BE AS PER ABOVE STANDARD.
3. PIPES HAVING PROBABILITY OF PROLONGED VIBRATION SEAL WELDING MAY BE DONE ALL AROUND AFTER TIGHTENING THERMOWELL WITHIN THE BOSS.
4. SEE NOTES-2 TO 14 OF DRG. NO. 0000-999-POI-A-035, Sh-6 Of 14.

FOR TENDER PURPOSE ONLY



NTPC LIMITED
(A GOVERNMENT OF INDIA ENTERPRISE)
ENGINEERING DIVISION

PROJECT TYPICAL THERMAL POWER PROJECT

TITLE INSTRUMENT SOURCE CONNECTION DETAILS

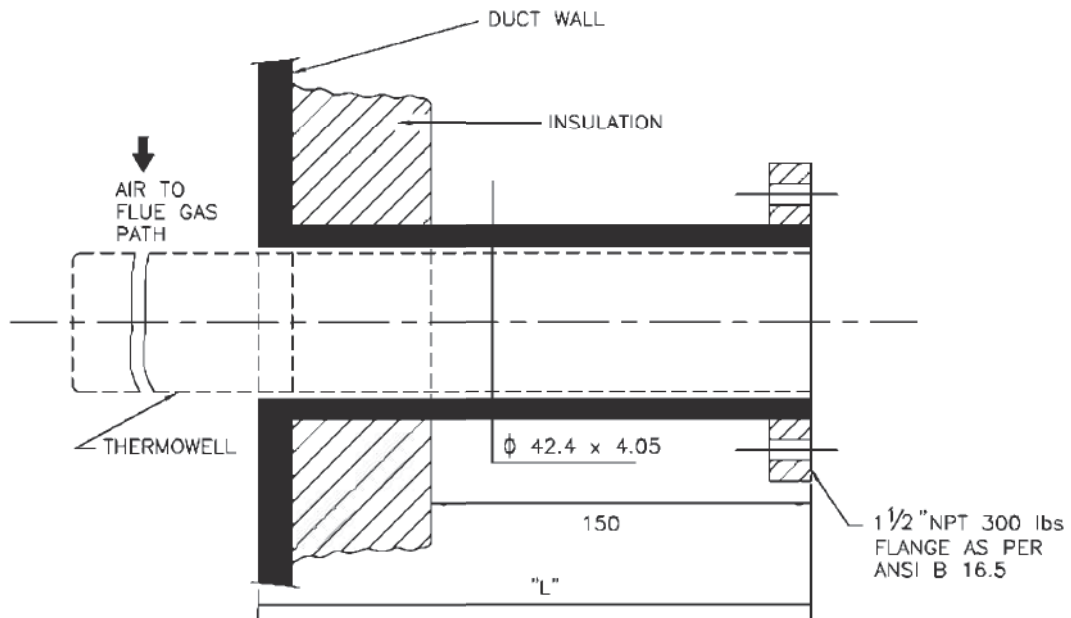
REV. NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	E	C	O&I	ARCH.	APFD.	DATE
A	FIRST ISSUE										21.08.18
CLEARED BY											

SIZE	SCALE	DRG. NO.	REV. NO.
A4	N.T.S.	0000-999-POI-A-035	A

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THIS IS PART OF TECHNICAL SPECIFICATION PE-TS-468-571-A901-REV-00.

TEMP. MEASUREMENT



NOTES:—

1. THIS TYPE OF TEMPERATURE CONNECTIONS SHALL BE PROVIDED FOR TEMPERATURE MEASUREMENT IN AIR AND FLUE GAS DUCT.
2. MATERIAL OF THERMOWELL SHALL BE OF 316SS.
3. EXTERNAL CONNECTION SHALL BE OF SLIP ON FLANGED TYPE AND THERMOWELL DESIGN SHALL BE AS PER ASME.PTC-19.3 (REFER NOTES 9&10 OF DRG.NO. 0000-999-POI-A-035, Sh-6 Of 14).
4. BIDDER TO SUPPLY AND INSTALL THE COUNTER FLANGED AND THERMOWELL (ALONG WITH TEMP. ELEMENT).
5. ALL DIMENSIONS ARE INDICATIVE ONLY.

FOR TENDER PURPOSE ONLY



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ENGINEERING DIVISION

PROJECT **TYPICAL THERMAL POWER PROJECT**

TITLE **INSTRUMENT SOURCE CONNECTION DETAILS**

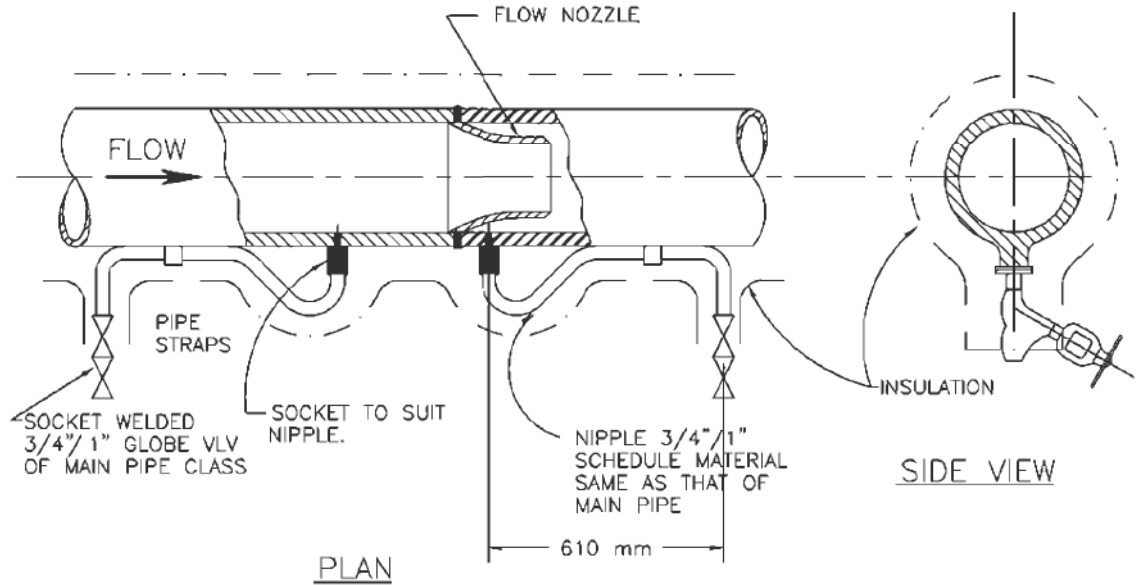
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A	FIRST ISSUE										27.08.19
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SIZE	SCALE	DRG. NO.	REV. NO.
A4	N.T.S.	0000-999-POI-A-035	A

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FLOW MEASUREMENT



NOTES:-

1. THIS METHOD OF CONNECTING NIPPLES AND VALVES ON THE HORIZONTAL PIPE IS APPLICABLE FOR MEASUREMENT OF STEAM AT TEMP. ABOVE 455°C .
2. FOR STEAM SERVICE IN HORIZONTAL PIPE THE PRESSURE HOLES AND CONNECTING NIPPLES SHOULD BE IN THE HORIZONTAL PLANE OF THE PIPE CENTRE LINE.
3. THE ENTIRE LENGTH OF THESE NIPPLES AS WELL AS SHUT OFF VALVES SHOULD BE LAGGED IN WITH STEAM LINE AS SHOWN IN THE DRAWING.
4. FLOW ELEMENTS SHALL BE PROVIDED WITH 3 PAIRS OF TAPPING POINTS.

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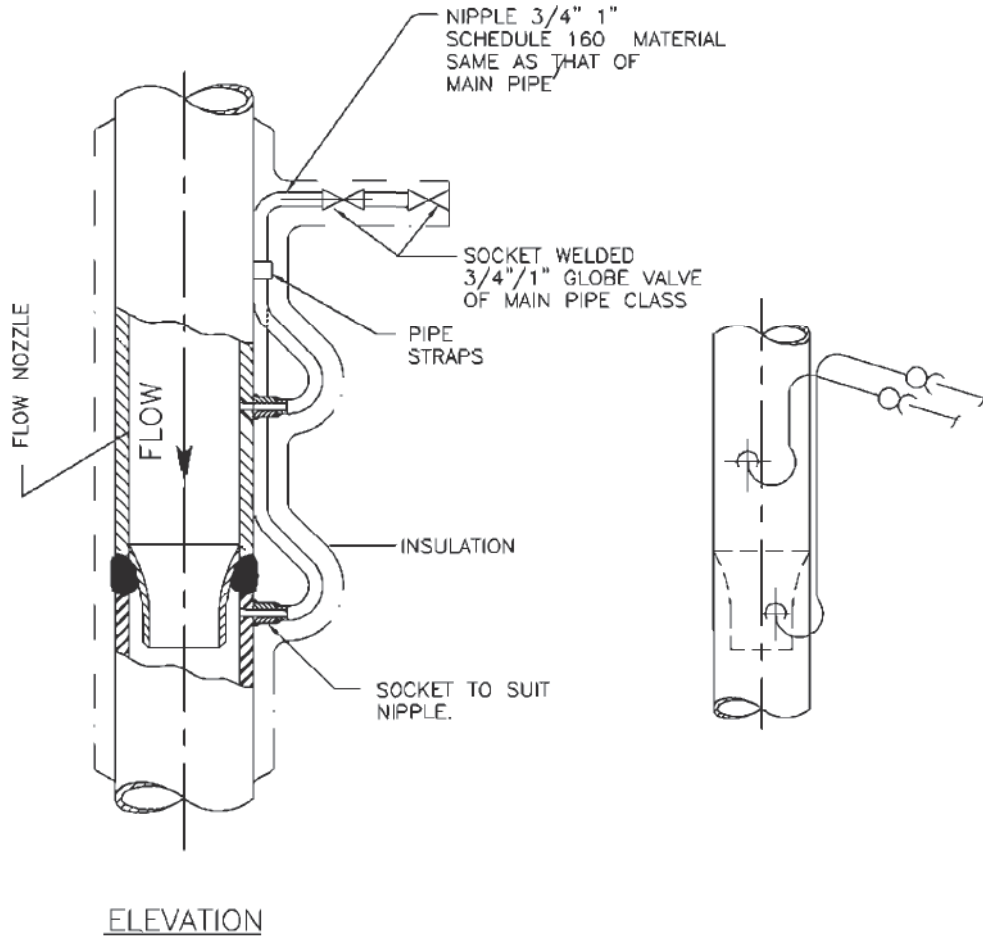
PROJECT TYPICAL THERMAL POWER PROJECT

TITLE INSTRUMENT SOURCE CONNECTION DETAILS

REV. NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	E	C	O&I	ARCH.	APPR.	DATE
A	FIRST ISSUE									T.G.	21.08.12
CLEARED BY											

SIZE	SCALE	DRG. NO.	REV. NO.
A4	N.T.S.	0000-999-POI-A-035	A

FLOW MEASUREMENT



NOTES:-

1. THIS METHOD OF CONNECTING NIPPLES AND VALVES ON THE VERTICAL STEAM PIPE IS APPLICABLE FOR MEASUREMENT OF STEAM AT TEMP. ABOVE 455°C
2. THE ENTIRE LENGTH OF THESE NIPPLES AS WELL AS SHUT OFF VALVES SHOULD BE LAGGED IN WITH STEAM LINE AS SHOWN IN THE DRAWING.
3. ON VERTICAL STEAM PIPE BOTH HIGH TEMPERATURE (SPECIAL VENTS) NIPPLES WILL BE LONG ENOUGH SO THAT HIGH AND LOW PRESSURE CONNECTION NIPPLES WILL BE AT SAME LEVEL.
4. UP STREAM AND DOWN STREAM PRESSURE CONNECTIONS MUST BE INSTALLED IN DIFFERENT PLANES PASSING THROUGH THE CENTRE OF THE PIPE.
5. FLOW ELEMENTS SHALL BE PROVIDED WITH 3 PAIRS OF TAPPING POINTS.

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ENGINEERING DIVISION

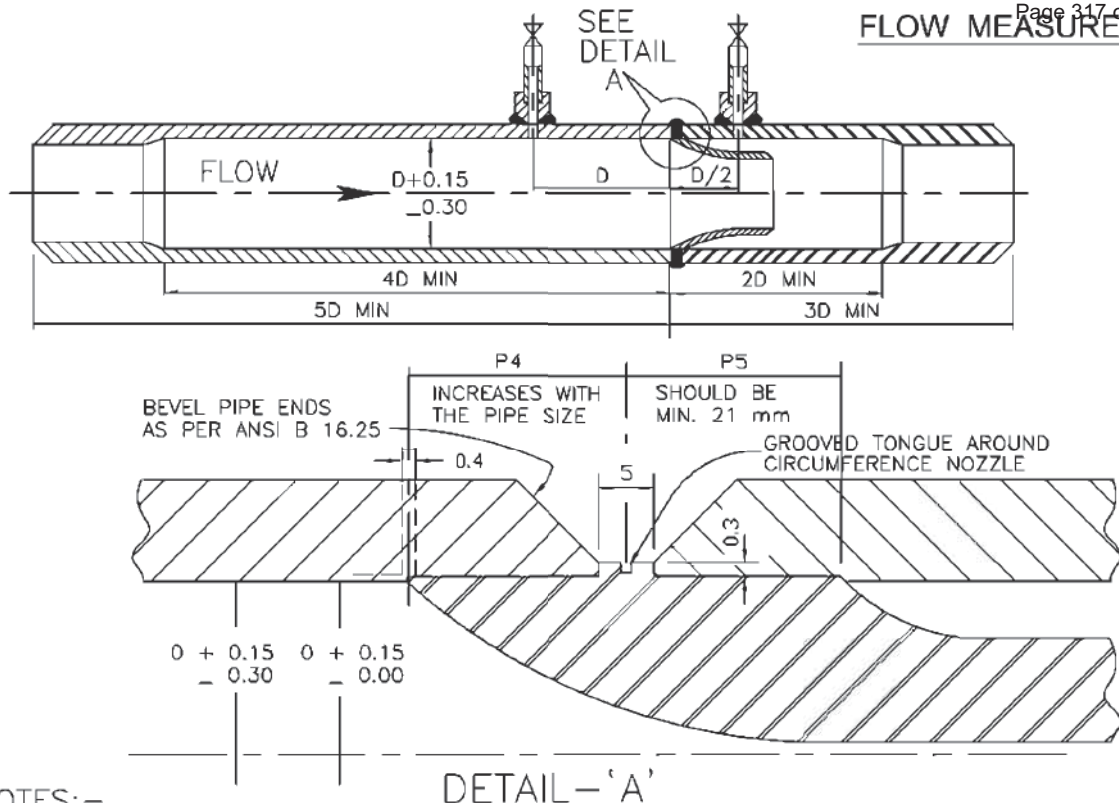
PROJECT **TYPICAL THERMAL POWER PROJECT**

TITLE **INSTRUMENT SOURCE CONNECTION DETAILS**

REV. NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	E	C	O&I	ARCH.	APFD.	DATE
A	FIRST ISSUE										
CLEARED BY											

SIZE	SCALE	DRG. NO.	REV. NO.
A4	N.T.S.	0000-999-POI-A-035	A

FLOW MEASUREMENT



NOTES:-

1. COMPLETE FLOW NOZZLE BRANCH ASSEMBLY ALONG WITH NIPPLES AND SOURCE ISOLATION VALVES SHALL BE SUPPLIED BY THE BIDDER. THE BIDDER ALSO TO INSTALL FLOW NOZZLE WITHIN THE MACHINED BRANCH, PRESSURE STUBS ON THE BRANCH PIPE (FOR ORIENTATION OF PRESSURE TAP REF. NOTE-3) ALONG WITH NIPPLE AND SOURCE ISOLATION VALVES.
2. THE MACHINING OF BRANCH PIPE SHOULD BE DONE AFTER PRESSURE CONNECTIONS HAVE BEEN WELDED TO PIPE AND ALSO EXTEND FOR ATLEAST 4D IN THE INLET SECTION, 2D IN THE OUTLET SECTION, MEASURED FROM THE INLET FACE OF FLOW NOZZLE. TOTAL BRANCH PIPE ASSEMBLY SHOULD BE ATLEAST A LENGTH OF 8D/5D IN THE INLET SECTION AND 3D IN THE OUTLET SECTION, MEASURED FROM THE INLET FACE OF THE FLOW NOZZLE AS SHOWN ABOVE.
3. ON HORIZONTAL PIPE RUN PRESSURE CONNECTIONS ARE TO BE LOCATED ON SIDES OF THE PIPE FOR LIQUID AND STEAM SERVICE AND ON THE TOP FOR DRY GAS SERVICE FOR PROCESS LIQUIDS. INSTALLATION OF PRESS. TAPS MAY BE ALLOWED WITHIN AN ANGLE OF 45° ELBOW HORIZONTAL FOR SPECIAL CASES BUT NO BOTTOM CONNECTIONS ARE ALLOWED.
4. THE LOCATION OF PRESSURE TAPS MUST BE WITHIN 1.5 mm (1/16") OF DISTANCE SPECIFIED AND NUMBER OF PAIRS OF PRESSURE TAPS TO BE PROVIDED WILL BE AS PER FLOW MEASUREMENT DATA SHEET.
5. PRESSURE TAPS SHOULD BE DRILLED RADIALLY WITH RESPECT TO PIPE AND THIS DRILLING SHOULD BE DONE AFTER ANY COUPLING FOR ATTACHING THE PRESSURE TUBING HAS BEEN WELDED TO THE PIPE. THE HOLE WHERE IT BREAKS THROUGH THE INNER SURFACE OF THE PIPE MUST BE FREE OF BURRS OR WIRE EDGE AND CORNER OF EDGE HOLE LEFT ROUNDED VERY SLIGHTLY (1/64" RADIUS).
6. RECOMMENDED MAXIMUM DIAMETERS OF PRESSURE TAP HOLES IN THE BRANCH PIPES WILL BE AS PER EN ISO 5167:2003. THE DIAMETER FOR HOLE SHOULD REMAIN SAME FOR DISTANCE NOT LESS THAN 2.5 TIME OF DIA FROM THE INNER SURFACE OF THE PIPE.
7. FLOW NOZZLE SHALL BE CENTRED IN THE PIPE WITHIN 0.8 mm (1/32") OF THE PIPE AXIS. INSIDE DIAMETER MEASURED AT FOUR POINTS AT ANY CROSS SECTION SHALL NOT DIFFER BY MORE THAN 1%.
8. BRANCH PIPE SHALL BE AS PER MAIN PIPING MATERIAL SPECIFICATION. INTERNAL SURFACE OF BORED SECTIONS MUST BE SMOOTH AND STRAIGHT, FREE FROM SCALES, PITS, BURRS OR ANY IRREGULARITIES.
9. FLOW NOZZLE MATERIAL SHALL BE 316 SS AND THE DESIGN AS PER ASME.
10. MAXIMUM UPSTREAM AND DOWN STREAM STRAIGHT LENGTH REQUIRED FROM INLET FACE OF FLOW NOZZLE SHALL BE AS PER EN ISO 5167:2003.

DETAIL - 'A'

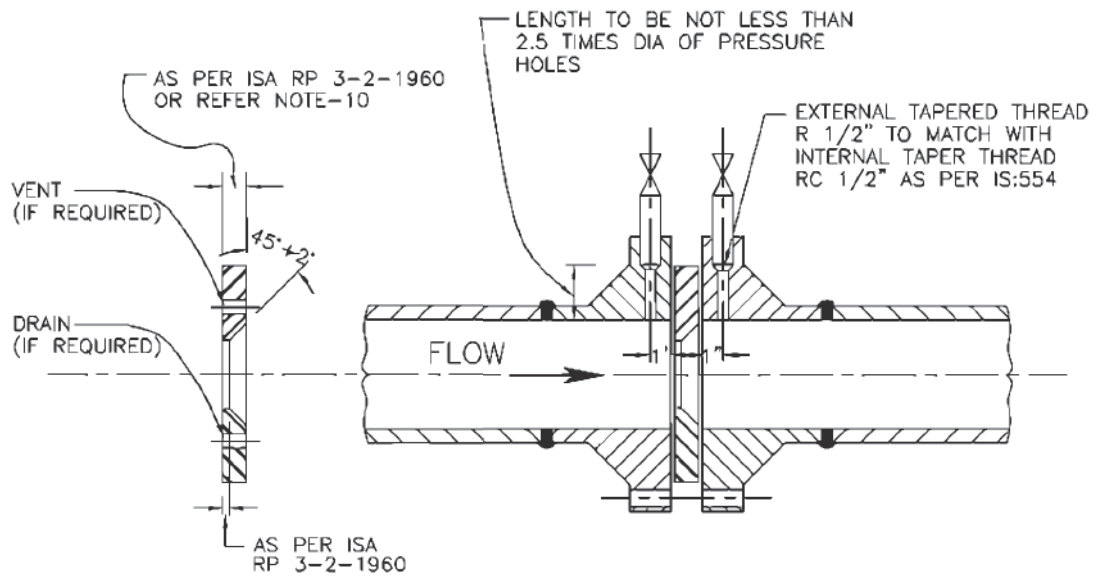
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PROJECT					TYPICAL THERMAL POWER PROJECT								
TITLE					INSTRUMENT SOURCE CONNECTION DETAILS								
REV. NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	E	C	O/I	ARCH.	APPD.	DATE		
A	FIRST ISSUE										21.08.14		
CLEARED BY										SIZE	SCALE	DRG. NO.	REV. NO.
										A4	N.T.S.	0000-999-POI-A-035	A
Sh-11 Of 14													

FLOW MEASUREMENT




NOTES:—

1. ORIFICE PLATE MOUNTED BETWEEN FLANGES WITH FLANGE TAPPING (AS SHOWN ABOVE) SHOULD BE LIMITED TO PIPE SIZES OF 2" OR LARGER.
2. ORIFICE PLATE SHALL BE MOUNTED BETWEEN PIPING FLANGES WITH THE SHARP EDGE FACING UPSTREAM SUCH THAT CENTRE OF THE CONCENTRIC ORIFICE SHOULD BE WITHIN 0.79 mm (1/32") OF THE AXIS OF THE PIPE.
3. TWO GASKETS SHALL BE INSERTED BETWEEN THE PLATE AND THE FLANGES AND INSIDE DIAMETER OF THE GASKETS SHOULD BE ATLEAST 1.5 mm (1/16") GREATER THAN THE INSIDE DIAMETER OF THE PIPE SO THAT THEY DO NOT PROTRUDE INTO THE PIPE.
4. PIPING FLANGES SHALL BE ANSI WELD NECK, RAISED FACE TYPE. THE FLANGE IS TO BE ALIGNED WITH THE FACE PERPENDICULAR TO THE FLOW AXIS.
5. BIDDER TO SUPPLY ORIFICE PLATE SPECIAL TYPE (HAVING PRESS. CONNECTIONS) OF FLANGES ALONG WITH GASKETS, NIPPLES AND SOURCE VALVES.
6. ON HORIZONTAL PIPE RUN PRESSURE CONNECTIONS ARE TO BE TAKEN FROM SIDES FOR LIQUID AND STEAM SERVICE AND FROM TOP FOR DRY GAS SERVICE. FOR PROCESS LIQUIDS INSTALLATION OF PRESSURE TAPS MAY BE ALLOWED WITHIN AN ANGLE OF 45° ELBOW THE HORIZONTAL IN SPECIAL CASES BUT NO BOTTOM CONNECTIONS ARE ALLOWED.
7. THE LOCATION OF PRESSURE TAPS MUST BE WITHIN 1.5 mm (1/16") OF THE DISTANCE SPECIFIED.
8. MAXIMUM DIAMETER OF PRESS. CONNECTION HOLES SHALL BE AS PER RECOMMENDATIONS OF ASME PTC 19.5. THE DIAMETER OF THE HOLE SHOULD REMAIN THE SAME FOR A DISTANCE NOT LESS THAN 2.5 TIMES OF THE DIAMETER BEFORE EXPANDING INTO THE PRESSURE PIPE.
9. THERE MUST BE NO BURRS WIRE EDGES OR OTHER IRREGULARITIES ALONG THE EDGE OF THE HOLE AND IT MUST BE SQUARE AND ROUNDED SLIGHTLY (1/64" RADIUS).
10. ORIFICE PLATE SHOULD BE FLAT WITHIN 0.02 mm (0.001") AND THE SURFACE ROUGHNESS SHOULD NOT EXCEED 20 MICRO INCH. THE THICKNESS OF THE ORIFICE PLATE SHOULD BE AS PER EN ISO 5167:2003.
11. FOR HORIZONTAL PIPE RUN DRAIN HOLES IN ORIFICE PLATES ARE AT THE BOTTOM (APPROX. TANGENT TO INSIDE DIA OF PIPE) FOR STEAM OR GAS SERVICE. VENT HOLES SHOULD BE LOCATED ON UPPER SIDE FOR INCOMPRESSIBLE FLUID.
12. ORIFICE PLATE SHOULD BE OF 316 SS (ASTM A167-54 GRADE-II).
13. RECOMMENDED MINIMUM LENGTHS OF STRAIGHT PIPE PRECEDING AND FOLLOWING ORIFICES SHALL BE AS PER EN ISO 5167:2003.
14. THREE PAIRS OF PRESSURE TAPS SHALL BE PROVIDED WITH NIPPLES OF REQUIRED LENGTH AND SOURCE VALVES AND THE UN-USED TAPS ARE PLUGGED.
15. THE INTERNAL TAPERED CONNECTION WITHIN THE FLANGE FOR PRESSURE TAPS SHOULD BE RC 1/2" AND THE NIPPLE SHOULD ALSO OF EXTERNAL THREADED R 1/2" AS PER IS:554. THE LENGTH OF THREADED ENGAGEMENT SHALL BE AS PER ABOVE STANDARD.

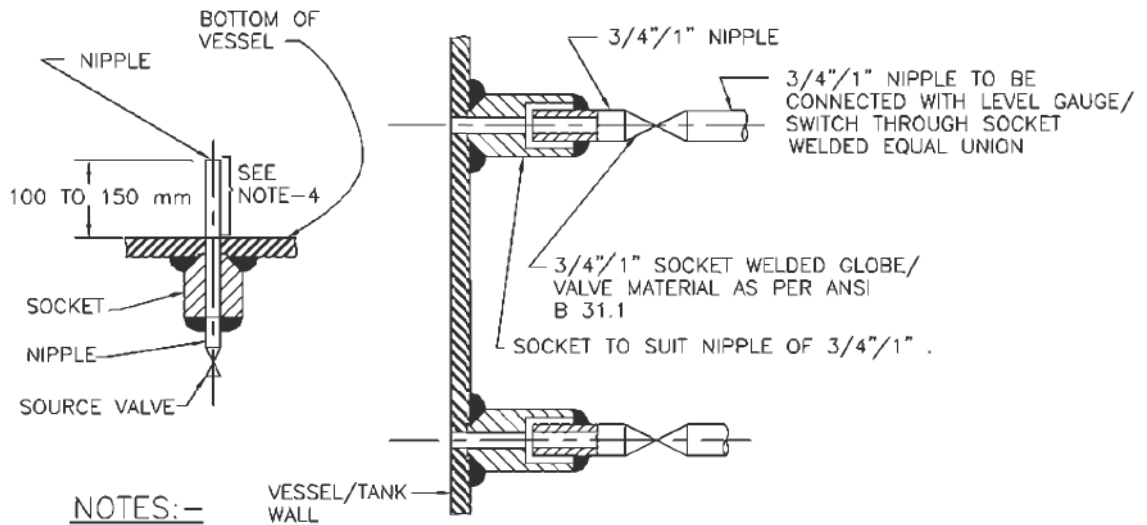
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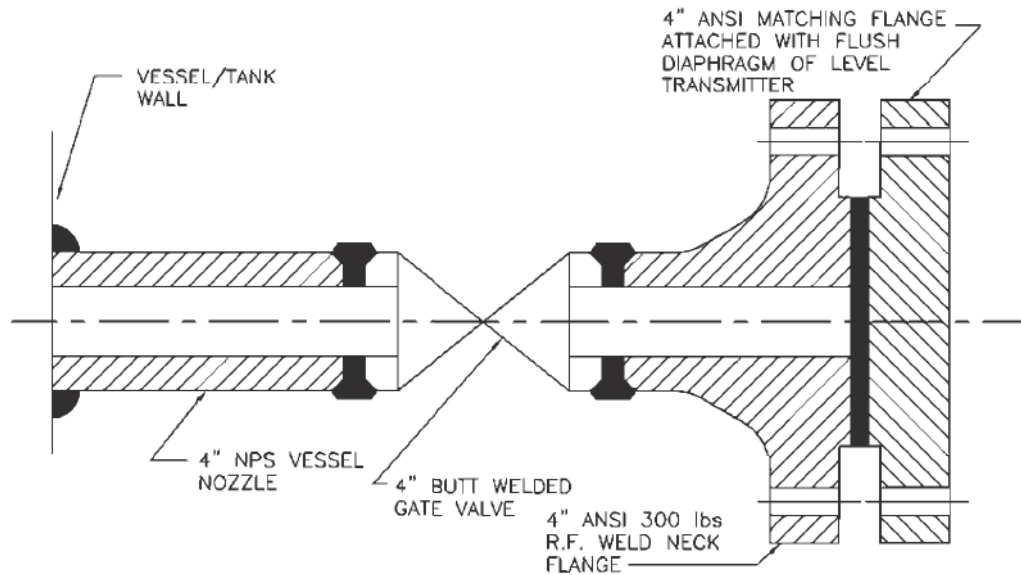
										 NTPC LIMITED (A GOVERNMENT OF INDIA ENTERPRISE) ENGINEERING DIVISION	
PROJECT										TYPICAL THERMAL POWER PROJECT	
TITLE										INSTRUMENT SOURCE CONNECTION DETAILS	
A	FIRST ISSUE								T.G.		31-08-18
REV. NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	E	C	OR	ARCH.	APPD.	DATE
Cleared by										SIZE	A4
										SCALE	N.T.S.
										DRG. NO.	0000-999-POI-A-035
										REV. NO.	A
										Sh-12 Of 14	

LEVEL MEASUREMENT



NOTES:-


1. THIS TYPE OF PROCESS CONNECTION SHALL BE USED FOR LEVEL GAUGE AND EXTERNAL CAGE TYPE FLOAT OR DISPLACER OPERATED LEVEL SWITCH.
2. FOR GAUGES 3/4" NIPPLE ALONG WITH 3/4" SW SOURCE VALVE AND FOR SWITCHES 1" NIPPLE ALONG WITH 1" SW SOURCE VALVE SHALL BE PROVIDED AS PROCESS CONNECTION.
3. SOURCE CONNECTION ON VESSEL SHOULD NOT BE LOCATED AT PLACES SUBJECTED TO INTERFACE AND TURBULENCE FROM INLETS AND OUTLETS.
4. IF LOWER CONNECTION IS TAKEN FROM BOTTOM OF THE VESSEL THEN THE NIPPLE MUST BE 100 mm TO 150 mm ABOVE THE BOTTOM OF THE VESSEL.



NOTES:-

1. THIS TYPE OF PROCESS CONNECTION SHALL BE PROVIDED FOR TANK LEVEL MEASUREMENT OF VISCOUS OR CORROSIVE LIQUID USING FLUSH DIAPHRAGM/WAFER TYPE LEVEL TRANSMITTER.
2. WELDING OF MATCHING FLANGE TO GATE VALVE SHALL BE DONE BY BIDDER.

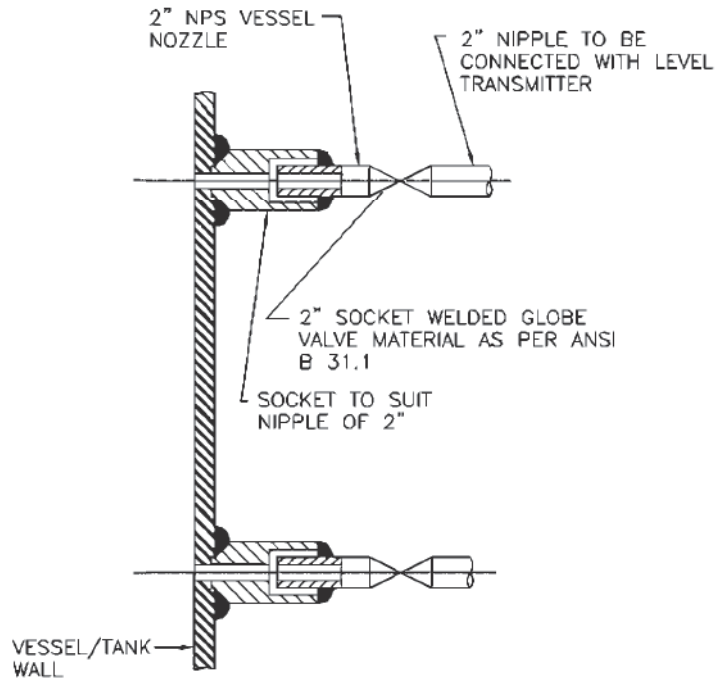
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 NTPC LIMITED (A GOVERNMENT OF INDIA ENTERPRISE) ENGINEERING DIVISION															
PROJECT					TYPICAL THERMAL POWER PROJECT										
TITLE					INSTRUMENT SOURCE CONNECTION DETAILS										
REV. NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	E	C	O&I	ARCH.	APPR.	DATE	SIZE	SCALE	DRG. NO.	REV. NO.
A	FIRST ISSUE											A4	N.T.S.	0000-999-POI-A-035	A
CLEARED BY										Sh-13 Of 14					

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LEVEL MEASUREMENT



NOTES:-

1. THIS TYPE OF PROCESS CONNECTION SHALL BE USED FOR DISPLACER TYPE LEVEL TRANSMITTER.
2. SOURCE CONNECTION ON VESSEL SHOULD NOT BE LOCATED AT PLACES SUBJECTED TO INTERFACE AND TURBULENCE FROM INLETS AND OUTLETS.
3. IF LOWER CONNECTION IS TAKEN FROM BOTTOM OF THE VESSEL THEN THE NIPPLE MUST BE 100 mm TO 150 mm ABOVE THE BOTTOM OF THE VESSEL.

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PROJECT					TYPICAL THERMAL POWER PROJECT						
TITLE					INSTRUMENT SOURCE CONNECTION DETAILS						
REV. NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	E	C	O&I	ARCH.	APFD.	DATE
A	FIRST ISSUE										T.G.
Cleared by											
SIZE			SCALE			DRG. NO.			REV. NO.		
A4			N.T.S.			0000-999-POI-A-035			A		
Sh-14 Of 14											

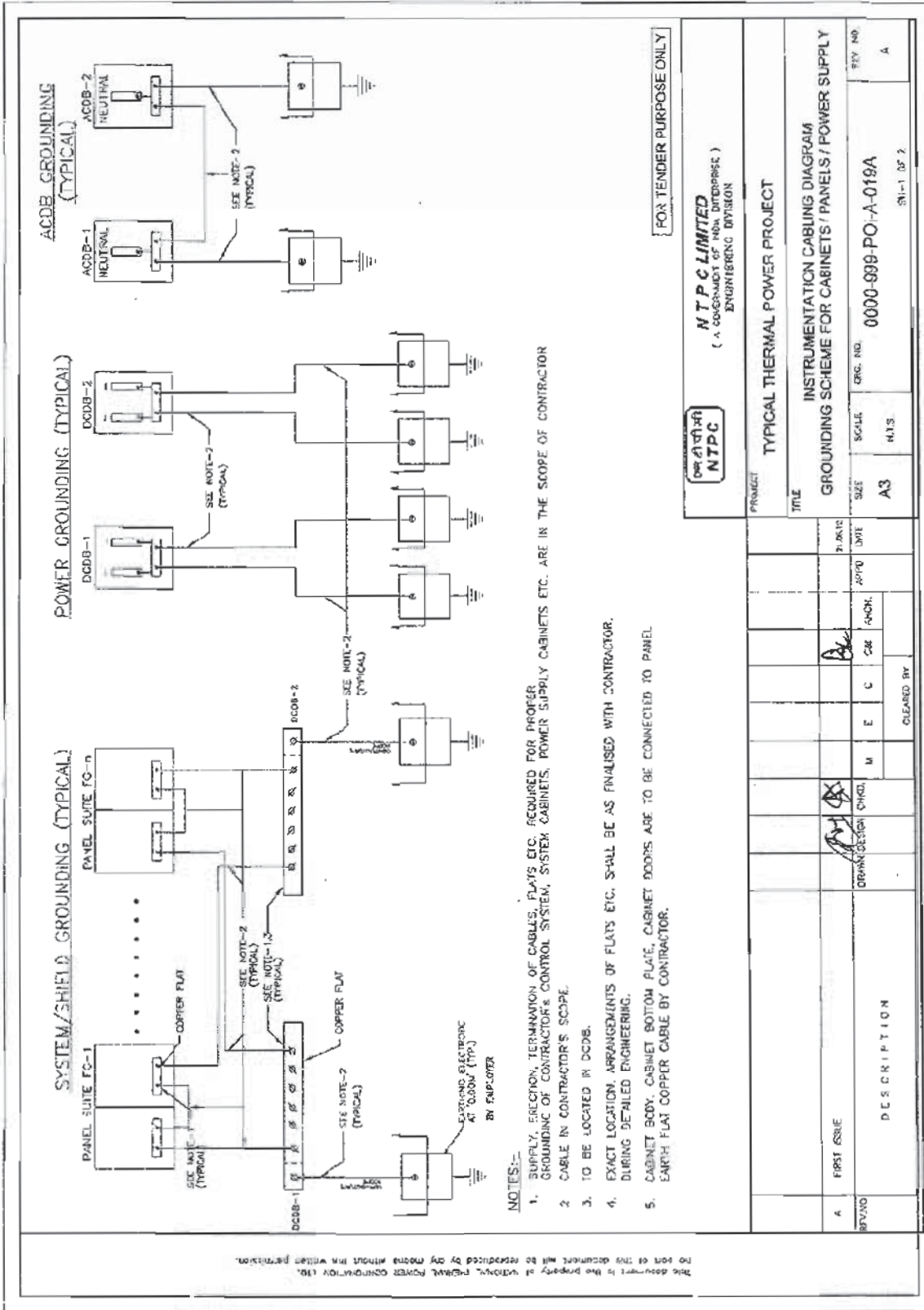


**C&I SPECIFICATION FOR
GYPSUM DEWATERING EQUIPMENT**

SECTION: C
SUB SECTION: C&I

INSTRUMENT INSTALLATION DRAWING


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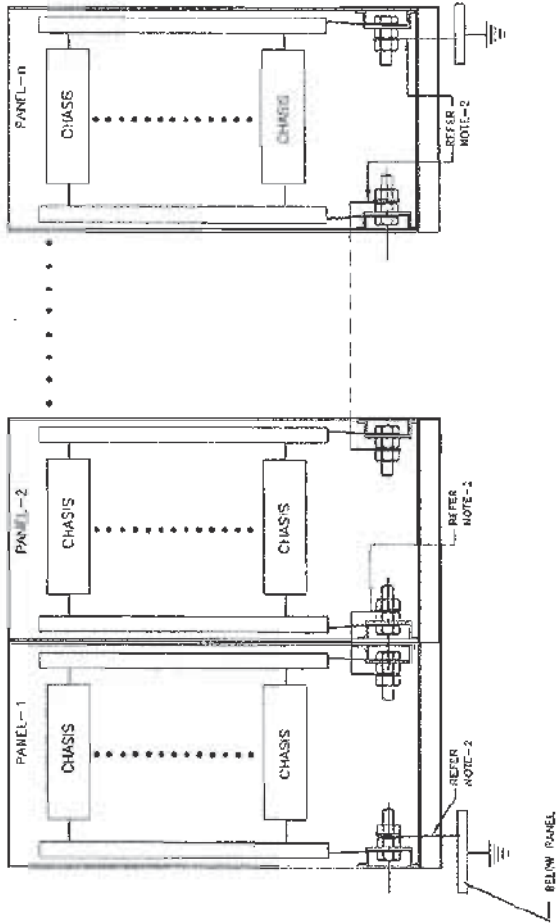
NOTES:-

1. SUPPLY, ERECTION, TERMINATION OF CABLES, FLAYS ETC. REQUIRED FOR PROPER GROUNDING OF CONTRACTOR'S CONTROL SYSTEM, SYSTEM CABINETS, POWER SUPPLY CABINETS ETC. ARE IN THE SCOPE OF CONTRACTOR
2. CABLE IN CONTRACTOR'S SCOPE.
3. TO BE LOCATED IN DCDB.
4. EXACT LOCATION, ARRANGEMENTS OF FLAYS ETC. SHALL BE AS FINALISED WITH CONTRACTOR, DURING DETAILED ENGINEERING.
5. CABINET BODY, CABINET BOTTOM FLAYE, CABINET DOORS ARE TO BE CONNECTED TO PANEL EARTH FLAT COPPER CABLE BY CONTRACTOR.

FOR TENDER PURPOSE ONLY

 NTPC LIMITED (A CORPORATION OF INDIA GOVERNMENT) ENGINEERING DIVISION				
TYPICAL THERMAL POWER PROJECT				
INSTRUMENTATION CABLING DIAGRAM GROUNDING SCHEME FOR CABINETS / PANELS / POWER SUPPLY				
PROJECT	SIZE	SCALE	ORG. NO.	REV. NO.
TYPICAL THERMAL POWER PROJECT	A3	N.T.S.	0000-999-PO-A-019A	A
				SH-1 OF 2
DESCRIPTION		DATE	BY	CHECKED BY
FIRST ISSUE				
REVISED				

**GROUNDING FOR EACH ROW OF PANELS
(TYPICAL)**



NOTES:-

1. SUPPLY, ERECTION, TERMINATION OF CABLES, FLATS ETC. REQUIRED FOR PROPER GROUNDING OF CONTRACTOR'S CONTROL SYSTEM, SYSTEM CABINETS, POWER SUPPLY CABINETS ETC. ARE IN THE SCOPE OF CONTRACTOR.
2. CABLE IN CONTRACTOR'S SCOPE.
3. TO BE LOCATED IN DCDB.
4. EXACT LOCATION, ARRANGEMENTS OF FLATS ETC. SHALL BE AS FINALISED WITH CONTRACTOR DURING DETAILED ENGINEERING.
5. CABINET BODY, CABINET BOTTOM PLATE, CABINET DOORS ARE TO BE CONNECTED TO PANEL EARTH FLAT COPPER CABLE BY CONTRACTOR.

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NTPC LIMITED
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ENGINEERING DIVISION

PROJECT TYPICAL THERMAL POWER PROJECT	
TITLE INSTRUMENTATION CABLING DIAGRAM GROUNDING SCHEME FOR CABINETS / PANELS / POWER SUPPLY	
REV. NO. A	SCALE A3
DRWN. DATE 11.08.12	APPD. DATE 11.08.12
DESIGN DRFT X	E C X
DRAWN BY <i>[Signature]</i>	CHECKED BY <i>[Signature]</i>
DESCRIPTION SH-2 OF 2	

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LIST OF MATERIALS

ITEM NO.	DESCRIPTION
1.	1/2" 3/4" 1" WPS SCH 40/80/100/120/140 WPS PROCESS EQUIPMENT/ INSTRUMENT NIPPLE OF MATERIAL SAME AS THAT OF MAIN PIPE.
2.	1/2"/3/4"/1" SW GLOBE VALVE/GATE VALVE
3.	3/4" / 1" x 1/2" SW REDUCING INSERT
4.	1/2" / 3/4" PIPE
5.	1/2" / 3/4" SW EQUAL TEE
6.	1/2" / 3/4" SW GLOBE VALVE
7.	1/2" / 3/4" WPS SW x 1/2" / 3/4" NPT(M) CARBON/ALLOY STEEL NIPPLE.
8.	1/2" / 3/4" NPT(F) CAP.
9.	1/2" / 3/4" PIPE UNION
10.	8" SS SYPHON
11.	1/2" BLIND 3005# B7 AND FLANGE DRILLED AND TAPED FOR 1" NPT PIPE.
12.	SUITABLE ADAPTER.
13.	1/4" CHROME MOLY STEEL TUBE.
14.	
15.	1" 3/4" SW EQUAL TEE.
16.	DAMPING(WATER ELEMENT)
17.	ISOLATION VALVE 318 SS 1/4" SW

NOTES:-

1. THE MATERIAL SPECIFICATION AND SCHEDULE NO. OF IMPULSE PIPE & NIPPLE AS LISTED HEREIN SHALL BE AS PER TECHNICAL SPECIFICATIONS.
2. THE MATERIAL SPECIFICATION AND RATING OF FITTINGS SHALL BE AS PER TECHNICAL SPECIFICATIONS. WELDED/FITTINGS SHALL CONFORM TO AWS-B1.1.
3. INSTRUMENTS VALVES BODY STEM MATERIAL AND PRESSURE CLASS SHALL BE AS PER TECHNICAL SPECIFICATIONS.
4. FOR BLOWER AIR/VALUE GAS SERVICES SOURCE CONNECTIONS IMPULSE PIPING AND ALL FITTINGS SHALL BE OF 3/4" NB SIZE.
5. GAUGES SHALL NOT BE MOUNTED ON THE PIPE IT WILL BE MOUNTED ON A CHANNEL OR FRAME OR A BACK.
6. * SLOPE APPROX. 50 MM / METRE.

FOR TENDER PURPOSE ONLY

NTPC

NTPC LIMITED
(A GOVERNMENT OF INDIA ENTERPRISE)
ENGINEERING DIVISION

PROJECT: TYPICAL THERMAL POWER PROJECT

TITLE: INSTRUMENT INSTALLATION DIAGRAM (FOR PRESSURE GAUGE)

REV. NO.	SCALE	DRG. NO.	REV. NO.
A	A3	0000-999-POI-A-022	A
REV. NO.	SCALE	DRG. NO.	REV. NO.
A	A3	0000-999-POI-A-022	A

DESCRIPTION

FIRST ISSUE

DRAWN DESIGN CHKD. M E C

T.G. CBI ARCH.

21/08/12

APPRO. DATE

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LIST OF MATERIALS

ITEM NO.	DESCRIPTION
1.	1/2" 3/4" NPS SCH. 80/180 SW1/2" NPT NIPPLE OF MATERIAL SAME AS THAT OF MAIN PIPE.
2.	3/4" 1" SW GLOBE VALVE.
3.	3/4" 1" TO 1/2" REDUCING INSERT
4.	1/2" NPS PIPE
5.	1/2" SW EQUAL TEL.
6.	1/2" SW GLOBE VALVE
7.	1/2" NPS SCH. 80/180 SW1/2" CS/AS COUPLER
8.	1/2" PIPE UNION
9.	3/8" VALVE MANIFOLD (FOR DETAIL SEE DRAWING NO. 0000-100-POI-A-023.
10.	SUITABLE ADAPTER
11.	SS TUBE
12.	1/2" PIPE x 1/2" TUBE UNION
13.	1/2" NPS SCH. 80/180 SW1/2" NPT(M) CS/AS NIPPLE

FOR TENDER PURPOSE ONLY

ELEVATION
TRANSMITTER MOUNTED BELOW INSTRUMENT SOURCE POINT

ELEVATION
TRANSMITTER MOUNTED ABOVE INSTRUMENT SOURCE POINT

ELEVATION
LIQUID PRESSURE MEASUREMENT

ELEVATION
TRANSMITTER MOUNTED ABOVE INSTRUMENT SOURCE POINT

ELEVATION
TRANSMITTER MOUNTED BELOW INSTRUMENT SOURCE POINT

ELEVATION
TRANSMITTER MOUNTED ABOVE INSTRUMENT SOURCE POINT

ELEVATION
TRANSMITTER MOUNTED BELOW INSTRUMENT SOURCE POINT

ELEVATION
TRANSMITTER MOUNTED ABOVE INSTRUMENT SOURCE POINT

NOTES:-

- SAME NOTES UNDER DRG. NO. 0000-999-FO-A-023.
- FOR VACUUM APPLICATION OTHER PORT OF TRANSMITTER SHALL BE KEPT OPEN TO ATMOSPHERE.

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ENGINEERING DIVISION

FOR TENDER PURPOSE ONLY

PROJECT TYPICAL THERMAL POWER PROJECT

TITLE INSTRUMENT INSTALLATION DIAGRAM
(PRESSURE MEASUREMENT USING PRESS/DP TRANSMITTERS STEAM/LIQUID VACUUM)

SCALE DRG. NO. 0000-999-POI-A-025

SIZE A3

SCALE N.T.S.

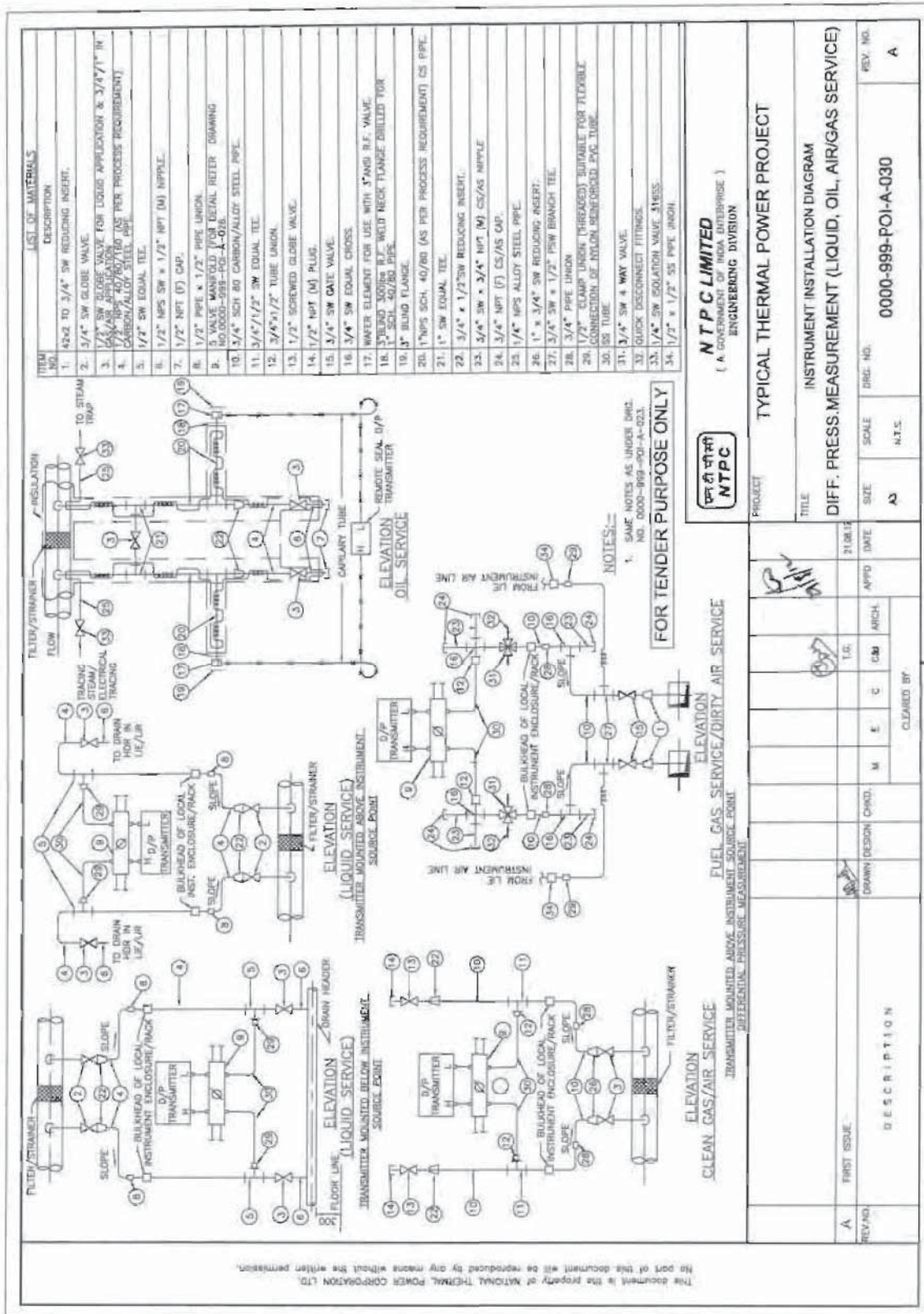
REVISION

NO.	DESCRIPTION	DATE	APP'D	CHK'D	BY
A	FIRST ISSUE	31.08.17			

REV. NO. A

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THIS IS PART OF TECHNICAL SPECIFICATION PE-TS-468-571-A901 REV 00.



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LIST OF MATERIALS

ITEM NO.	DESCRIPTION
1.	3/4" NPT BRASS/STAINLESS/PTFE/PAI GAS THER. PROCESS EQUIPMENT, CARBON/ALLOY STEEL PIPE.
2.	3/4" SW GLOBE VALVE.
3.	3/4" SW UNION.
4.	3/4" NPT GLOBE VALVE.
5.	3/4" NPT (M) CAP.
6.	3/4" NPT (F) UNION CONNECTION.
7.	1" SW EQUAL UNION.
8.	1" x 1/2" SW REDUCING INSERT.
9.	1" SW EQUAL TEE.
10.	1/2" SW GLOBE VALVE.
11.	1/2" NPS 90x1/2" NPT(M) CS/AS NPPLE.
12.	1/2" NPT (F) CAP.
13.	3/5" x 1/2" NPS SCH.40/80 CS/AS PIPE.
14.	1/2" NPS SCH.80/180 CS/AS NPPLE.
15.	1" SW GLOBE VALVE.

ELEVATION

LOCAL LEVEL INDICATION USING GAUGE GLASS

ELEVATION

LOCAL LEVEL INDICATION USING MULTIPLE GAUGES FOR INCREASED RANGE NOT COVERED IN A SINGLE UNIT

ELEVATION

FLOAT OR DISPLACER OPERATED EXTERNAL CAGE TYPE LEVEL SWITCH INSTALLATION

NOTES:-

- FOR LEVEL GAUGE 3/4" AND FOR LEVEL SWITCH 1" PROCESS CONNECTION SHALL BE PROVIDED.
- NOTES UNDER DRC. NO. 0005-999-PD-A-033 (WHICHEVER ARE RELEVANT).

FOR TENDER PURPOSE ONLY

NTPC LIMITED
(A GOVERNMENT OF INDIA ENTERPRISE.)
ENGINEERING DIVISION

TYPICAL THERMAL POWER PROJECT


PROJECT


TITLE


INSTRUMENT INSTALLATION DIAGRAM (LEVEL GAUGE & SWITCHES)


REV. NO.	SCALE	DRG. NO.	REV. NO.
A	A3	0000-999-POI-A-031	A

REV. NO.	DESCRIPTION	DATE	BY	CHKD.	APPD.	DATE
A	FIRST ISSUE	21.08.13				

CLAUSE NO.	TECHNICAL REQUIREMENTS									
PROCESS CONNECTION AND PIPING										
1.00.00	PROCESS CONNECTION PIPING									
1.01.00	The Contractor shall provide, install and test all required material for completeness of Impulse Piping System and Air Piping System as per the requirements of this Sub-Section on as required basis for the connection of all instruments and control equipments of entire plant.									
1.01.01	IMPULSE PIPING, TUBING, FITTINGS, VALVES AND VALVE MANIFOLDS									
1.01.02	All impulse pipes shall be of seamless type conforming to ANSI B36.10 for schedule numbers. The size of impulse pipe shall be ½" for Steam & Water Application and ¾" for Air & Flue Gas applications. The rating of material of impulse pipes, tubes, fittings, valves and their installation thereof shall conform to the latest edition of standards as per following table:									
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%;">Impulse Pipes, Tubes (Material, Rating)</td> <td>ANSI B31.1, ANSI B31.1a, ANSI/ISA 77.70</td> </tr> <tr> <td>Valves (Material, Pr. Class, Size)</td> <td>ASTM A182/ASTM A105 as per ASME 16.34</td> </tr> <tr> <td>Fittings (Size, Rating, Material)</td> <td>ANSI B31.1, ANSI B31.1a, ASME B16.11-2009</td> </tr> <tr> <td>Installation Schemes</td> <td>BS 6739-2009, ANSI/ISA 77.70</td> </tr> </table>			Impulse Pipes, Tubes (Material, Rating)	ANSI B31.1, ANSI B31.1a, ANSI/ISA 77.70	Valves (Material, Pr. Class, Size)	ASTM A182/ASTM A105 as per ASME 16.34	Fittings (Size, Rating, Material)	ANSI B31.1, ANSI B31.1a, ASME B16.11-2009	Installation Schemes	BS 6739-2009, ANSI/ISA 77.70
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Installation Schemes	BS 6739-2009, ANSI/ISA 77.70									
1.01.03	Stainless steel tube shall be provided inside enclosures & racks from tee connection to valve manifold and then to instrument. The source shut-off (primary process root valve) and blow down valve shall be of 1/2 inch size globe valve type for all applications except for air and flue gas service wherein no source shut-off valves are to be provided. Two root valves are to be used wherever pressure is more than 40 Kg/cm ² or Temp>280 °C. The end connections of valves shall be of socket welded type. Typical installation scheme of DP Transmitter (inside LIE/LIR) mounted below instrument source point is indicated in Drg. No. 0000-999-POI-A-036. Same scheme with necessary changes shall be applied for other instruments.									
1.01.03	The valve manifolds of 316 SS with pressure rating suitable for intended application shall be provided as given below:									
<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 15%;">Manifold</th> <th>Application/Measurement</th> </tr> </thead> <tbody> <tr> <td>2 Valve</td> <td>Pressure measurements using pressure transmitters/pressure switches</td> </tr> <tr> <td>3 Valve</td> <td>Pressure measurements using differential pressure transmitter/ switches</td> </tr> <tr> <td>5 Valve</td> <td>Differential Pressure, Flow and Level Measurements</td> </tr> </tbody> </table>			Manifold	Application/Measurement	2 Valve	Pressure measurements using pressure transmitters/pressure switches	3 Valve	Pressure measurements using differential pressure transmitter/ switches	5 Valve	Differential Pressure, Flow and Level Measurements
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2 Valve	Pressure measurements using pressure transmitters/pressure switches									
3 Valve	Pressure measurements using differential pressure transmitter/ switches									
5 Valve	Differential Pressure, Flow and Level Measurements									
2.00.00	For Pr./D.P gauges, two-way globe/gate valve shall be provided on each impulse line to the instrument in Fluid/Air & Flue Gas applications respectively .									
2.00.00	AIR SUPPLY PIPING									
2.01.01	All pneumatic piping, fittings, valves, air filter cum regulator, purge rotameter and other accessories required for instrument air for the various pneumatic devices/ instruments shall be provided. This will include as a minimum air supply to pneumatically operated control valves, actuators, instruments, continuous and intermittent purging requirements etc.									
2.02.00	Instrument air and Service air supply shall be provided for continuous and intermittent purging respectively for all transmitters of mill, dirty air and flue gas applications. Purging Scheme shall be as per Drg. No. 0000-999-POI-A-036.									
2.03.00	The Contractor shall also provide SS Tubing and associated fittings (screwed type) of suitable sizes for all pneumatic equipments/actuators (including supply air, signal air and output to actuators) conforming to ANSI 31.1 and 31.3 standard. All other air supply lines shall be of mild steel hot dipped galvanized inside and outside as per IS-1239, heavy duty									
LOT-IA PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOCUMENT NO.: CS-0011-109(1A)-2	SUB-SECTION-III-C3 PCP								
PAGE 1 OF 4										

CLAUSE NO.	TECHNICAL REQUIREMENTS 		
	<p>with threaded ends. Fittings for air supply line shall be of forged carbon steel A234 Gr. WPB galvanized inside and outside, screwed as per ASA B2.1. Dimensions of fittings shall be as per ASA B16.11 of rating 3000 lbs. Air supply piping shall be adequately sloped to prevent accumulation of condensed water within the pipe. The air supply headers, sub-headers and branch pipes shall be supported properly by clamps or supports.</p>		
2.04.00	<p>The instrument/service air supply to each equipment/devices requiring air supply shall be provided by a well designed air distribution scheme comprising of 2" GI Pipe Header feeding 1" GI Pipe sub-header feeding ½" pipe at each equipment/device. Instrument air filters cum regulator set with mounting accessories shall be provided for each pneumatic device requiring air supply except for Ash Handling System wherein it shall be provided on instrument air header at each location.</p>		
2.05.00	<p>All the isolation valves in the air supply line shall be gate valves as per ASTM B62 inside screw rising stem, screwed female ends as per ASA B2.1. Valve bonnet shall be union type & trim material shall be stainless steel, body rating 150 pounds ASA. The valve sizes shall be ½ inch to 2 inch.</p>		
2.06.00	<p>Instrument air filters cum regulator set with mounting accessories shall be provided for pneumatic device requiring air supply. The filter regulators shall be suitable for 10-kg/ sq.cm max. Inlet pressure. The filter shall be of size 5 microns and of material sintered bronze. The air set shall have 2-inch size pressure gauge and built in filter housing blowdown valve. The end connection shall be as per the requirement to be finalized during detailed engineering.</p>		
3.00.00	<p>INSTALLATION AND ROUTING</p>		
3.01.01	<p>All instrument piping, tubing and its accessories shall be supported in a safe manner to prevent excessive vibrations and anchored sufficiently to prevent undue strain on connected equipment. Impulse piping shall be supported at an interval not exceeding 1.5 meters. The slope of the impulse pipe from the process connection to the instrument shall be as per ANSI/ISA 77.70 latest edition and BS 6739-2009. All impulse piping shall be installed to permit free movement due to thermal expansion. Wherever required expansion loops shall be provided.</p>		
	<p>Condensate pots shall be provided for all level measurements in steam and water services, all flow measurement in steam services and for flow measurements in water services above 120 Deg. C. Colour coding of all impulse pipes shall be done by the Contractor in line with the colour coding being followed for the parent pipes.</p>		
4.00.00	<p>SHOP AND SITE TESTS</p>		
4.01.01	<p>The equipment and work performed as per this Sub-section shall be subject to shop and site test as per requirements of Sub-section-III-E-04 (Quality Assurance & Inspection) other applicable clauses of this Sub-section and Employer approved quality assurance plan.</p>		
4.01.02	<p>Hydrostatic and Pneumatic leakage tests shall be performed on all pipes, tubing and systems and shall conform to ANSI B31.1.</p>		
5.00.00	<p>LOCAL INSTRUMENT ENCLOSURE AND RACKS</p> <p>All transmitters, switches etc. for FGD system and other system being provided under the contract shall be suitably grouped together and mounted inside (i) local instruments enclosures in case of open areas of the plant and (ii) In local instrument racks in case of covered areas. The GA of LIE with purging indicated in the Drg. No. 0000-999-POI-A-036 is to be followed by contractor. The GA of LIR shall be similar to LIE except for front/rear doors and side panels.</p>		
<p>LOT-IA PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p>TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOCUMENT NO.: CS-0011-109(1A)-2</p>	<p>SUB-SECTION-III-C3 PCP</p>	<p>PAGE 2 OF 4</p>

CLAUSE NO.	TECHNICAL REQUIREMENTS		
5.01.00	<div style="text-align: right; border: 1px solid black; padding: 2px; width: fit-content; margin-bottom: 10px;">  </div> <p>The internal layout shall be such that the impulse piping/ blow down lines are accessible from back side of the enclosure / rack and the transmitters etc. are accessible from front side for easy maintenance. Bulkheads, especially designed to provide isolation from process line vibration shall be installed on instrument enclosures/racks to meet the process sensing line connection requirement. Vibration dampeners shall be installed for each enclosure / rack. The Degree of Protection of LIE and JB of LIE/LIR shall be IP-55.</p> <p>The enclosures shall be constructed of 3 mm sheet plate and shall be of modular construction with one or more modules and two end assemblies bolted together to form an enclosure. Double inter locking doors shall be provided. The doors shall be the three-point locking type constructed of not less than 1.6 mm thick steel. Doors shall have concealed quick removal type pinned hinges and locking handles. Door locks shall accept the same key.</p> <p>The instrument racks shall be free standing type constructed of suitable 5 mm thick channel frame of steel and shall be provided with a canopy to protect the equipment mounted in racks from falling objects, water etc. The canopy shall not be less than 3 mm thick steel, and extended beyond the ends of the rack.</p> <p>Enclosures/Racks shall be reinforced as required to ensure true surface and to provide adequate support for instruments and equipment mounted therein. Centre posts or any member which would reduce access shall not be provided.</p> <p>Contractor shall provide not more than three variants for LIE/LIR with respect to max. no. transmitters mounted in each LIE/LIR.</p> <p>ENCLOSURE / RACKS FOR DUAL I/P TEMPERATURE TRANSMITTERS</p> <p>All Dual Input temperature transmitters for FGD system and other system being provided under the contract shall be suitably grouped together and mounted inside (i) Enclosures in case of open areas of the plant and (ii) Racks in case of covered areas. Integral JB shall be provided with each Enclosure and Rack.</p> <p>The internal layout shall be such that the transmitters are accessible from both front and back side of the enclosure / rack for easy maintenance.</p> <p>Enclosure/ Racks shall be of robust and rugged design. Vibration dampeners shall be installed for each enclosure / rack. The Degree of Protection of Enclosure and JB shall be IP-55.</p> <p>Enclosure and Racks shall be free standing type.</p> <p>Enclosures/Racks shall be reinforced as required to ensure true surface and to provide adequate support for instruments and equipment mounted therein.</p> <p>Contractor shall provide not more than five variants for Enclosure/ Rack with respect to max. no. transmitters mounted in each Enclosure/ Rack. However, the maximum number of Transmitters that can be grouped in one Enclosure/ Rack shall be decided during detail Engineering.</p>		
<p style="text-align: center;">LOT-IA PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p style="text-align: center;">TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOCUMENT NO.: CS-0011-109(1A)-2</p>	<p style="text-align: center;">SUB-SECTION-III-C3 PCP</p>	<p style="text-align: center;">PAGE 3 OF 4</p>

CLAUSE NO.	TECHNICAL REQUIREMENTS			
6.00.00	<p>INSTALLATION OF OTHER INSTRUMENTS:</p> <p>For installation and routing of other field mounted instruments which are not covered in Cl. No. 5.00.00, please refer Cl. No 52.04.00(J) of Section-VI, Part-D, Erection Conditions of Contract (ECC) of Technical Specifications.</p>			
<p>LOT-IA PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p>TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOCUMENT NO.: CS-0011-109(1A)-2</p>	<p>SUB-SECTION-III-C3 PCP</p>	<p>PAGE 4 OF 4</p>	



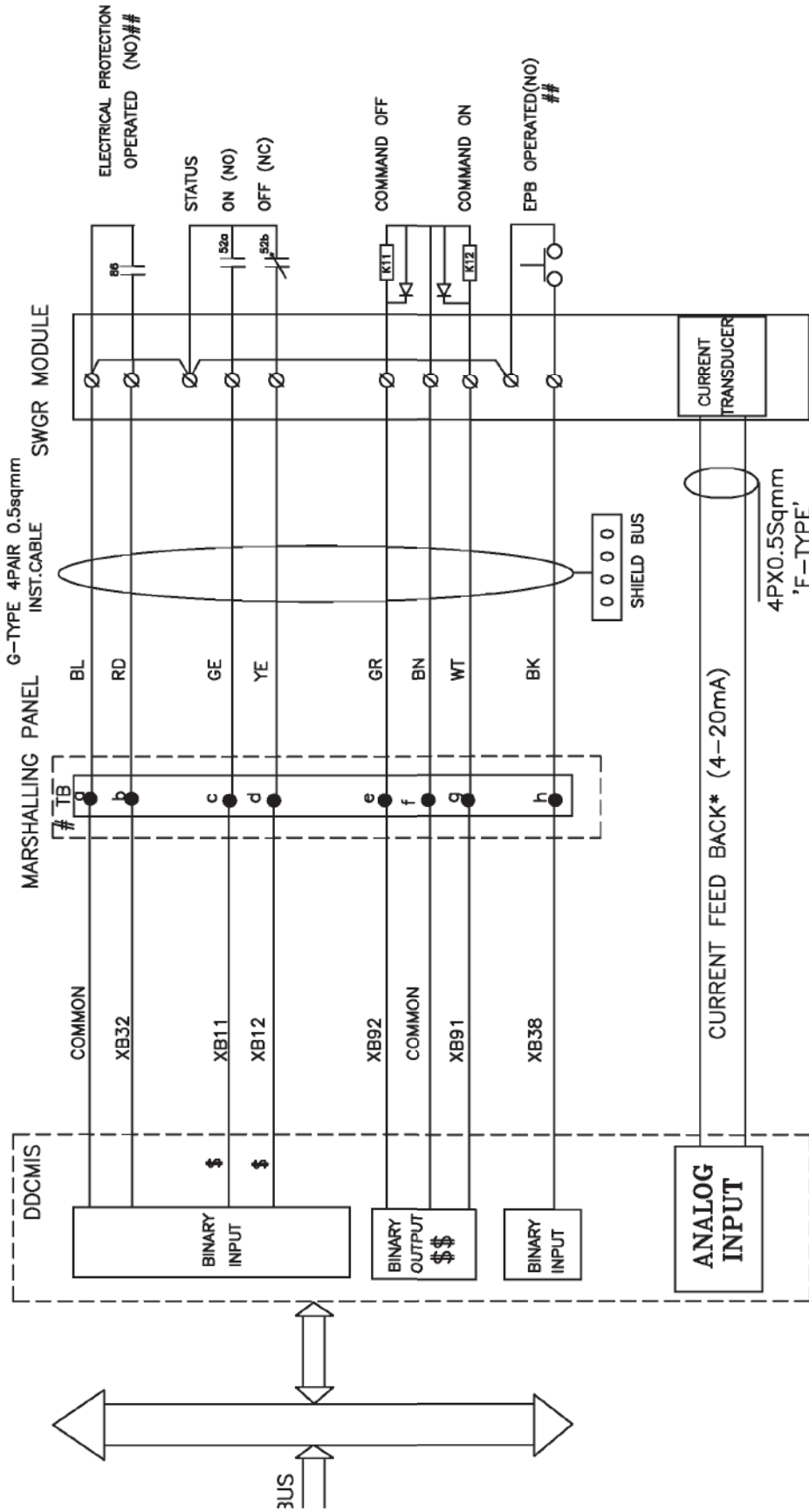
**C&I SPECIFICATION FOR
GYPSUM DEWATERING EQUIPMENT**

SECTION: C
SUB SECTION: C&I

**SIGNAL INTERFACE
BETWEEN
DRIVES AND DCS**

THIS IS PART OF TECHNICAL SPECIFICATION PE-TS-468-571-A901 REV 00.

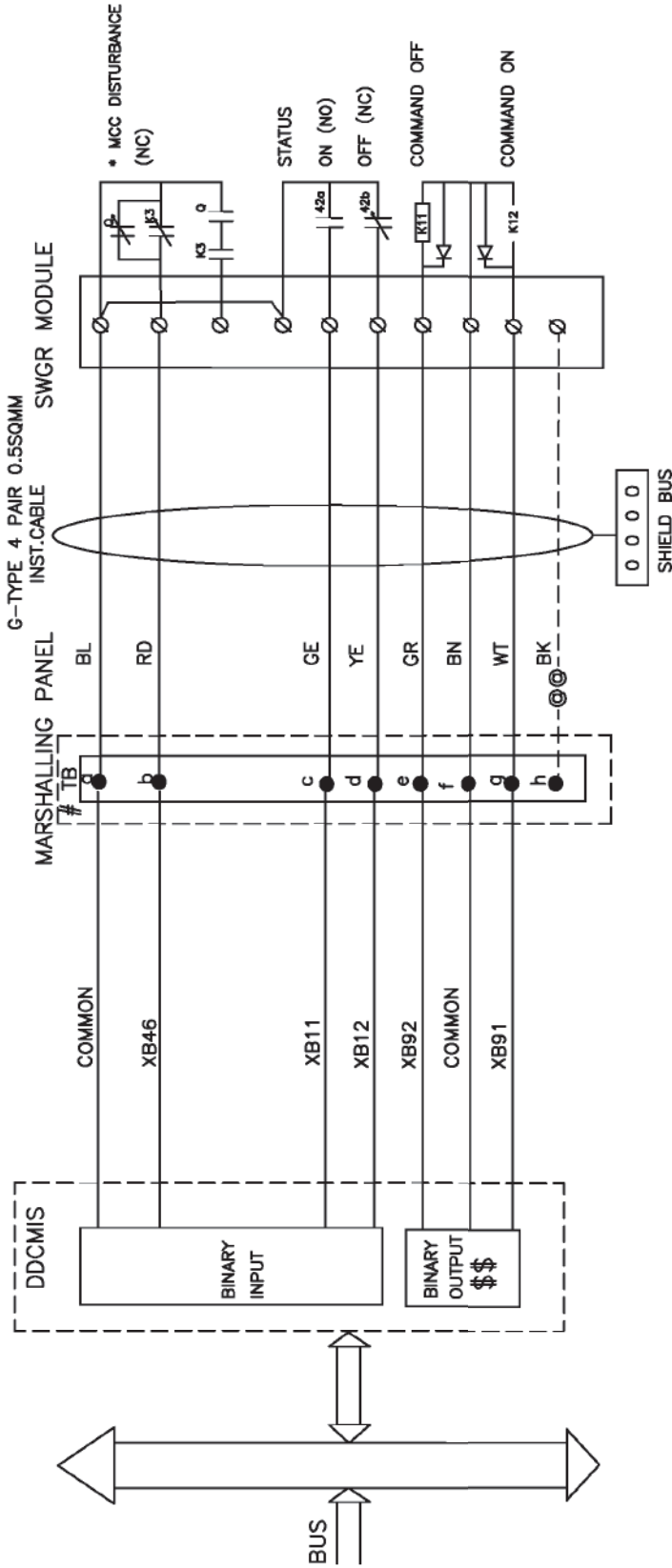
DDCMIS INTERFACE WITH HT SWITCH GEAR (HT)



- 1 \$ REDUNDANT INPUTS FOR UNIT DDCMIS ONLY
- 2 \$\$ REDUNDANT OUTPUTS WHEREVER APPLICABLE
- 3 # 8 LEVEL TERMINAL BLOCK
- 4 ## DI-SOE SIGNALS FOR UNIT DDCMIS ONLY
- 5 * CURRENT SIGNAL IS TO BE CONSIDERED IN DDCMIS FROM HT BREAKER FOR HT MOTORS.

	3x660 MW NORTH KARANPURA (FGD PACKAGE)	DRG.NO.	PE-DM-424-145-1002
	DDCMIS INTERFACE WITH HT SWITCH GEAR(HT)	SH	03 OF 10

DDCMIS INTERFACE WITH LT MCC (LT)



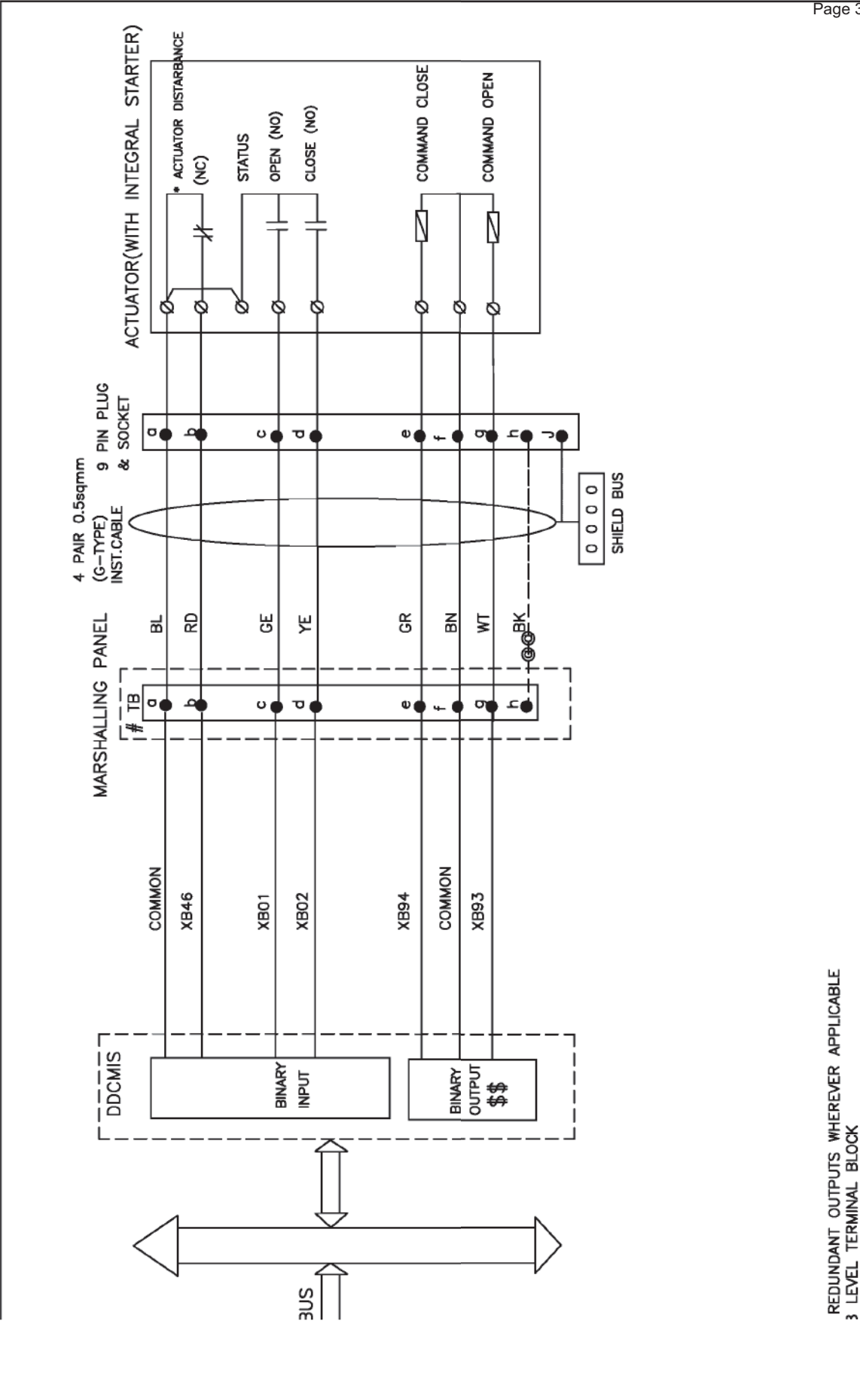
\$ REDUNDANT OUTPUTS WHEREVER APPLICABLE
 8 LEVEL TERMINAL BLOCK
 @ IN EACH DDCMIS POST, UNUSED TB'S ARE USED FOR SPARE CORE TERMINATION SEQUENTIALLY.
 * MCC DISTURBED= THERMAL O/L OPT/CONT SUPP FAIL/EPB OPTD DRIVE POWER SUPPLY OFF



3x660 MW NORTH KARANPURA (FGD PACKAGE)

DDCMIS INTERFACE WITH LT MCC (LT)	SHT	PE-DM-424-145-1002
04	OF	10

DDCMIS INTERFACE WITH BID

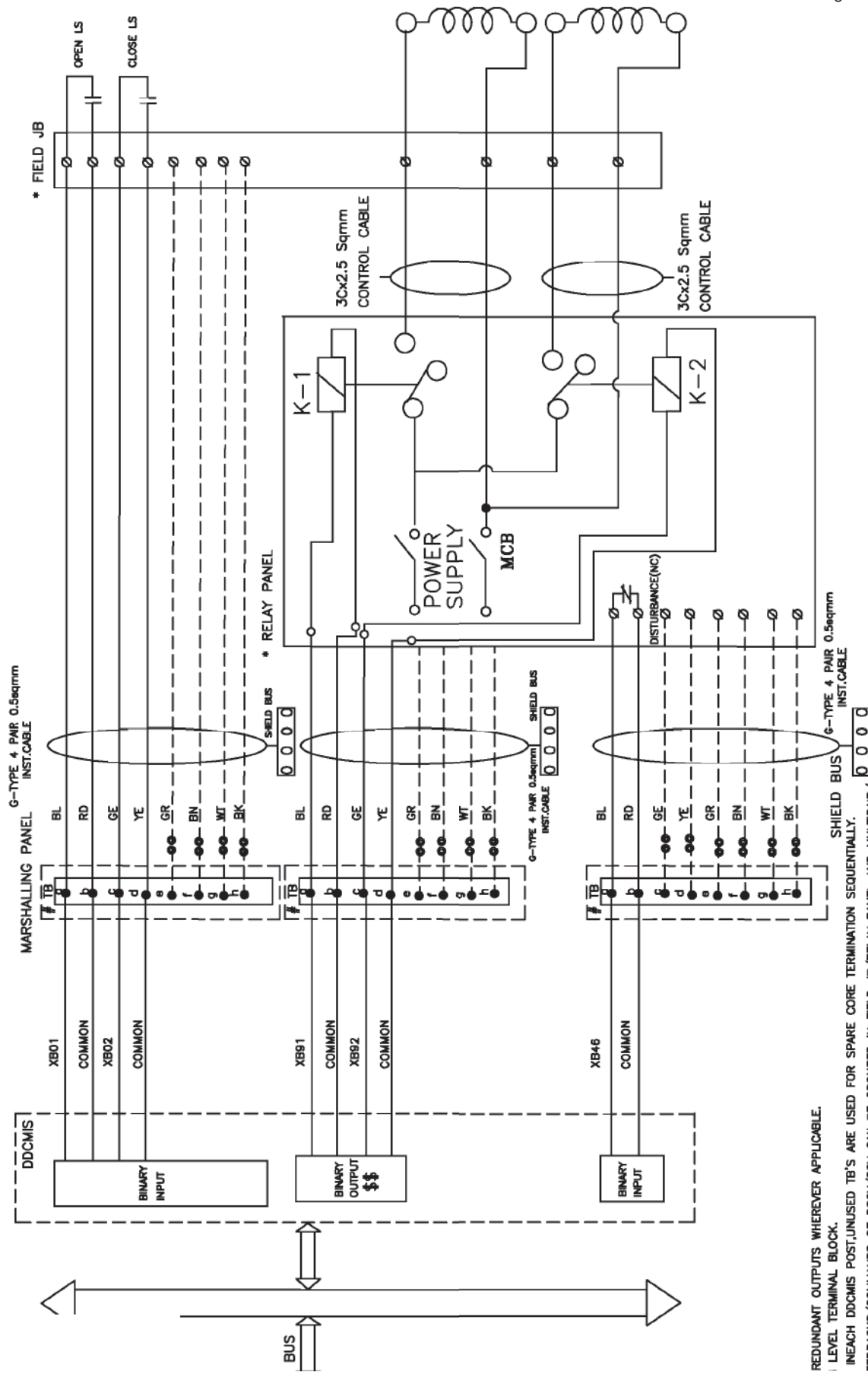


3x680 MW NORTH KARANPURA (FGD PACKAGE)	DRG.NO.	PE-DM-424-145-1002
DDCMIS INTERFACE WITH BID	SHT	05 OF 10

REDUNDANT OUTPUTS WHEREVER APPLICABLE
3 LEVEL TERMINAL BLOCK

INEACH DDCMIS POST,UNUSED TB'S ARE USED FOR SPARE CORE
TERMINATION SEQUENTIALLY.
DISTURBANCE=LOSS OF POWER SUPPLY(1PHASE/3PHASE)/LOSS OF
CONTROL SUPPLY/MOTOR THERMOSTAT TRIP/THERMAL OVER LOAD

DDCMIS INTERFACE WITH DUAL COIL SOLENOID (DSOV/L)

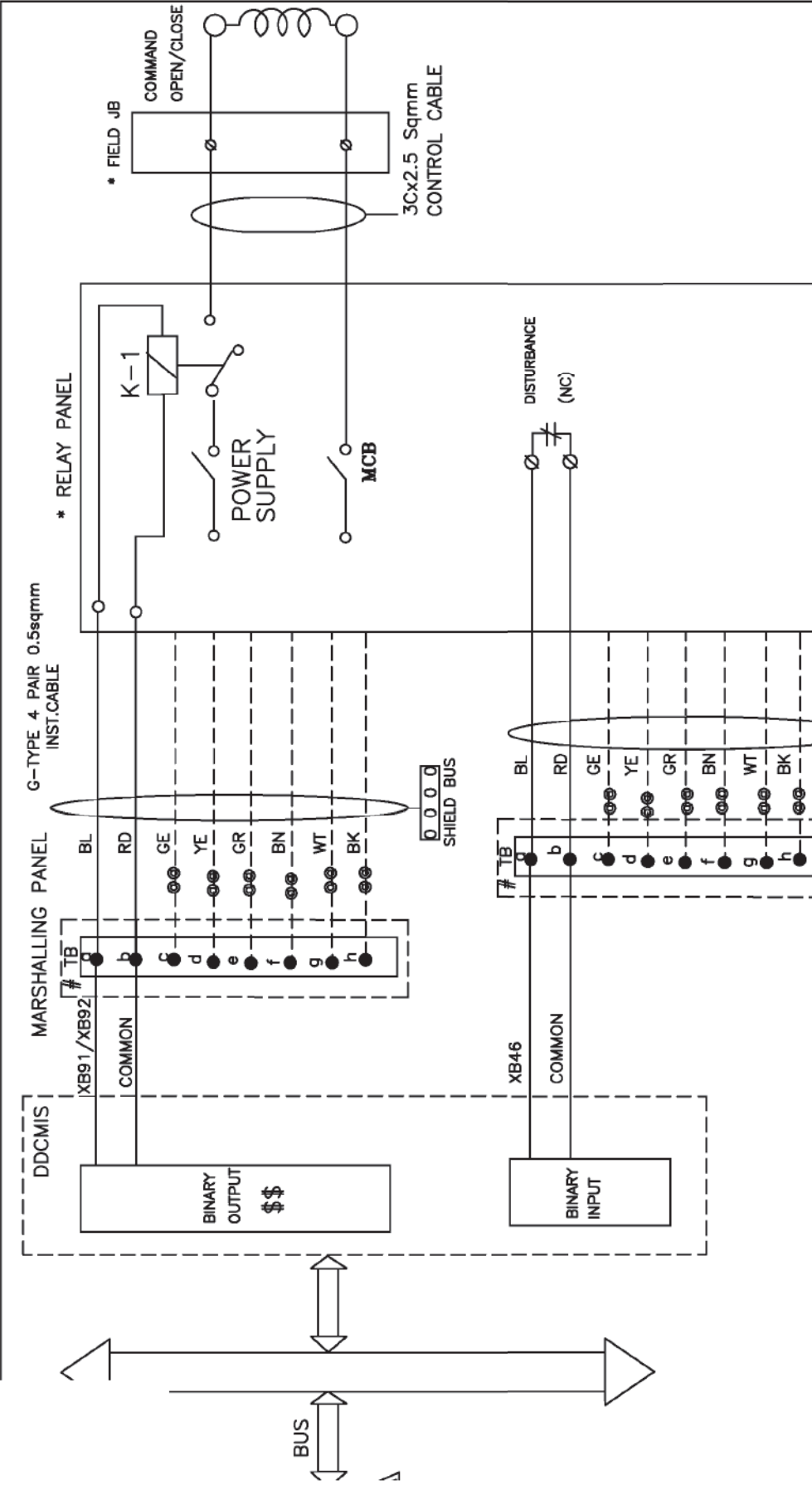


	3x660 MW NORTH KARANPURA (FGD PACKAGE)	DRG.NO. PE-DN-424-145-ID02
DDCMIS INTERFACE WITH DUAL COIL SOLENOID (DSOV/L)		SHT 06 OF 10

REDUNDANT OUTPUTS WHEREVER APPLICABLE.
 LEVEL TERMINAL BLOCK.
 EACH DDCMIS POST, UNUSED TB'S ARE USED FOR SPARE CORE TERMINATION SEQUENTIALLY.
 FEEDBACKS/COMMANDS OF DSOV/SOV CAN BE GROUPED IN FIELD JB/RELAY PANEL AND MARSHALING PANEL.
 CABLE IS TO BE USED FOR GROUPED SIGNALS FROM FIELD JB/RELAY PANEL TO MARSHALING PANEL.
 ON/OFF TYPE SOLENOID ACTUATED CONTROL VALVE.
 INDEPENDENT OUTPUT FROM CONTROL SYSTEM SHALL BE PROVIDED TO PUSH-PULL TYPE LIVES WITH DUAL COIL SOLENOIDS.

THIS IS PART OF TECHNICAL SPECIFICATION PE-TS-468-571-A901-REV-00.

DDCMIS INTERFACE WITH SOV/O/SOV/C(WITH OUT FEEDBACKS)



† REDUNDANT OUTPUTS WHEREVER APPLICABLE.

8 LEVEL TERMINAL BLOCK.

⊙ IN EACH DDCMIS POST, UNUSED TB'S ARE USED FOR SPARE CORE TERMINATION SEQUENTIALLY.

GROUPED SIGNALS FROM FIELD JB/RELAY/PANEL TO MARSHALLING PANEL.

OR ON/OFF TYPE, SOLENOID ACTUATED CONTROL VALVE.

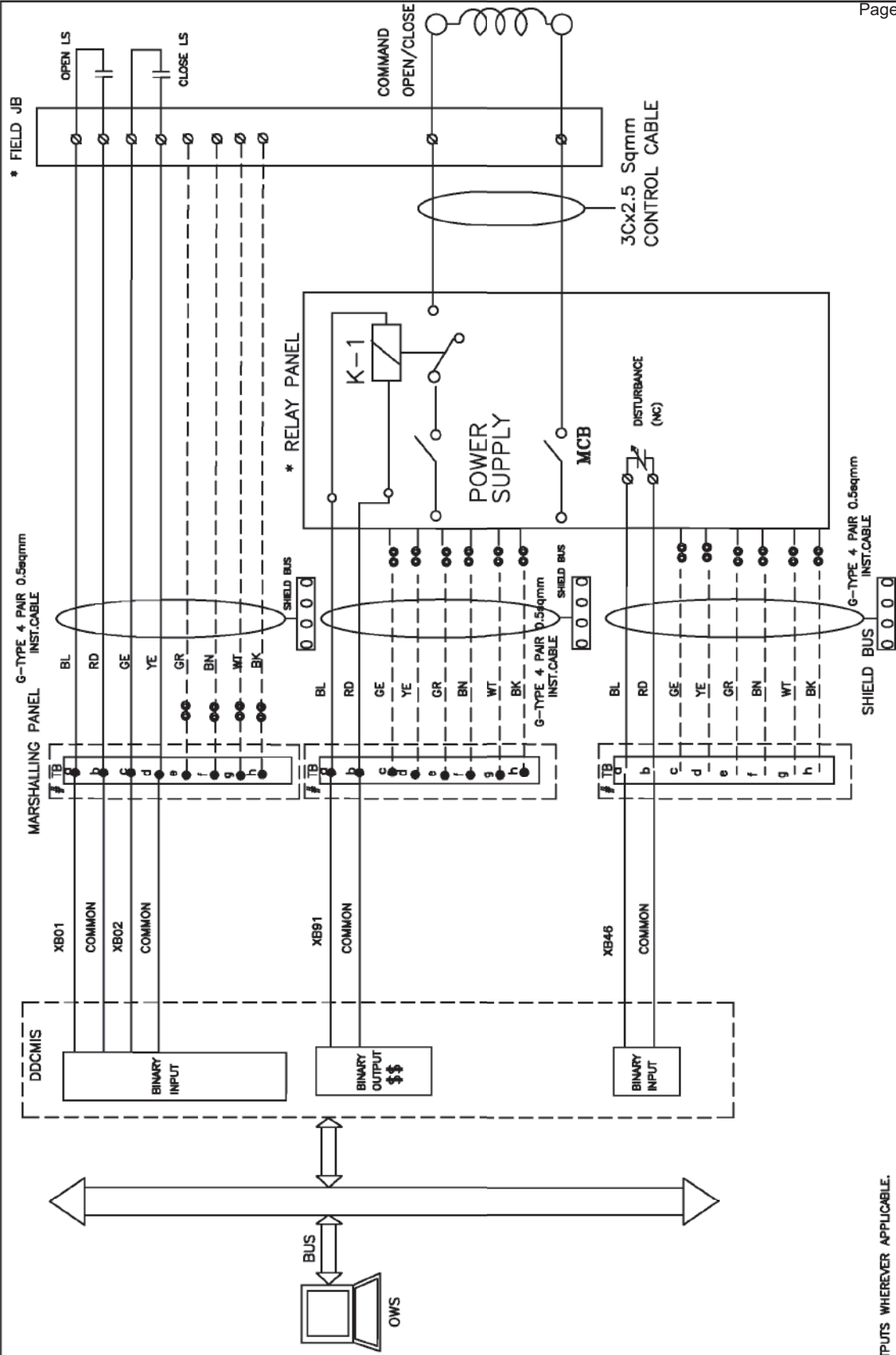



3x660 MW NORTH KARANPURA
(FGD PACKAGE)
DDCMIS INTERFACE WITH
SOV/O/SOV/C(WITHOUT FEEDBACKS)

DRG.NO.
PE-DN-424-145-ID02

SHT 07 OF 10

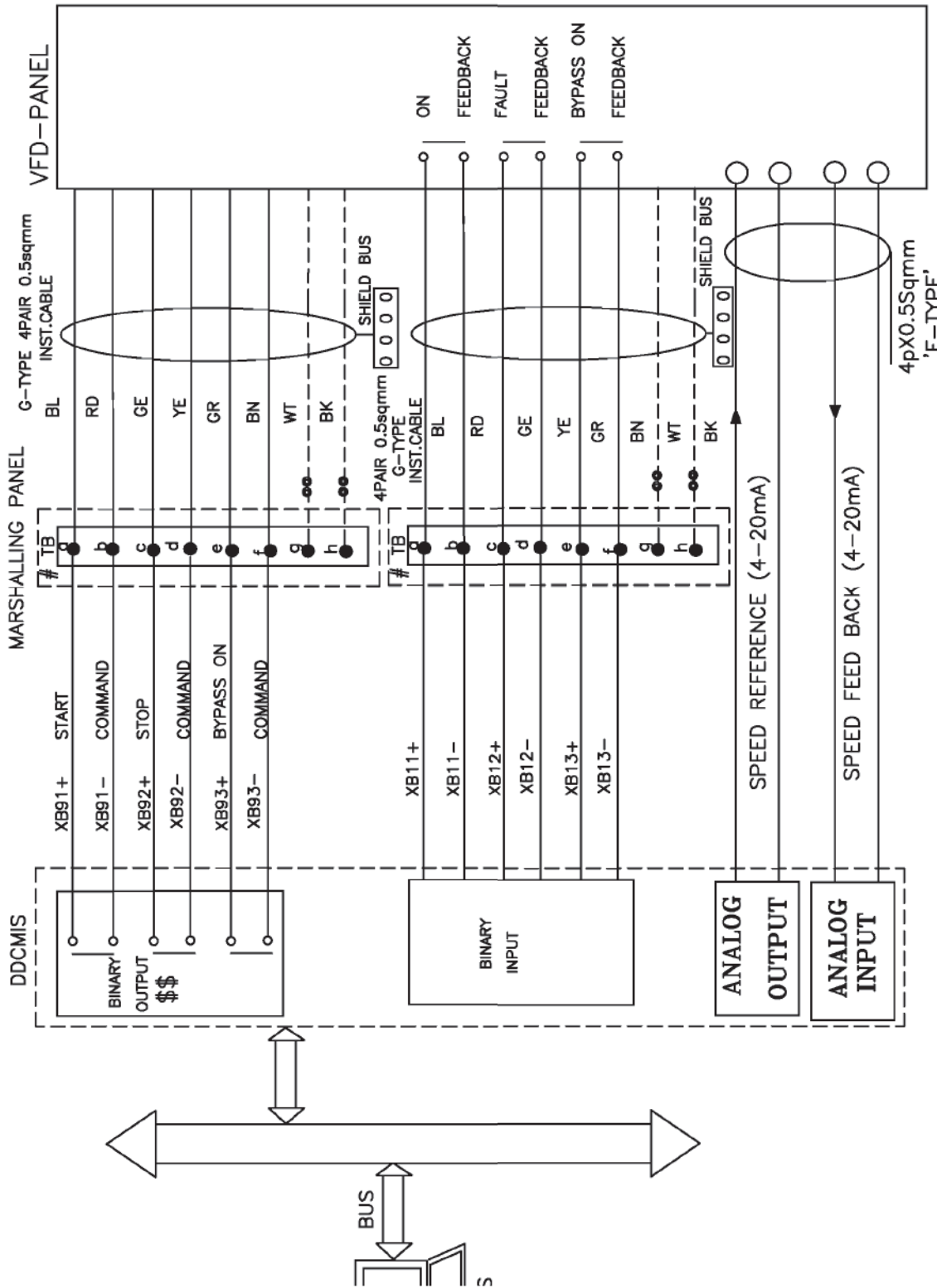
DDCMIS INTERFACE WITH SOV/O/L(WITH FEED BACKS)



	3x660 MW NORTH KARANPURA (FGD PACKAGE)	DRG.NO. PE-DN-424-145-1002
DDCMIS INTERFACE WITH SOV/O/L(WITH FEEDBACKS)		SHT 08 OF 10

EDUNDANT OUTPUTS WHEREVER APPLICABLE.
 LEVEL TERMINAL BLOCK.
 EACH DDCMIS POST, UNUSED TB'S ARE USED FOR SPARE CORE TERMINATION SEQUENTIALLY.
 FEEDBACKS/COMMANDS OF DSOV/SOV CAN BE GROUPED IN FIELD JB/RELAY PANEL AND MULTIPAIR/
 CABLE IS TO BE USED FOR GROUPED SIGNALS FROM FIELD JB/RELAYPANEL TO MARSHALING PANEL
 ON/OFF TYPE, SOLENOID ACTUATED CONTROL VALVE.

DDCMIS INTERFACE WITH VFD



- :-1 \$\$ REDUNDANT OUTPUTS WHEREVER APPLICABLE
- :-2 # 8 LEVEL TERMINAL BLOCK
- :-3 @ IN EACH DDCMIS POST, UNUSED TB'S ARE USED FOR SPARE CORE TERMINATION SEQUENTIALLY.
- :-4 OTHER VFD SIGNALS WILL BE CONSIDERED AS PER IO LIST.



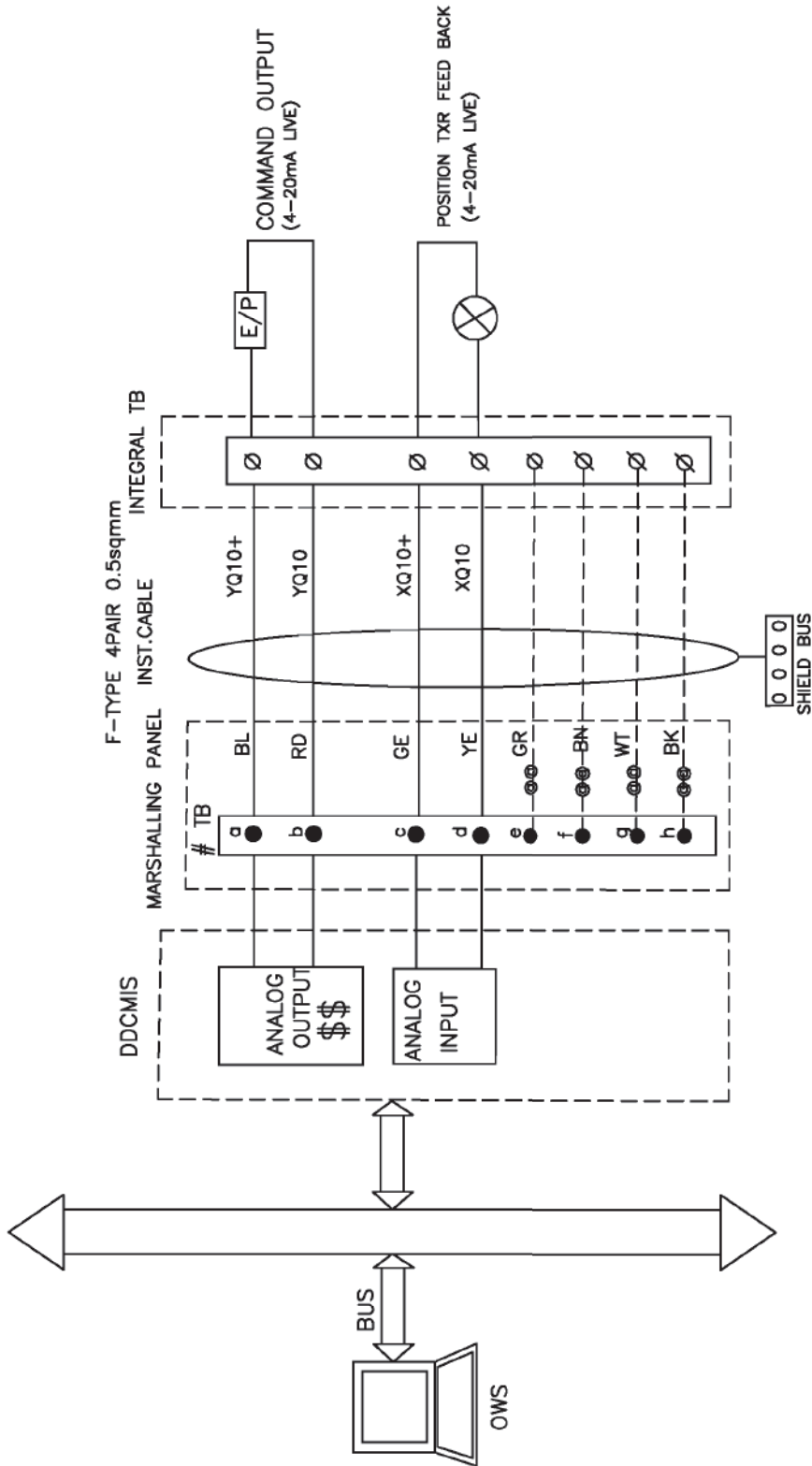
3x660 MW NORTH KARANPURA
(FGD PACKAGE)

DDCMIS INTERFACE WITH VFD

DRG. NO. PE-DM-424-145-1002

SHT 09 OF 10

INTERFACE FOR MODULATING DRIVES - CLCS



DANT OUTPUTS WHEREVER APPLICABLE
 . TERMINAL BLOCK
 CH DDCMIS POST, UNUSED TB's ARE USED FOR SPARE CORE TERMINATION SEQUENTIALLY.
 IDIVIDUAL & OVERALL SHIELD CABLE.

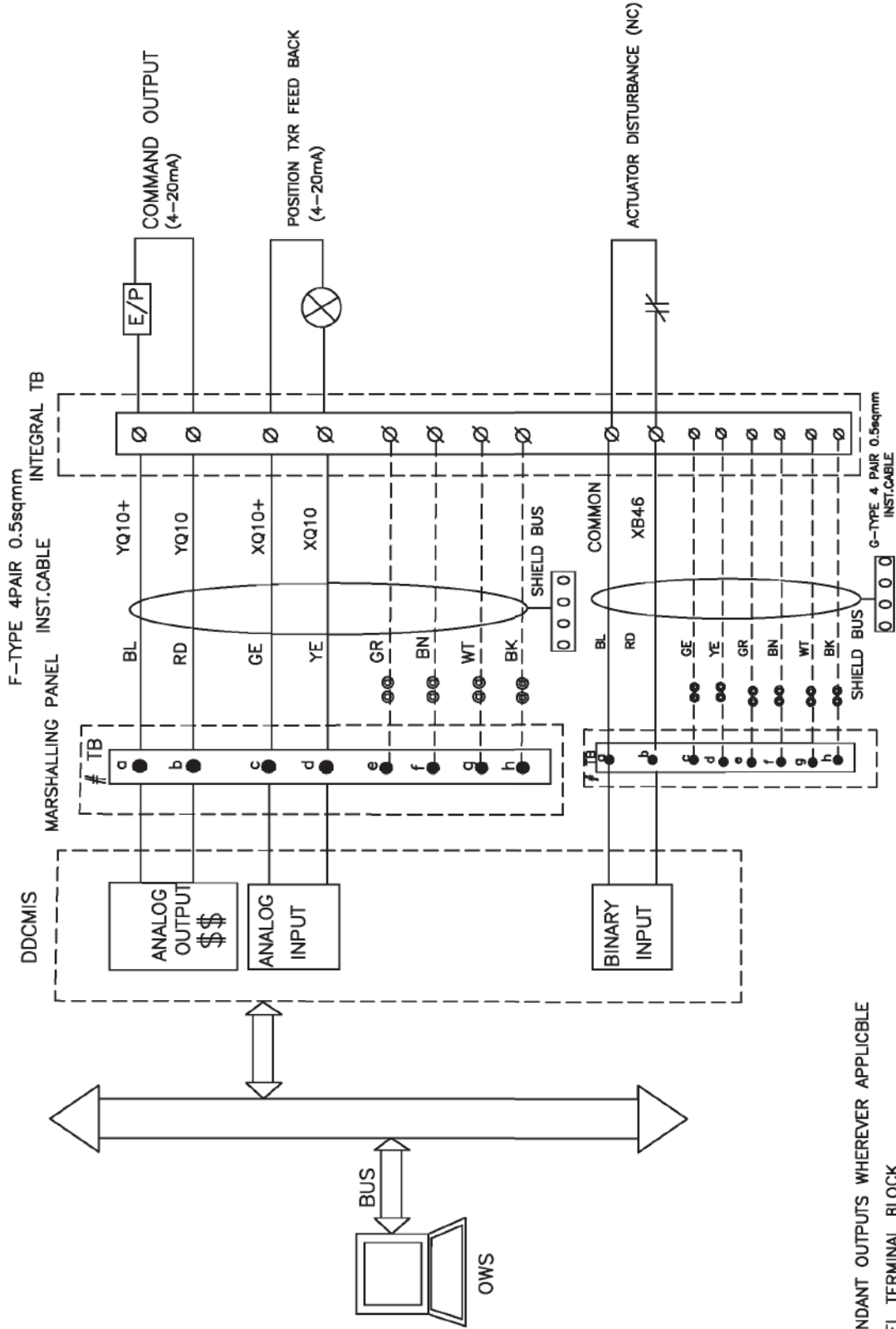


3x660 MW NORTH KARANPURA
 (FGD PACKAGE)

DRG.NO.	PE-DM-424-145-1002
SHT	10 OF 10

INTERFACE FOR MODULATING DRIVES - CLCS

INTERFACE FOR MODULATING DRIVES - CLCS-M



- \$\$\$ REDUNDANT OUTPUTS WHEREVER APPLICABLE
- # 8 LEVEL TERMINAL BLOCK
- \$\$\$ IN EACH DDCMIS POST, UNUSED TB'S ARE USED FOR SPARE CORE TERMINATION.
- F-TYPE: INDIVIDUAL & OVERALL SHIELD CABLE.

	3XB00 MW NTPC PATRATU STPP PHASE-1	DRG.NO. 96685-001-406-PVI-B-1628
	INTERFACE FOR MODULATING DRIVES - CLCS-M	SHT 15 OF 34



**C&I SPECIFICATION FOR
GYPSUM DEWATERING EQUIPMENT**

SECTION: C
SUB SECTION: C&I

**DRIVE & INSTRUMENT INTERFACE
DIAGRAM**

THIS IS PART OF TECHNICAL SPECIFICATION PE-TS-468-571-A901 REV 00.

LIST OF MATERIALS

ITEM NO.	DESCRIPTION
1.	ISOLATION VALVE (gate/ globe) SS.
2.	SEALERS FOR TEE
3.	AIR FILTER REGULATOR
4.	WOT" AIR HEADER SS.
5.	COMP. NEEDLE VALVE SS.
6.	AIR PURGE SET.
7.	COMP. VALVE SS.
8.	PLUG SS.
9.	TOPE SS CONNECTION
10.	TOPE COMP. ESTAL. TEE UNION
11.	TOPE COMP. ESTAL. TEE UNION
12.	WALNUT-SS. BUSHING FOR SS PIPE CONNECTION
13.	SEWATER TUBE SS.
14.	BRASS TEE SS.
15.	PT. BRASS.
16.	NYLON FLEX. HOSE BRANDED WITH SS. WELD.
17.	HOSE TAMPON COUPL. SS.
18.	QUICK DISCONNECT SS. (PURGE AIR CONNECTION) TS. INSTRUMENT SOURCE END)

LIST OF MATERIALS

ITEM NO.	DESCRIPTION
14.	SW GLOBE VALVE.
17.	SW EQUAL TEE.
18.	S.S. NIPPLE.
19.	3" VALVE MANIFOLD
20.	SW HALF COUPLER CS.
21.	PIPE A TUBE UNION
22.	SEALABLE ADAPTER
23.	SS TUBE

WELLHEAD CROSS-SECTIONAL

WELLHEAD ELEVATION

SCHEMATIC

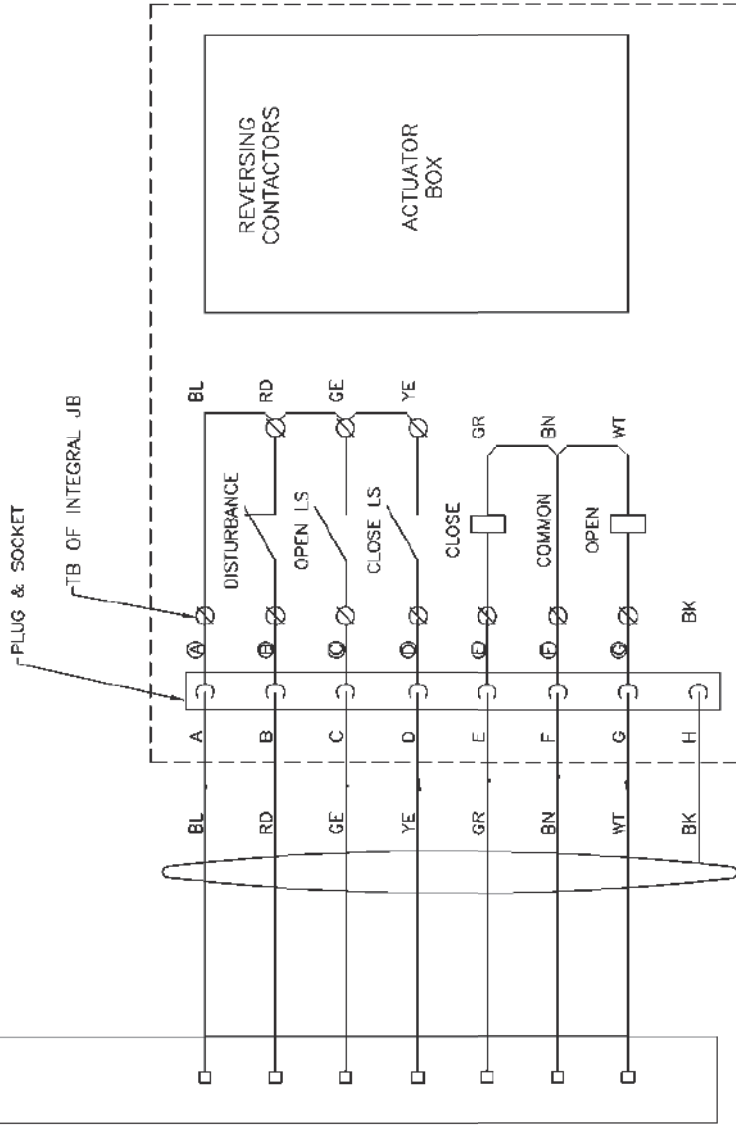
TYPICAL PURGE AIR CONNECTION INSIDE THE INST. ENCLOSURE
 (APPLICABLE FOR MILL, AIR & VALVE GAS SERVICE INSTRUMENTS)
 (ADAPTING PURGE AIR)
 (Drop Header of each L&L/AIR shall be connected to nearest plant drain)

TYPICAL PURGE AIR CONNECTION INSIDE THE INSTRUMENT SOURCE PANEL

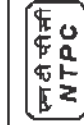
FOR TENDER PURPOSE ONLY

WPT/PT (NTPC)	NTPC LIMITED (A COMPANY OF NTPC LIMITED)	WELL NO.	WELL NO.
PROJECT TYPICAL THERMAL POWER PROJECT (TURNKEY EPC PACKAGE)		WELL NO.	WELL NO.
SCOPE TYPICAL GAS OF LOCAL INSTRUMENT ENCLOSURE PURGING SCHEME (SP TRANSMITTER)		WELL NO.	WELL NO.
WELL NO.	WELL NO.	WELL NO.	WELL NO.

TERMINATION AT
CONTROL SYSTEM END



FOR TENDER PURPOSE ONLY

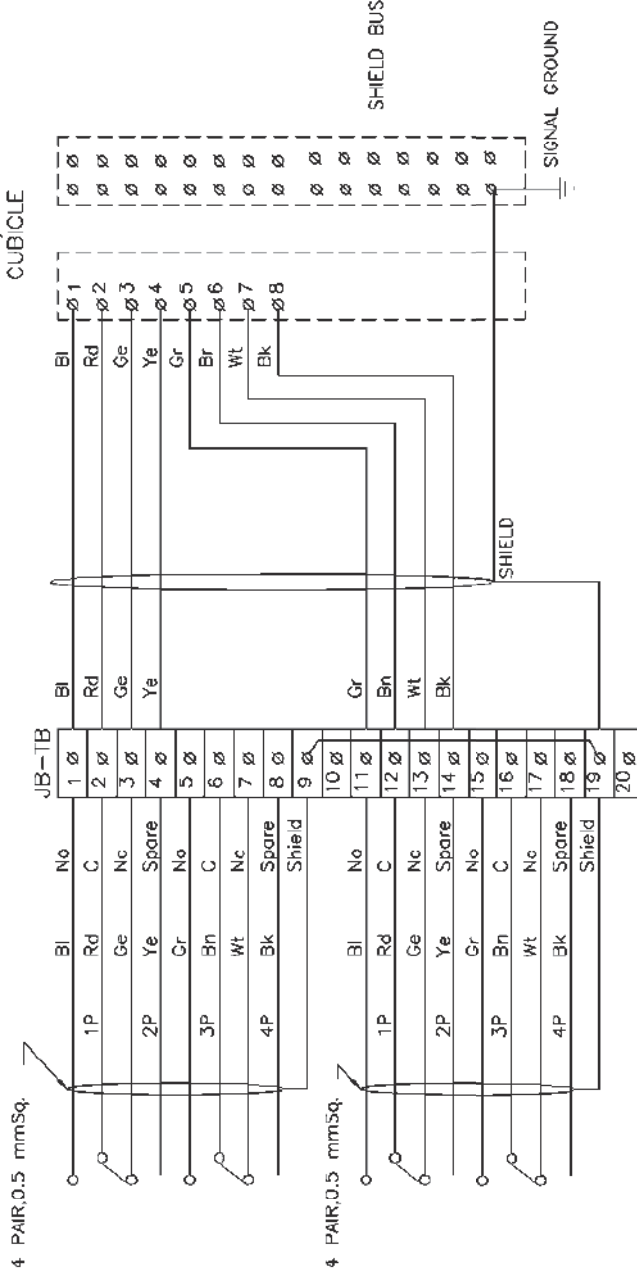


नेशनल थर्मल पावर कॉर्पोरेशन लिमिटेड
National Thermal Power Corporation Ltd.
(A GOVERNMENT OF INDIA ENTERPRISE)
ENGINEERING DIVISION

PROJECT		TYPICAL THERMAL POWER PROJECT	
TITLE		INTERFACING OF ACTUATORS	
REV. NO.	D	DRG. NO.	0000-999-POLA-063
FIRST ISSUE	D	SCALE	N.T.S.
DATE	21.08.12	SIZE	A3
APPRO. DATE		DATE	
ARCH.		C&I	
C		E	
M		CLEARED BY	
CHKD.		DESIGN	
DRAWN		DESIGN	
DESCRIPTION			

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MARSHALLING/TERMINATION CUBICLE

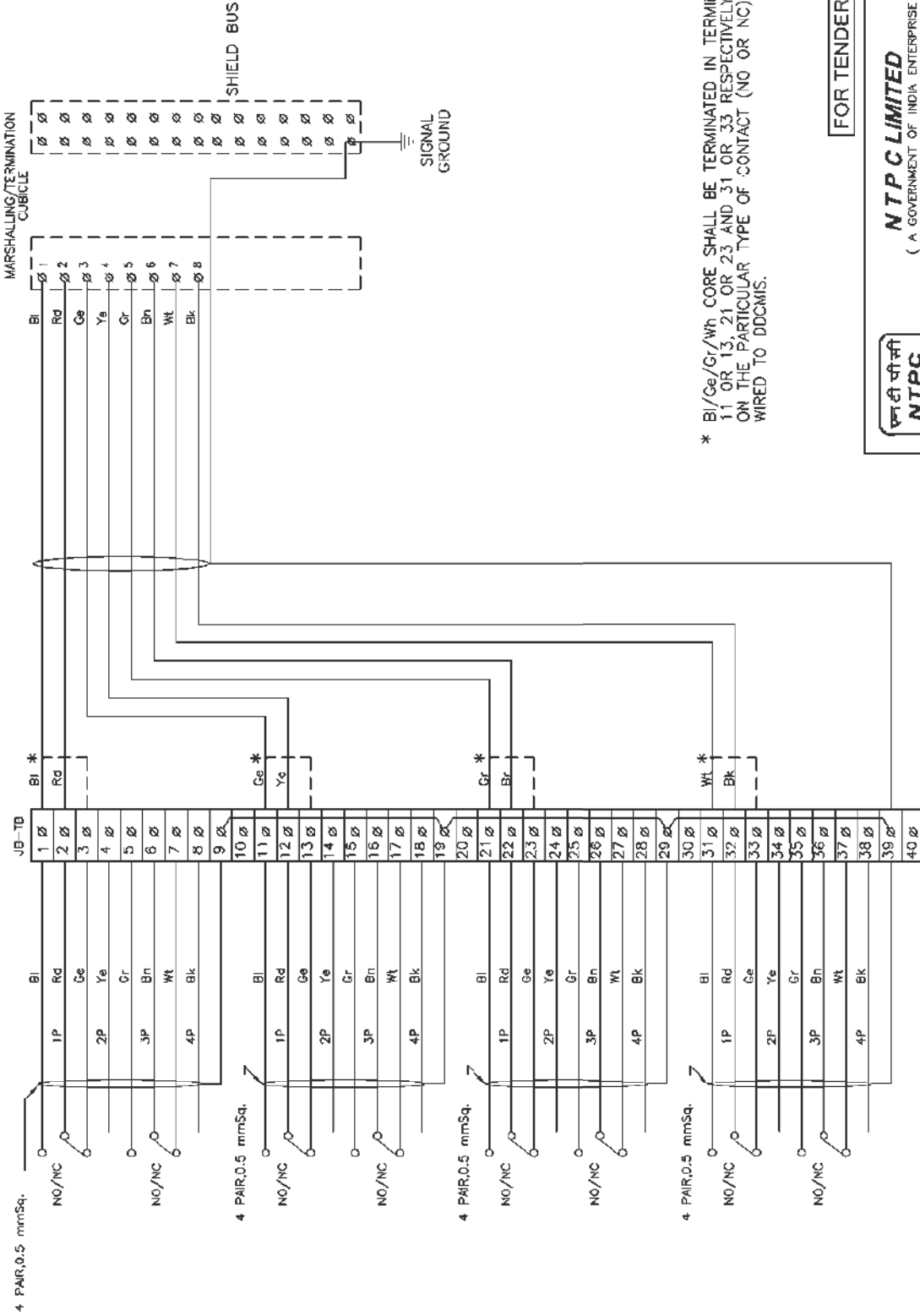


FOR TENDER PURPOSE ONLY

NTPC LIMITED (A GOVERNMENT OF INDIA ENTERPRISE) ENGINEERING DIVISION		Page 345 of 588	
PROJECT TYPICAL THERMAL POWER PROJECT		TITLE INTERFACING OF FIELD INSTRUMENTS/ SWGR SWITCH (COC) TERMINATION DETAILS	
REV. NO.	A	SCALE	NTS
DR. NO.	0000-999-POI-A-065	DRG. NO.	SH 01 OF 15
DATE	21.06.12	APPROV.	ARCH.
DESIGN	CHKD.	M	E
DRAWN	DESIGN	C&I	ARCH.
CLEARED BY			
DESCRIPTION			
FIRST ISSUE			

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* BI/Ge/Gr/Wt CORE SHALL BE TERMINATED IN TERMINAL 1 OR 3, 11 OR 13, 21 OR 23 AND 31 OR 33 RESPECTIVELY DEPENDING ON THE PARTICULAR TYPE OF CONTACT (NO OR NC) IS TO BE WIRED TO DDCMIS.

FOR TENDER PURPOSE ONLY



NTPC LIMITED
 (A GOVERNMENT OF INDIA ENTERPRISE)
 ENGINEERING DIVISION

PROJECT		TYPICAL THERMAL POWER PROJECT	
TITLE		INTERFACING OF FIELD INSTRUMENTS SWITCH TERMINATION DETAILS NO/NC	
REV. NO.	A	DRG. NO.	0000-999-POI-A-065
SIZE	A3	SCALE	NTS
DATE	21.06.12	APPRD	
Cleared by		M	E
DESCRIPTION		CHKD.	DESIGN
FIRST ISSUE		DRAWN	

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INTERNAL WIRING INT. JB OF CV
 POSITIONER COMMAND
 POS FEEDBACK
 1 Ø
 2 Ø
 3 Ø
 4 Ø
 5 Ø
 6 Ø
 7 Ø
 8 Ø
 9 Ø

4 PAIR, 0.5 mmSq.

LOCAL JB

1 Ø
 2 Ø
 3 Ø
 4 Ø
 5 Ø
 6 Ø
 7 Ø
 8 Ø
 9 Ø
 10 Ø
 11 Ø
 12 Ø
 13 Ø
 14 Ø
 15 Ø
 16 Ø
 17 Ø
 18 Ø
 19 Ø
 20 Ø
 21 Ø
 22 Ø
 23 Ø
 24 Ø
 25 Ø
 26 Ø
 27 Ø
 28 Ø
 29 Ø
 30 Ø
 31 Ø
 32 Ø

BI
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Ø 1
 Ø 2
 Ø 3
 Ø 4
 Ø 5
 Ø 6
 Ø 7
 Ø 8

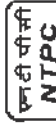
INTERNAL WIRING INT. JB OF CV
 POSITIONER COMMAND
 POS FEEDBACK
 1 Ø
 2 Ø
 3 Ø
 4 Ø
 5 Ø
 6 Ø
 7 Ø
 8 Ø
 9 Ø

Gr
 Bn
 Wt
 Bk

SHIELD BUS

SIGNAL GROUND

FOR TENDER PURPOSE ONLY



NTPC LIMITED
 (A GOVERNMENT OF INDIA ENTERPRISE)
 ENGINEERING DIVISION

PROJECT

TYPICAL THERMAL POWER PROJECT

TITLE

INTERFACING OF FIELD INSTRUMENTS CONTROL VALVE

Page 347 of 588

DATE 21.06.12

SCALE NTS

DRG. NO. 0000-999-POI-A-065

REV. A

SH 03 OF 15

REV. NO. A

DESCRIPTION

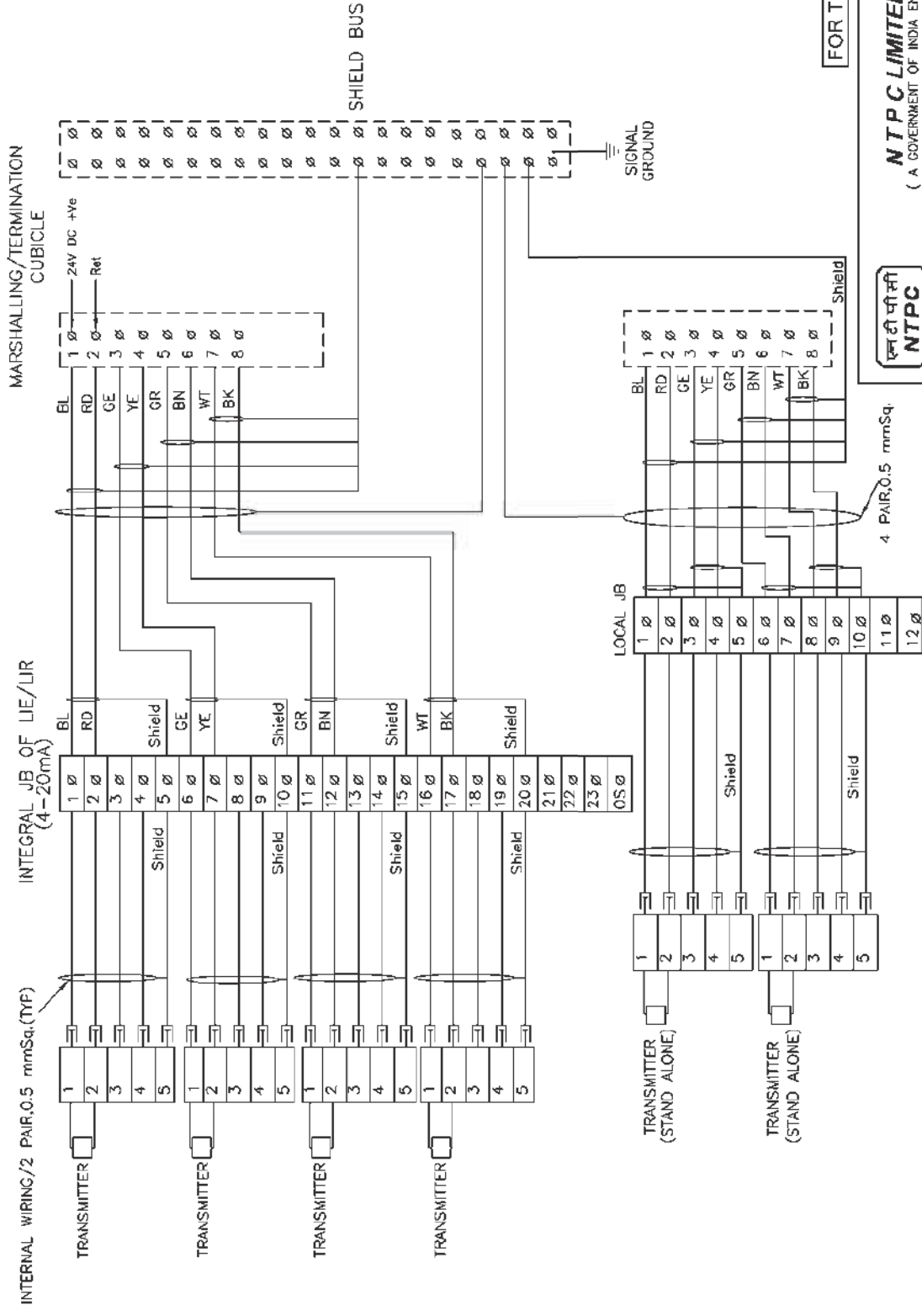
DRAWN DESIGN

CHKD.

M E C C&I ARCH. APPD. DATE

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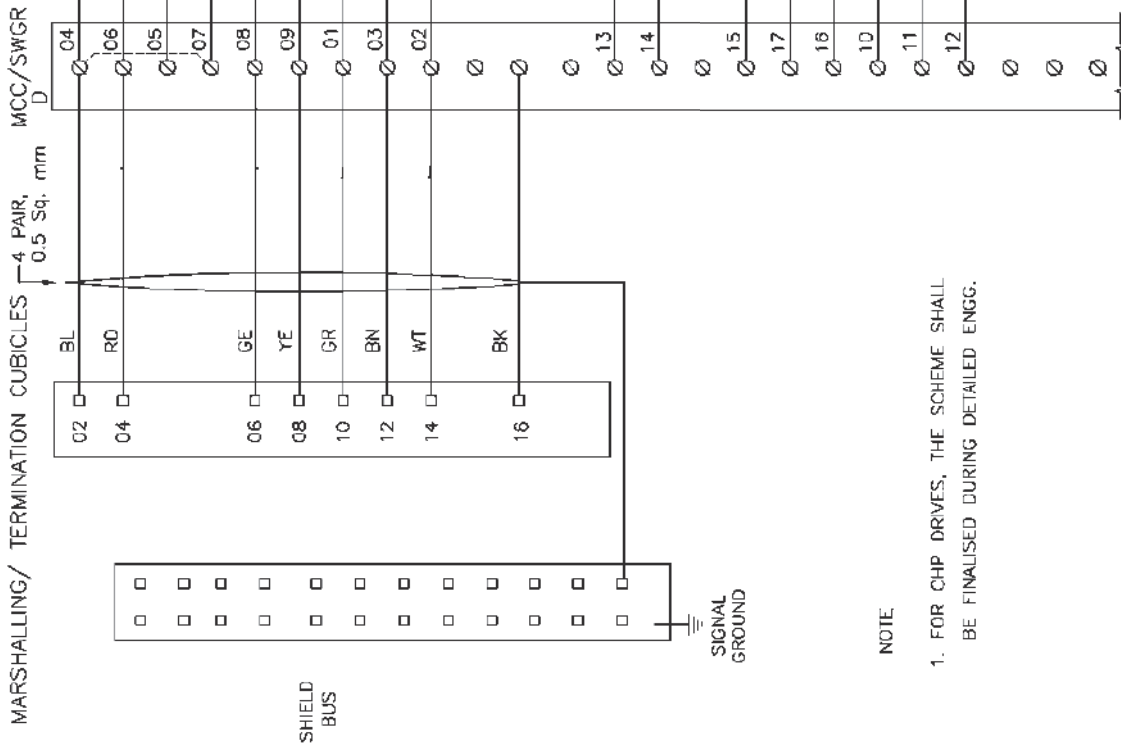


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ENGINEERING DIVISION

PROJECT		TYPICAL THERMAL POWER PROJECT	
TITLE		INTERFACING OF FIELD INSTRUMENTS 4-20mA	
REV. NO.	DRG. NO.	SCALE	REV. NO.
A	0000-999-PO1-A-065	NTS	B
B		A3	SH 04 OF 15
DESCRIPTION			
INTERNAL WIRING FOR LIE/LIR MOUNTED SHOWN WIRING OF STAND ALONE IXC/IR SHOWN			
DRAWN DESIGN CHKD.			
APPROD DATE			
21.08.12			
12.1.05			
C&I ARCH.			
M E C			
CLEARED BY			

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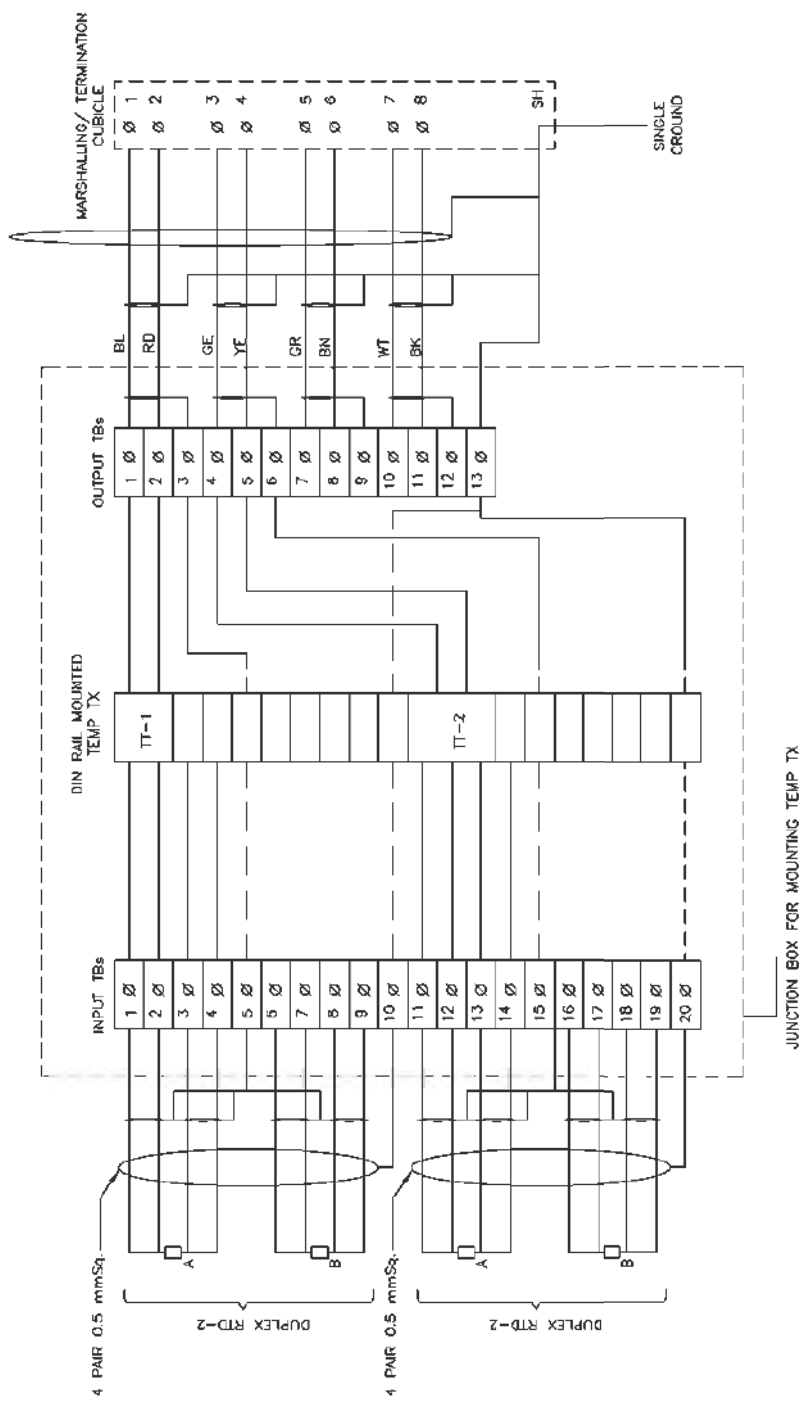
NOTE

- FOR CHP DRIVES, THE SCHEME SHALL BE FINALISED DURING DETAILED ENGG.

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NTPC LIMITED (A GOVERNMENT OF INDIA ENTERPRISE) ENGINEERING DIVISION		Page 349 of 530	
TYPICAL THERMAL POWER PROJECT			
INTERFACE OF FIELD INSTRUMENTS INTERFACE OF DDCMIS WITH MCC/SWGR/ACTUATOR (LT MOTORS)			
REV. NO.	A	SCALE	DRG. NO.
		A3	0000-999-POI-A-065
		SIZE	SH 05 OF 15
		DATE	REV.
		21.06.12	A
DESCRIPTION		APPD M	ARCH. C&I C E M CLEARED BY

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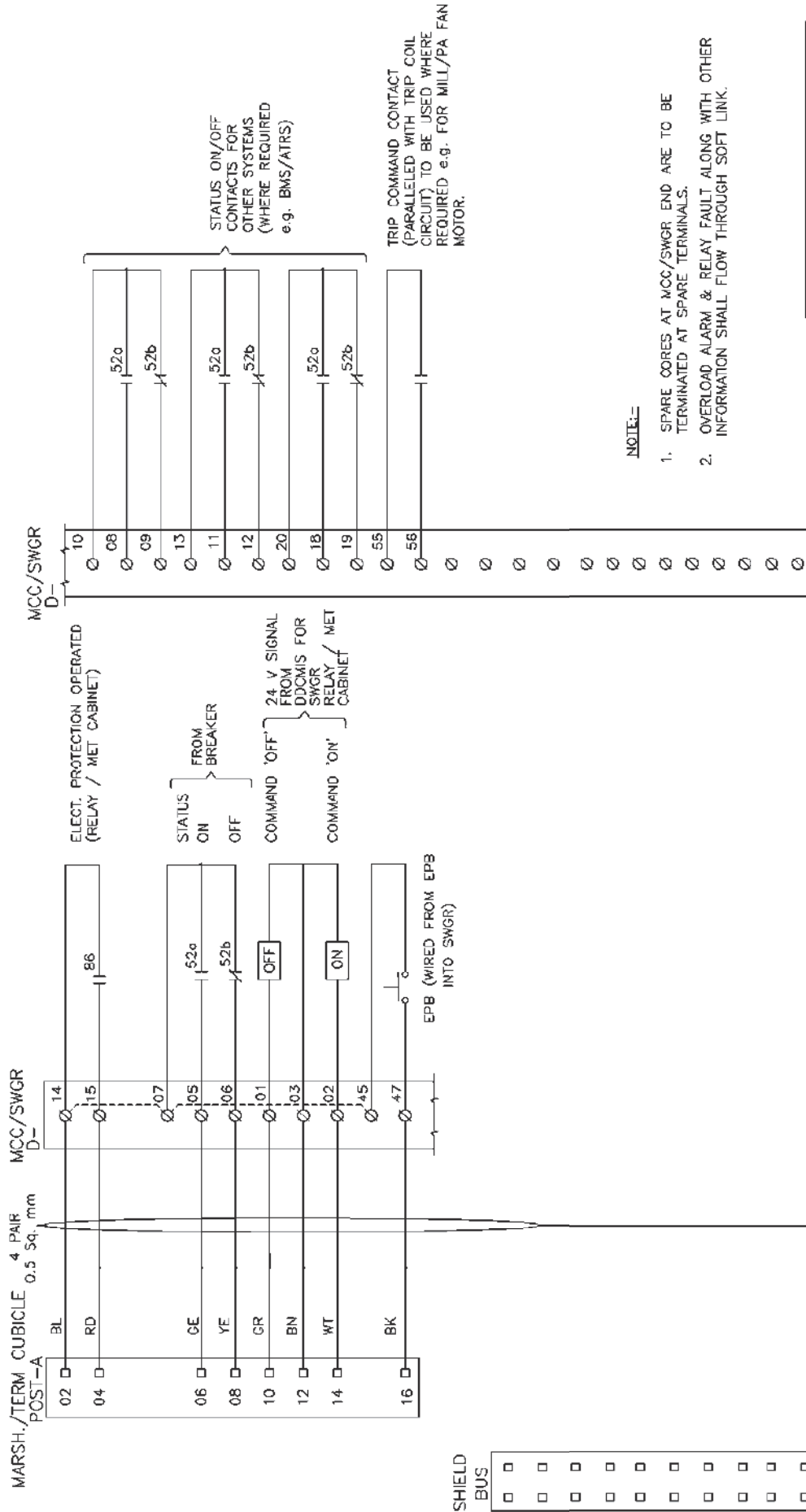
- NOTE :-
- 1) ABOVE IS THE TYP. DRG. MOUNTED TEMP TRANSMITTER FRO T/C APPLICATION. EXACT TYPE OF TEMP TRANSMITTERS SHALL BE AS PER PART-A OF SPECIFICATION.
 - 2) THE EXACT GROUPING OF TEMP TXs SHALL BE FINISHED DURING DETAILED ENGG. STAGE.
 - 3) PLEASE NOTE THAT THIS CONFIGURATION IS SHOWN FOR SINGLE INPUT DIN MOUNTED TT. FOR DUAL INPUT TT BOTH THE ELEMENTS OF RTD SHALL BE CONNECTED TO IT THROUGH INPUT TBs.

FOR TENDER PURPOSE ONLY

NTPC LIMITED (A GOVERNMENT OF INDIA ENTERPRISE) ENGINEERING DIVISION		Page 350	
PROJECT TYPICAL THERMAL POWER PROJECT		TITLE INTERFACING OF FIELD INSTRUMENTS TYPICAL RTD CONNECTION WITH TEMP TRANSMITTERS IN JBS	
REV. NO.	A	SCALE	NTS
DRG. NO.	0000-999-POI-A-065	DATE	21.06.12
DESCRIPTION		APPRO. BY	ARCH.
DESCRIPTION		M	E
DESCRIPTION		C	C&I
DESCRIPTION		CHKD.	CLEARED BY
DESCRIPTION		DRAWN	DESIGN
DESCRIPTION		REV. NO.	A
DESCRIPTION		SH	05 OF 15

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NOTE:-

1. SPARE CORES AT MCC/SWGR END ARE TO BE TERMINATED AT SPARE TERMINALS.
2. OVERLOAD ALARM & RELAY FAULT ALONG WITH OTHER INFORMATION SHALL FLOW THROUGH SOFT LINK.

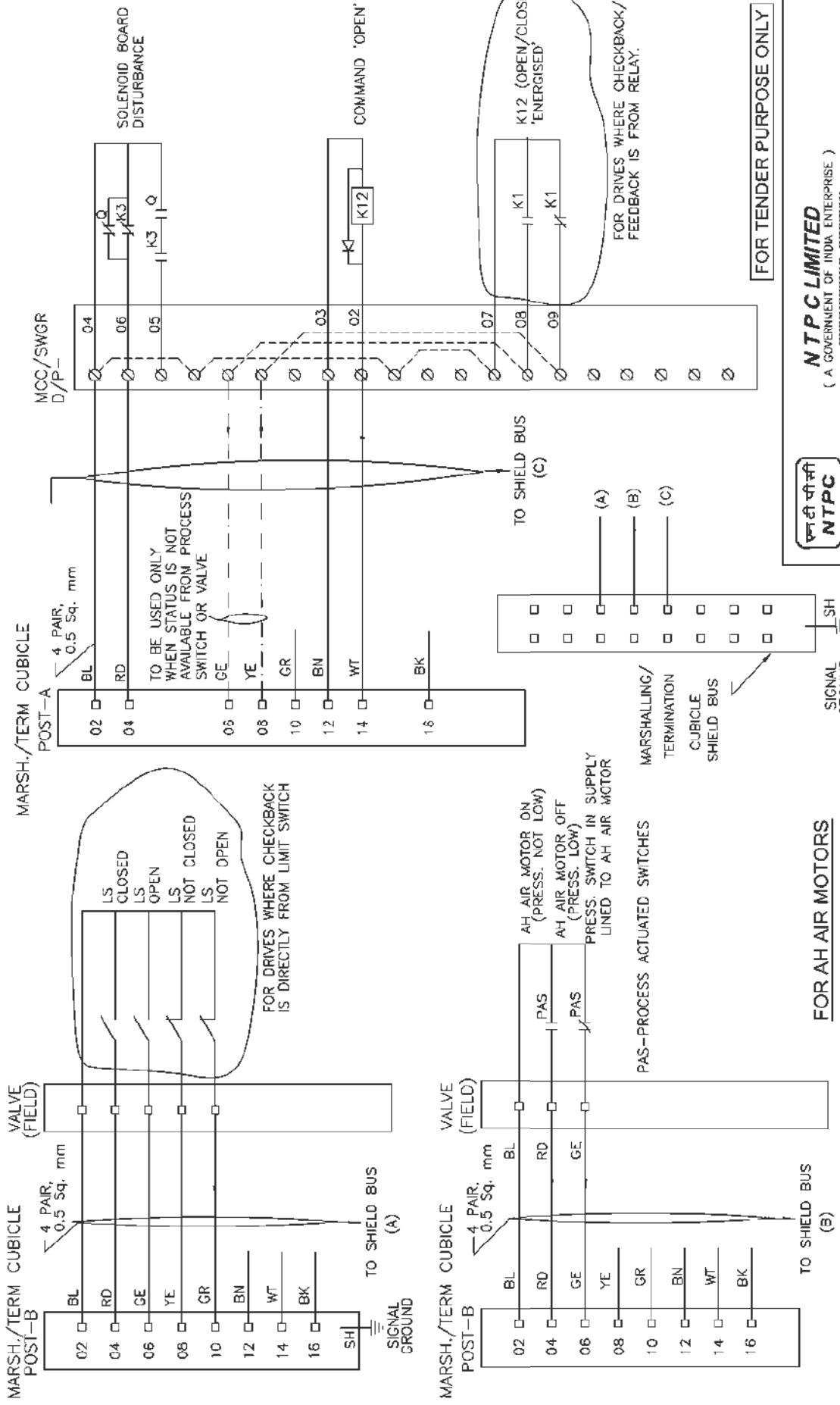
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NTPC LIMITED
(A GOVERNMENT OF INDIA ENTERPRISE)
ENGINEERING DIVISION

PROJECT		TYPICAL THERMAL POWER PROJECT	
TITLE		INTERFACING OF FIELD INSTRUMENTS INTERFACE OF DDCMIS WITH MCC/SWGR/ACTUATOR (HT MOTORS)	
REV. NO.	A	SCALE	NTS
DRG. NO.	0000-999-POI-A-065	DATE	21.06.12
REV.	B	APPROVED	ARCH.
DESCRIPTION		Cleared by	
FIRST ISSUE		M E C C&I	
DRAWN		DESIGN	
CHKD.		M E C C&I	

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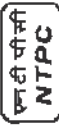
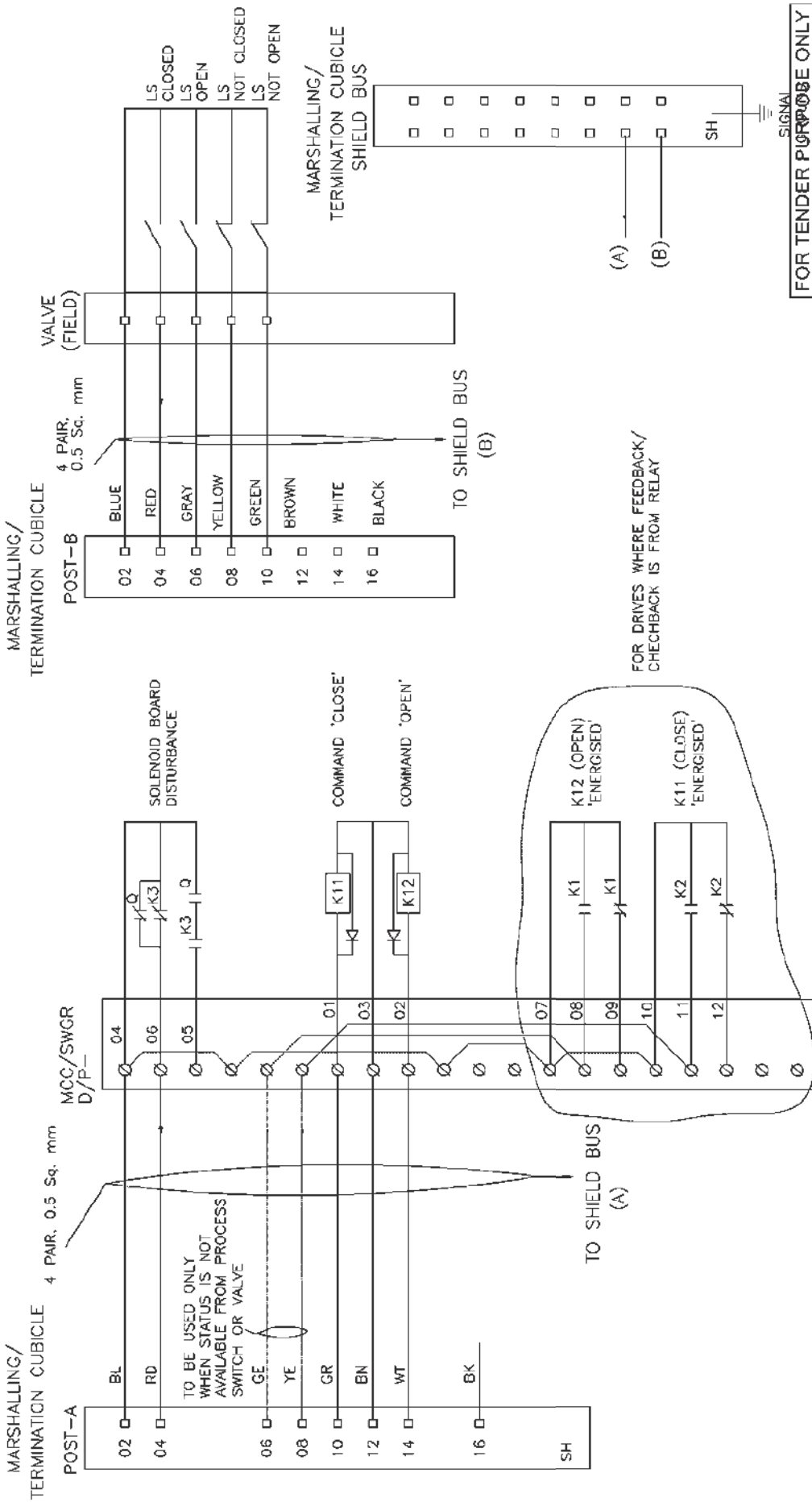
NTPC LIMITED
(A GOVERNMENT OF INDIA ENTERPRISE)
ENGINEERING DIVISION



PROJECT		TYPICAL THERMAL POWER PROJECT	
TITLE		INTERFACE OF FIELD INSTRUMENTS INTERFACE OF DDCMIS WITH MCC/SWGR/ACTUATOR (SINGLE COIL SOLENOID)	
REV. NO.	DATE	SCALE	DRG. NO.
A	21.06.12	A3	0000-999-POI-A-065
DESCRIPTION		NTS	SH 08 OF 15
Cleared by		REV. A	

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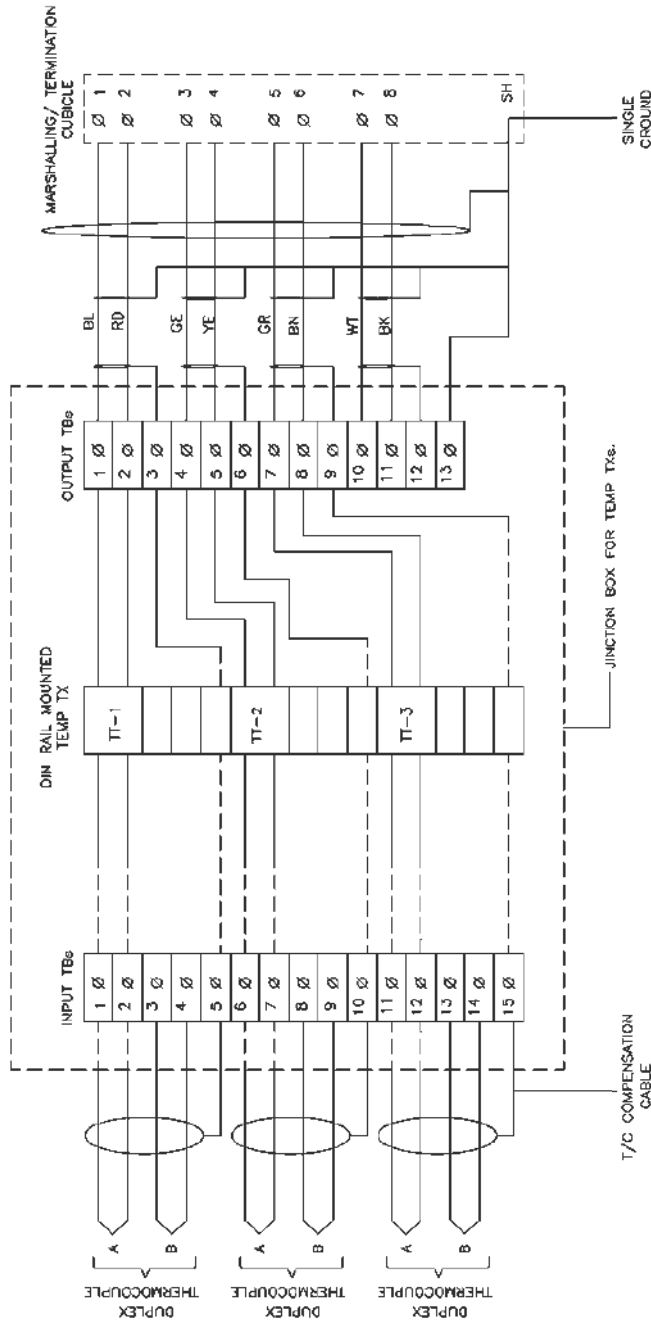


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 (A GOVERNMENT OF INDIA ENTERPRISE)
 ENGINEERING DIVISION

FOR TENDER PURPOSE ONLY

PROJECT		TYPICAL THERMAL POWER PROJECT	
TITLE		INTERFACING OF FIELD INSTRUMENTS INTERFACE OF DDCMS/PLC WITH MCC/SWGR/ACTUATOR (DOUBLE COIL SOLENOIDS)	
REV. NO.	DATE	SCALE	DRG. NO.
A	21.08.12	A3	0000-999-POI-A-065
DESCRIPTION		NTS	SH 09 OF 15
Cleared by		REV. A	

THIS IS PART OF TECHNICAL SPECIFICATION PE-TS-468-571-A901-REV-00.



- NOTE :-
- 1) ABOVE IS THE TYP. DRG. MOUNTED TEMP TRANSMITTER FRO T/C APPLICATION. EXAC- TYPE OF TEMP TRANSMITTERS SHALL BE AS PER PART-A OF SPECIFICATION.
 - 2) THE EXACT GROUPING OF TEMP TXs SHALL BE FINISHED DURING DERAILED ENGG. STAGE.
 - 3) AFTER GLADDING OF T/C CABLES ON JB. THE CABLE PAIR OF FIRST ELEMENT WILL BE DIRECTLY CONNECTED TO TI AND THE CABLE PAIR OF SECOND ELEMENT SHALL BE WIRED TO INPUT TBs FOR FUTURE USE.
 - 4) PLEASE NOTE THAT THIS CONFIGURATION IS SHOWN FOR SINGLE INPUT DIN RAIL MOUNTED TI. FOR DUAL INPUT TI BOTH THE ELEMENT OF T/C SHALL BE CONNECTED DIRECTLY TO TI WITHOUT INPUT TBs. HOWEVER 5 NOS OF INPUT TBs ARE TO PROVIDED FOR EACH T/C FOR FUTURE USE.

FOR TENDER PURPOSE ONLY



NTPC LIMITED
(A GOVERNMENT OF INDIA ENTERPRISE)
ENGINEERING DIVISION

PROJECT		TYPICAL THERMAL POWER PROJECT				
TITLE		INTERFACING OF FIELD INSTRUMENTS TYPICAL T/C CONNECTION WITH TEMP TXs IN JBs				
REV. NO.	DESCRIPTION	CHKD.	DESIGN	ARCH.	DATE	SCALE
B	CABLING OF 2ND RTD CHANGED TO MATCH COLOR CODE				21.08.12	A3
A	FIRST ISSUE				29.04.06	NTS
DRWN		DESIGN		CHKD.		DRG. NO.
						0000-999-POI-A-065
CLEARED BY		M	E	C	C&I	ARCH.
						SH 15 OF 15
						REV. B



**C&I SPECIFICATION FOR
GYPSUM DEWATERING EQUIPMENT**

SECTION: C
SUB SECTION: C&I

**QUALITY ASSURANCE FOR
INSTRUMENTS & LCP AND TYPE TEST
REQUIREMENTS**

THIS IS PART OF TECHNICAL SPECIFICATION PE-TS-468-571-A901 REV 00.

CLAUSE NO.

QUALITY ASSURANCE & INSPECTION



ELECTRICAL ACTUATOR WITH INTEGRAL STARTER

Test/Attributes Characteristics	RPM ®	No Load Current ®	IR & HV Test®	Mounting Dimension®	All routine Test as per Standard & Specification®	Correct Phase Sequence®	Operation & Setting of limit Switch/Torque Switch®	Stall Torque/Current (A)	Hand Wheel operation/ Auto de clutch function (A)	Function of Aux. like Potentiometer, space heater, position indicator	EPT output ®	Grease leakage ®	Local/ Remote (Open-Stop-Close) Operation® Safety check (Single phasing, Phase correction, Tripping etc.) (A)
ELECTRICAL ACTUATOR WITH INTEGRAL STARTER(IS_9334)													
Motor	Y	Y	Y	Y	Y								
Final Testing	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
<p>Note: 1) Detailed procedure of Burn-in and Elevated Temperature test shall be as per Quality Assurance Programme in General Technical Conditions</p> <p>2) This is an indicative list of tests/checks. The manufacturer is to furnish a detailed quality plan indicating the practices and procedure adopted along with relevant supporting documents.</p> <p>® - Routine Test (A) - Acceptance Test Y - Test applicable</p>													

LOT-2 PROJECTS
FLUE GAS DESULPHURISATION (FGD)
SYSTEM PACKAGE

TECHNICAL SPECIFICATION
SECTION – VI
BID DOC. NO.:CS-0011-109(2)-9

PART-B
SUB-SECTION-V-QE7
ELECTRICAL ACTUATORS
WITH INTEGRAL STARTERS

PAGE
1 OF 1

THIS IS PART OF TECHNICAL SPECIFICATION PE-TS-468-571-A901 REV 00.

CLAUSE NO.

QUALITY ASSURANCE & INSPECTION



Process, Connection & piping FOR C&I SYSTEMS

TESTS

ITEMS

	Visual ®	GA, BOM, Layout of component & construction feature®	Dimension ®	Paint Shade/thickness ®	Flattening, flaring, hydrotest, hardness check as per ASTM standard	Component Ratings ®	Wiring ®	Make, Model, Type, Rating®	IR & HV ®	Review of TC for instrument/devices (R)	Accessibility of TBs/Devices ®	Illumination,grounding ®	Tubing ®	Leak/Hydro test(A)	Chemical/physical properties of material (A)	Proof pressure test,Dismantling & reassembly test,Hydraulic impulse and vibration test (R)	Tests as per standards & specification
Local Instrument enclosure	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y				
Local instruments racks	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y				
Junction Box	Y	Y	Y	Y	*	Y		Y	Y								
Gauge Board	Y	Y	Y	Y		Y		Y		Y			Y	Y			
Impulse pipes and tubes	Y		Y		Y			Y							Y		
Socket weld fittings ANSI B-16.11	Y		Y					Y							Y		Y
Compression fittings	Y		Y					Y						Y	Y	Y	
Instrument valves & Valve manifolds	Y		Y					Y						Y	Y		
Copper tubings ASTM B75	Y							Y									Y

*-applicable for painted junction boxes.

Note: R-Routine Test

A- Acceptance Test

Y – Test applicable

Note: This is an indicative list of tests/checks. The manufacturer is to furnish a detailed quality plan indicating the Practices and Procedure adopted alongwith relevant supporting documents.

CLAUSE NO.

QUALITY ASSURANCE & INSPECTION



VFD MODULE SQE_28

ATTRIBUTES / CHARACTERISTICS	Visual & Dimensional checks	Make / Type / Rating etc.	Final Inspectio n as ISS / IEC	Remarks
ITEMS/COMPONENTS, SUB SYSTEM ASSEMBLY				
HT Breaker (IEC 56)	Y	Y	Y	
DC Reactor	Y	Y		For details refer table for DC Reactor
Transformer	Y	Y		For details refer table for Transformer
Motor	Y	Y		For details refer separate table for Motor
VFD Panel	Y	Y		For details refer table for VFD

Note : 1) This is an indicative list of tests/checks. The manufacture is to furnish a detailed Quality

Plan indicating the practices & Procedure followed alongwith relevant supporting documents during QP finalisation.

2) Make of all major Bought Out Items will be subject to NTPC approval.

CLAUSE NO.

QUALITY ASSURANCE & INSPECTION



DC REACTOR

ATTRIBUTES / CHARACTERISTICS ITEMS/COMPONENTS, SUB SYSTEM ASSEMBLY	Visual	Dimensional	Mech. & Chem. Property	Electrical Characteristics	Pretreatment by Seven Tank	Painting by Stove Enameling	Final Inspection as per IS-2026	Welding/NDT
Winding Material (Aluminium)	Y	Y	Y	Y				
Insulation Material	Y	Y		Y				
Sheet Steel	Y	Y	Y					
Winding	Y	Y		Y				
Fabrication of Enclosures	Y	Y			Y	Y		Y
Assembly	Y	Y						
Routine Tests	Y	Y					Y	

- Note :
- 1) This is an indicative list of tests/checks. The manufacturer to furnish a detailed Quality Plan indicating their practice & procedure along with relevant supporting documents during QP finalisation for all items.
 - 2) All major Bought Out Items will be subject to NTPC approval.

CLAUSE NO.

QUALITY ASSURANCE & INSPECTION



TRANSFORMER (OIL FILLED)

Attributes / Characteristics Items/Components Sub Systems	Visual & Dimensional Checks	Mechanical properties	Electrical strength	Thermal properties	Chemical Composition	Compatibility with oil	NDT / DPT / MPI / UT	Ageing Test.	Voltage Ratio, Vector Group & Polarity, Magnetic Balance Test	Make / Type / Rating / Model / TC / General Physical Inspection.	WPS & PQR	Routine Test as per relevant test	Routine Test
Tank, H.V. & L.V. Cable Box / Flange throat	Y	Y					Y						
Conservator / Radiator / Cooler / Pipes	Y	Y					Y						
Copper Conductor (IS:191)	Y	Y	Y		Y								
Insulating Material	Y	Y	Y	Y	Y	Y							
CRGO Lamination & Built Core	Y	Y	Y		Y	Y							
Bushing / Insulator (IS:2544 / 5621)	Y	Y								Y		Y	
Gasket	Y				Y	Y		Y				Y	
Transformer Oil (IS:335 / IEC296)												Y	
Off-Circuit Tap Changer	Y									Y			
Core Coil Assembly & Pre-tanking	Y								Y				
Marshalling Box	Y	Y					Y					Y	
WTI, OTI, MOG, PRD, Breather, Terminal Connector, Bucholz Relay, Globe & Gate Valve,	Y									Y			
Welding (ASME Sect-IX)	Y										Y		
Complete Transformer (IS:2026/ IEC-60076)	Y												Y

Note: 1) This is an indicative list of tests / checks. The manufacturer is to furnish a detailed Quality Plan indicating the practice and procedure along with relevant supporting documents.
2) All major Bought Out Items will be subject to NTPC approval.

CLAUSE NO.

QUALITY ASSURANCE & INSPECTION



DRY TYPE TRANSFORMER

Attributes / Characteristics Items/Components Sub Systems	Visual & Dimensional check	Mechanical properties	Electrical strength	Thermal Properties	Chemical Properties	NDT / DP / MPI	Voltage Ratio, Vector Group & Polarity	Make / Type / Rating / Model / TC / General Physical Inspection	WPS & PQR	Routine Test as per relevant standard	Measurement of capacitance & tan delta between winding	Routine Test
Enclosure door, H.V. & L.V. Cable Box / Flange Throat	Y	Y						Y				
Copper Conductor	Y	Y	Y		Y							
Insulating Material	Y			Y	Y							
CRGO Lamination & Built Core	Y											
Bushing /Insulator (IS:2544 / 5621)	Y							Y		Y		
Gasket	Y							Y		Y		
Off-Circuit Tap Changer	Y							Y				
Core Coil Assembly	Y					Y						
Marshalling Box	Y									Y		
WTI, Thermister, Terminal Connector	Y							Y				
Welding									Y			
Complete Transformer (IS:11171 / IEC 60076)	Y										Y	Y
<p>Notes: 1) This is an indicative List of test/checks. The manufacturer is to furnish a detailed Quality Plan indicating his practice and procedure along with relevant supporting documents during QP finalization for all item.</p> <p>2. All major Bought out Items will be subject to NTPC approval.</p>												

VFD PANEL

LOT-2 PROJECTS
FLUE GAS DESULPHURISATION (FGD)
SYSTEM PACKAGE

TECHNICAL SPECIFICATION
SECTION – VI
BID DOC. NO.:CS-0011-109(2)-9

PART-B
SUB-SECTION-V-QE13
VFD MODULE

PAGE
4 OF 5

CLAUSE NO.

QUALITY ASSURANCE & INSPECTION



Attributes Characteristics	Electrical Properties	Mechanical Properties	Chemical Properties	Dimensions / Finish	Type/ Rating/Functional check	HV/IR	Routine test as per relevant std.	Constructional Features	IS:6005 ,Seven tank process	Paint finish/ shade/thickness	Mountings / BOM/ Make, Completeness	Interlock Functional & Operation Testing / Simulation check	Degree of Protection Test	Final testing as per Relevant
Sheet Steel (IS-513)		Y	Y	Y										
Aluminum / Copper Bus-bar (IS-5082/IS-613/IS-1987)	Y	Y	Y	Y										
Support Insulator (BS-2782/IEC-660/IS-10912)	Y	Y	Y	Y										
Control / Selector Switch (IS-6875)					Y	Y	Y							
Contactors/ MCB (IS-13947)					Y	Y	Y							
O/L Protection relays (IS-3231)					Y		Y							
C.T /V.T/ Indicating Meter (IS-2705/3156/1248)					Y	Y	Y							
Fuse/ Fuse carrier (IS-13703)					Y	Y	Y							
Terminals/lugs/pvc wires (IS-13947//IS-694)	Y			Y	Y	Y	Y							
Timers (IS-3231)					Y	Y	Y							
Push Button/ Lamp/ (IS-6875)					Y	Y	Y							
Control Transformer (IS-12021)					Y	Y	Y							
Mimic, Annunciater					Y		Y							
GASKET (IS-11149)		Y	Y	Y	Y		Y							
Fabrication								Y						
Pretreatment & Painting									Y	Y				
VFD panel										Y	Y	Y	Y	Y

NOTE:

1. This is an indicative list of Test/ Checks. The manufacturer to furnish a detailed Quality Plan indicating the practice and procedure along with relevant supporting documents.
2. All major Bought Out Items will be subject to NTPC approval.

CLAUSE NO.

QUALITY ASSURANCE & INSPECTION



MEASURING INSTRUMENTS (PRIMARY AND SECONDARY) Page- 1/2


TESTS ITEMS	Dimensions (R)	Make, Model, Type, Rating (R)	Process / Electrical connection (R)	Calibration (R)	Test as per standard (R)	Insulation Resistance (R)	IBR Certification (if applicable) (R)	Hydro Test (R)	Material Test certificate ©
	1. PR Gauge (IS-3624)	Y	Y	Y	Y	Y			
2. Temp. Gauge (BS-5235)	Y	Y	Y	Y	Y				
3. Pr./D.P.Switch(BS-6134)	Y	Y	Y	Y	Y	Y			
4. Electronic Transmitter(IEC-60770)	Y	Y	Y	Y	Y	Y			
5. Temp. Switch	Y	Y	Y	Y	Y	Y			
6. Recorder(IS-9319/ANSI C-39.4)	Y	Y	Y	Y	Y	Y			
7. Vertical indicators	Y	Y	Y	Y		Y			
8. Digital Indicators	Y	Y	Y	Y		Y			
9. Integrators	Y	Y	Y	Y					
10. Electrical Metering Instrument (IS-1248)	Y	Y	Y	Y	Y	Y			
11. Transducer (IEC-688)	Y	Y	Y	Y	Y	Y			
12. Thermocouples (IEC – 754 / ANSI-MC-96.1)	Y	Y	Y	Y	Y	Y			
13. RTD(IEC-751)	Y	Y	Y	Y	Y	Y			
14. Thermowell	Y		Y				Y	Y	Y
R-Routine Test A- Acceptance Test Y – Test applicable									
: Note: 1) This is an indicative list of tests/checks. The manufacturer is to furnish a detailed quality plan indicating the Practices and Procedure adopted along with relevant supporting documents.									

CLAUSE NO.

QUALITY ASSURANCE & INSPECTION



MEASURING INSTRUMENTS (PRIMARY AND SECONDARY) Page- 2/2												
TESTS ITEMS	Dimensions (R)	Make, Model, Type, Rating (R)	Process / Electrical connection (R)	Calibration (R)	Requirement as per standard (R)	WPS approval (A)	Non-destructive testing (R)	Calculation for accuracy (R)	Insulation Resistance (R)	IBR Certification as applicable (R)	Hydro test (R)	Material test certificate (A)
	15. Cold junction compensation box	Y	Y	Y	Y					Y		
16. Orifice plate(BS-1042)	Y	Y	Y	Y	*	Y	**	**		Y	Y	Y
17. Flow nozzle(BS-1042)	Y	Y	Y	Y	*	Y	Y			Y	Y	Y
18. Impact head type element	Y	Y	Y					Y				Y
19. Level transmitter/float type switch	Y	Y	Y	Y					Y	Y	Y	Y
20. Analysers	Y	Y	Y	Y								
21. Dust emission monitors	Y	Y	Y	Y								
*Calibration to be carried out on one flow element of each type and size if calibration carried out as type test same shall not be repeated.												
** If applicable												
R-Routine Test	A- Acceptance Test		Y – Test applicable									
Note: 1) This is an indicative list of tests/checks. The manufacturer is to furnish a detailed quality plan indicating the Practices and Procedure adopted along with relevant supporting documents.												


CLAUSE NO.	QUALITY ASSURANCE & INSPECTION														
INSTRUMENTATION CABLE															
TESTS															
ITEMS	Conductor Resistance ® & (A)	High Voltage ® & (A)	Insulation Resistance ® & (A)	Constructional detail, dimensions (A)	Outer-Sheath/core marking, end sealing (A)	Thermal Stability (A) +	Visual, Surface finish (A) +	Electrical Parameters ** (A) +	Persulphate Test (A) +	Overall/Coverage/Continuity (A)	Swidesh chimney Test (SS-4241475) (A) ++	FRLS Test * (A) ++	Tensile & Elongation before & after aging (A) ++	Vol. Resistivity. at room & Elevated Temp. (A) ++	Spark test report review ®
1. Instrument cable twisted and shielded															
Conductor(IS-8130)	Y			Y		Y	Y						Y	Y	
Insulation(VDE-207)				Y	Y	Y	Y						Y		Y
Pairing/Twisting				Y	Y	Y	Y								
Shielding				Y		Y			Y	Y					
Drain wire	Y			Y		Y		Y	Y	Y					
Inner Sheath				Y	Y	Y	Y					Y	Y		
Outer Sheath				Y	Y	Y	Y					Y	Y		
Over all cable	Y	Y	Y	Y	Y	Y	Y	Y		Y			Y		
Cable Drums(IS-10418)				Y		Y									
<p>Note : High Temp. cables shall be subjected to tests as per VDE-207(Part-6) Compensating cables shall be checked for Thermal EMF/Endurance test as per IS 8784.</p> <p>Note : This is an indicative list of tests/checks. The manufacture is to furnish a detailed Quality Plan indicating his practice & Procedure along with relevant supporting documents during QP finalization for all items.</p> <p>Note : ® - Routine Test A - Acceptance Test Y - Test Applicable</p> <p>Note : Sampling Plan for Acceptance test shall be as per IS 8784 (As applicable)</p> <ul style="list-style-type: none"> • * FRLS Tests: Oxygen / Temp Index (ASTM D-2863), Smoke Density Rating (ASTM – D 2843), HCL Emission (IEC-754-1) • ** Characteristic Impedance, Attenuation, Mutual Capacitance, Cross Talk (As applicable) <p>+ Sample size will be One No. of each size/type per lot.</p> <p>++ Sample size will be One No. sample for complete lot offered irrespective of size/type.</p>															
LOT-2 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(2)-9	PART-B SUB-SECTION-V-QC3 INSTRUMENTATION CABLES	PAGE 1 OF 1												

CLAUSE NO.

QUALITY ASSURANCE & INSPECTION




ELECTRICAL ACTUATOR WITH INTEGRAL STARTER													
Test/Attributes Characteristics													
ITEM/ COPONENT/ SUB SYSTEM ASSEMBLY/ TESTING	RPM ®	No Load Current ®	IR & HV Test®	Mounting Dimension®	All routine Test as per Standard & Specification®	Correct Phase Sequence®	Operation & Setting of limit Switch/Torque Switch®	Stall Torque/Current (A)	Hand Wheel operation/ Auto de clutch function (A)	Function of Aux. like Potentiometer, space heater, position	EPT output ®	Grease leakage ®	Local/ Remote (Open-Stop-Close) Operation® Safety check (Single phasing, Phase correction, Tripping etc.) (A)
ELECTRICAL ACTUATOR WITH INTEGRAL STARTER (IS 9334)													
Motor	Y	Y	Y	Y	Y								
Final Testing	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
<p>Note: 1) This is an indicative list of tests/checks. The manufacturer is to furnish a detailed quality plan indicating the practices and procedure adopted along with relevant supporting documents.</p> <p>® - Routine Test (A) - Acceptance Test Y - Test applicable</p>													

MANUFACTURER/BIDDER/SUPPLIER NAME & ADDRESS		STANDARD QUALITY PLAN				SPEC. NO. :		DATE:		
		CUSTOMER :				QP NO.: PE-QP-999-145-1056		DATE: 07.02.2020		
		PROJECT:				PO NO.: --		DATE: --		
		ITEM: LOCAL CONTROL PANEL				SYSTEM: C&I		SECTION: C		
SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANC E NORMS	FORMAT OF RECORD	AGENCY	REMARKS
					M	7	8	9	M C N	
1	2	3	4	5	6	7	8	9	**	
1.0	RAW MATERIAL Sheet Steel (CRCA & HR)	1. Chemical Composition 2. Bend Test 3. Surface finish 4. Waviness 5. Thickness 6. Mill marking	MA CR MA MA MA MA	Chemical analysis Mech. test Visual Visual Measurement Visual	Samp le Samp le 100% 100% 100% 100%	IS:1079 IS:513 IS:1079 IS:513 Manufacturing Standard Manufacturing Standard Approved Drg/Datasheet Manufacturing Standard	IS:1079 IS:513 IS:1079 IS:513 Manufacturing Standard No Waviness Approved Drg/Datasheet Manufacturing Standard	Test Certificate Test Certificate Inspection Report Inspection Report Inspection Report Inspection Report	PW V PW V PW -- PW -- PW V PW V	
2.0	Flats / Angles / Channels	1. Dimensions 2. Surface Defects 3. Straightness 4. Mill marking	MA MA MA MA	Measurement Visual Measurement Visual	Samp le 100% 100% 100%	IS:2062 Manufacturing Standard Manufacturing Standard IS:2062	IS:2062 Manufacturing Standard Manufacturing Standard IS:2062	Test Certificate Inspection Report Inspection Report Inspection Report	PW -- PW -- PW -- PW V	


BHEL				BIDDER/SUPPLIER				FOR CUSTOMER REVIEW & APPROVAL			
ENGINEERING		QUALITY		Sign & Date		Sign & Date		Name		Seal	
Prepared by:	<i>[Signature]</i> 14/02/2020	Name	CHETAN MALIK	Checked by:	<i>[Signature]</i>	Name	KUNDAN PRASAD	Reviewed by:	<i>[Signature]</i>	Approved by:	<i>[Signature]</i>
Reviewed by:	<i>[Signature]</i>	Name	RK RAINA	Reviewed by:	<i>[Signature]</i>	Name	RK JAISWAL	Reviewed by:	<i>[Signature]</i>	Approved by:	<i>[Signature]</i>


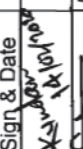

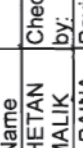
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MANUFACTURER/BIDDER/SUPPLIER		STANDARD QUALITY PLAN				SPEC. NO. :		DATE:		
		CUSTOMER :		QP NO.: PE-QP-999-145-1056		DATE: 07.02.2020				
		PROJECT:		PO NO.: --		DATE: --				
ITEM: LOCAL CONTROL PANEL		SYSTEM: C&I		SECTION: C		SHEET 2 OF 9				
SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY	REMARKS
					M				M	
					C/N				C	
									N	
1	2	3	4	5	6	7	8	9	D	
3.0	Cables / Wires	1. Visual / Surface defects 2. IR and HV 3. Conductor a) Resistance b) Size c) Sheet colour	MA MA MA	Visual Electrical Electrical Measurement Visual Verification	100% 100% 100% 100% 100%	IS:1554 or IS:694 IS:1554 or IS:694 IS:1554 or IS:694 IS:1554 or IS:694	IS:1554 or IS:694 IS:1554 or IS:694 IS:1554 or IS:694 IS:1554 or IS:694	Inspection Report Inspection Report Inspection Report Inspection Report	PW PW PW PW	
4.0	Electrical Components like Annunciator Transformers Lamps Switches PBs Contactors Relays	1. Verification at make and Type 2. Verification of Test Certificates 3. Operation / Functional check	CR CR CR	Visual Scrutiny of Type / Routine T.Cs. Electrical	Sample 100% Sample 100% Sample 100%	Approved Drg/Datasheet Relevant Indian Std & Catalogue Relevant Indian Std & Catalogue	Approved Drg/Datasheet Relevant Indian Std & Catalogue Relevant Indian Std & Catalogue	Test Certificate Inspection Report Inspection Report	PW PW PW	+ for relay & contactors only

ENGINEERING				QUALITY			
Prepared by:	Sign & Date	Name	Checked by:	Sign & Date	Name	Reviewed by:	Sign & Date
<i>[Signature]</i>	<i>[Signature]</i>	CHETAN MALIK	<i>[Signature]</i>	<i>[Signature]</i>	KUNDAN PRASAD	<i>[Signature]</i>	<i>[Signature]</i>
Reviewed by:	Sign & Date	Name	Checked by:	Sign & Date	Name	Reviewed by:	Sign & Date
<i>[Signature]</i>	<i>[Signature]</i>	RK RAINA	<i>[Signature]</i>	<i>[Signature]</i>	RK JAIWAL	<i>[Signature]</i>	<i>[Signature]</i>


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		PROJECT:				PO NO.: --		DATE: --								
ITEM: LOCAL CONTROL PANEL		SYSTEM: C&I				SECTION: C		SHEET 3 OF 9								
SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY	REMARKS						
1	Timers, Space Heaters, Thermostat, Indicating meters etc.	4. I.R. 5. H.V. 6. Calibration 7. Pick up / Drop off Voltage	MA	Electrical	100% 100% 100% 100%	Relevant Indian Std & Catalogue	Relevant Indian Std & Catalogue	Inspection Report	P/W		@ for all components except relays & contactors.					
												5	10%	Relevant Indian Std & Catalogue	Inspection Report	P/W
												6	10%	Relevant Indian Std & Catalogue	Inspection Report	P/W
												7	10%	Relevant Indian Std & Catalogue	Inspection Report	P/W
												8	10%	Relevant Indian Std & Catalogue	Inspection Report	P/W
												9	10%	Relevant Indian Std & Catalogue	Inspection Report	P/W
												10	10%	Relevant Indian Std & Catalogue	Inspection Report	P/W
5.0	Misc. Components like Gaskets, Terminal Blocks etc.	1. Verification of Type / Make 2. Surface defects 3. IR / HV on Terminal Blocks	MA	Visual	Samp le	Manufacturing Standard	Manufacturing Standard	Test Certificate	P/W							
IN PROCESS INSPECTION																

ENGINEERING		QUALITY	
Sign & Date	Name	Sign & Date	Name
	CHETAN MALIK		KUNDAN PRASAD
	RK RAINA		RK JAISWAL
Prepared by:		Checked by:	
Reviewed by:		Reviewed by:	

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		CUSTOMER :		QP NO.: PE-QP-999-145-1056		DATE: 07.02.2020				
		PROJECT :		PO NO.: --		DATE: --				
		ITEM: LOCAL CONTROL PANEL		SYSTEM: C&I		SECTION: C		SHEET 4 OF 9		
SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY	REMARKS
					6	7	8	9	**	
					M				M	
					C/N				C	
									N	
1	2	3	4	5	6	7	8	9	**	
6.0	Blanking / Bending / Forming	1. Dimensions 2. Surface defects after bending	MI MA	Measurement Visual	100% 100%	Approved Drg/Datasheet Manufacturing Standard	Approved Drg/Datasheet Manufacturing Standard	Inspection Report Inspection Report	PW PW	
7.0	Nibbling / Punching	1. Cutout Sizes 2. Deburring	MI MA	Measurement Visual	100% 100%	Approved Drg/Datasheet Approved Drg/Datasheet	Approved Drg/Datasheet Approved Drg/Datasheet	Inspection Report Inspection Report	PW PW	
8.0	ASSEMBLY Frame Assembly & Sheet fixing	1. Dimensions 2. Alignment 3. Welding Quality 4. Surface defects	MA MA MA MA	Measurement Measurement Visual Visual	100% 100% 100% 100%	Approved Drg/Datasheet Approved Drg/Datasheet Approved Drg/Datasheet Approved Drg/Datasheet	Approved Drg/Datasheet Approved Drg/Datasheet Approved Drg/Datasheet Approved Drg/Datasheet	Inspection Report Inspection Report Inspection Report Inspection Report	PW PW PW PW	

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Approved by:			

BIDDER/SUPPLIER	
Sign & Date	
Seal	

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ENGINEERING		QUALITY	
Prepared by:	Name	Checked by:	Sign & Date
	CHE TAN MALIK		07/02/2020
Reviewed by:	Name	Reviewed by:	Sign & Date
	RK RAINA		07/02/2020

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		PROJECT:				PO NO.: --		DATE: --					
		ITEM: LOCAL CONTROL PANEL				SYSTEM: C&I		SECTION: C		SHEET 5 OF 9			
SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANC E NORMS	FORMAT OF RECORD	AGENCY			REMARKS
					M	C/N				M	C	N	
1	2	3	4	5	6	7	8	9	*	**			
9.0	Pre-treatment and Painting	1. Pretreatment Process 2. Process parameters like bath temp. concentration etc. 3. Dipping / Removal Time 4. Surface quality after every dip 5. Primer after phosphating 6. Putty Application & Rubbing after primer 7. Paint first coat	MA MA MA MA MA MA MA	Visual Measurement Measurement Visual Visual, Thickness Visual Visual, Thickness	100% Periodic 100% 100% 100% 100% 100%	10% Periodic 10% 10% 10% 10% 10%	Manufacturing Standard Manufacturing Standard Manufacturing Standard Manufacturing Standard Manufacturing Standard Manufacturing Standard Manufacturing Standard	Manufacturing Standard Manufacturing Standard Manufacturing Standard Manufacturing Standard Manufacturing Standard Manufacturing Standard Manufacturing Standard	Inspection Report Inspection Report Inspection Report Inspection Report Inspection Report Inspection Report Inspection Report	✓ ✓ ✓ ✓ ✓ ✓ ✓	PW PW PW PW PW PW PW	V V V V V V V	

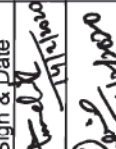
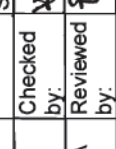
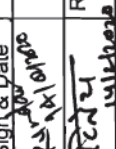

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Reviewed by:			
Approved by:			

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Sign & Date	Seal

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ENGINEERING		QUALITY	
Prepared by:	Name	Checked by:	Name
	CHETAN MALIK		KUNDAN PRASAD
Reviewed by:	Name	Reviewed by:	Name
	RK RAINA		RK JAISWAL

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		PROJECT:				PO NO.: --		DATE: --						
		ITEM: LOCAL CONTROL PANEL				SYSTEM: C&I		SECTION: C		SHEET 6 OF 9				
SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS	
					M	C/N					M	C	N	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	8.	Putty Application and Rubbing after first coat of paint	MA	Visual	100%	10%	Manufacturing Standard	Manufacturing Standard	Inspection Report	✓	P/W	V		
	9.	Paint second coat	MA	Visual, Thickness, Scratch test Colour adhesion	100%	10%	Manufacturing Standard	Manufacturing Standard	Inspection Report	✓	P/W	V		
10.	Panel Wiring	1. Wiring Layout	MA	Visual	100%	10%	Approved Drg/Datasheet	Approved Drg/Datasheet	Inspection Report	✓	P/W			
		2. Wiring Termination (Crimped Lugs)	MA	Visual	100%	10%	Approved Drg/Datasheet	Approved Drg/Datasheet	Inspection Report	✓	P/W			
		3. Ferrule numbers	MA	Visual	100%	10%	Approved Drg/Datasheet	Approved Drg/Datasheet	Inspection Report	✓	P/W			
		4. Colour of wiring	MA	Visual	100%	10%	Approved Drg/Datasheet	Approved Drg/Datasheet	Inspection Report	✓	P/W	V		
		5. Size of Conductor	MA	Measurement	100%	10%	Approved Drg/Datasheet	Approved Drg/Datasheet	Inspection Report	✓	P/W	V		
11.	Component Mounting	1. Correct components	MA	Visual	100%	10%	Approved Drg/Datasheet	Approved Drg/Datasheet	Inspection Report	✓	P/W			
		2. Fixing	MA	Visual	100%	10%	Approved Drg/Datasheet	Approved Drg/Datasheet	Inspection Report	✓	P/W			

BHEL			
ENGINEERING		QUALITY	
Sign & Date	Name	Sign & Date	Name
	CHETAN MALIK		KUNDAN PRASAD
	RK RAINA		RK JAISWAL

BIDDER/SUPPLIER			
Sign & Date	Seal	Sign & Date	Name


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		CUSTOMER :		PROJECT:		Q.P. NO.:	DATE:	PO NO.:	DATE:	
ITEM: LOCAL CONTROL PANEL		SYSTEM: C&I		SECTION: C		SHEET 7 OF 9				
SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY	REMARKS
1	2	3	4	5	6	7	8	9	M C N	
FINAL TESTING										
12.	Final Inspection	1. Workmanship 2. Component layout (neatness, accessibility & safety) Mounting / Proper fixing of all components 3. Components identification Marking / Name plates 5. Dimensions 6. Door functioning 7. Paint Shade	MA MA MA MA MA CR	Visual Visual Visual Measurement Functional Visual	100% 100% 100% 100% 100% 100%	Manufacturing Standard Approved Drg/Datasheet Approved Drg/Datasheet Approved Drg/Datasheet Approved Drg/Datasheet Approved Drg/Datasheet	Manufacturing Standard Approved Drg/Datasheet Approved Drg/Datasheet Approved Drg/Datasheet Approved Drg/Datasheet Approved Drg/Datasheet	Inspection Report Inspection Report Inspection Report Inspection Report Inspection Report Inspection Report	PW PW PW PW PW PW	At Random by BHEL, based on 100 % internal test reports by Mfr. At Random by BHEL, based on 100 % internal test reports by Mfr.

BHEL				BIDDER/ SUPPLIER				FOR CUSTOMER REVIEW & APPROVAL			
ENGINEERING		QUALITY		SIGNATURE		SIGNATURE		SIGNATURE		SIGNATURE	
Sign & Date	Name	Sign & Date	Name	Sign & Date	Name	Sign & Date	Name	Sign & Date	Name	Sign & Date	Name
Prepared by: <i>[Signature]</i> 14/12/2020	CHETAN MALIK	Checked by: <i>[Signature]</i> 14/12/2020	KUNDAN PRASAD	Reviewed by: <i>[Signature]</i> 14/12/2020	RK RAINA	Reviewed by: <i>[Signature]</i> 14/12/2020	RK JAISWAL	Doc No:		Reviewed by:	
Reviewed by: <i>[Signature]</i> 14/12/2020								Approved by:		Seal	

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	MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO.:	DATE:
	CUSTOMER:	CUSTOMER:		QP NO.: PE-OP-999-145-1056	DATE: 07.02.2020
	PROJECT:	PROJECT:		PO NO.: --	DATE: --
	ITEM: LOCAL CONTROL PANEL	SYSTEM: C&I		SECTION: C	
SHEET 8 OF 9					

SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY	REMARKS
					M	C/N			*	D		
1	2	3	4	5	6	7	8	9	**			
	8. Paint Thickness	CR	CR	Measurement	100%	10%	Approved Drg/Datasheet	Approved Drg/Datasheet	Inspection Report	√	P/W	W
	9. Workmanship of Gaskets	MA	MA	Visual	100%	10%	Manufacturing Standard	Manufacturing Standard	Inspection Report	√	P/W	W
	10. Wiring Layout	MA	MA	Visual	100%	10%	Approved Drg/Datasheet	Approved Drg/Datasheet	Inspection Report	√	P/W	W
	11. Wire Termination	MA	MA	Pulling manually	Sample	Sample	-----	Firm termination	Inspection Report	√	P/W	W
	12. Continuity	MA	MA	Electrical	100%	10%	-----	Continuity OK	Inspection Report	√	P/W	W
13.	TYPE TEST	Degree of Protection	CR	Mech. Protection	Sample	Sample	Approved Drg/Datasheet	Approved Drg/Datasheet	Type Test Certificate	√	P/W	V
14	ROUTINE TEST	IR before & after HV Test	CR	Electrical	100%	10%	Approved Drg/Datasheet	Approved Drg/Datasheet	Inspection Report	√	P/W	W

BHEL				BIDDER/ SUPPLIER				FOR CUSTOMER REVIEW & APPROVAL			
ENGINEERING		QUALITY		SIGN & DATE		SIGN & DATE		SIGN & DATE		SIGN & DATE	
Prepared by:	Name	Checked by:	Checked by:	Sign & Date	Sign & Date	Sign & Date	Sign & Date	Sign & Date	Sign & Date	Name	Seal
<i>[Signature]</i>	CHETAN MALIK	<i>[Signature]</i>	<i>[Signature]</i>	<i>[Signature]</i>	<i>[Signature]</i>	<i>[Signature]</i>	<i>[Signature]</i>	<i>[Signature]</i>	<i>[Signature]</i>		
Reviewed by:	Name	Reviewed by:	Reviewed by:	Reviewed by:	Reviewed by:	Reviewed by:	Reviewed by:	Reviewed by:	Reviewed by:		
<i>[Signature]</i>	RK RAINA	<i>[Signature]</i>	<i>[Signature]</i>	<i>[Signature]</i>	<i>[Signature]</i>	<i>[Signature]</i>	<i>[Signature]</i>	<i>[Signature]</i>	<i>[Signature]</i>		

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NAME & ADDRESS		CUSTOMER :					QP NO.: PE-QP-999-145-1056		DATE: 07.02.2020			
PROJECT:		PROJECT:					PO NO.: --		DATE: --			
ITEM: LOCAL CONTROL PANEL		SYSTEM: C&I					SECTION: C		SHEET 9 OF 9			
SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANC E NORMS	FORMAT OF RECORD	AGENCY	REMARKS	
1	2	3	4	5	6	7	8	9	10	11	12	
					M	C/N				M	C	N
15	FUNCTIONAL TEST	1. Control Logic Operation 2. Instrument Calibration 3. Temperature rise	CR	Electrical	100%	10%	Approved Drg/Datasheet	Approved Drg/Datasheet	Inspection Report	PW	W	
			CR	Electrical	10%	10%	Approved Drg/Datasheet	Approved Drg/Datasheet	Inspection Report	PW	W	
			CR	Electrical	100%	10%	Approved Drg/Datasheet Relevant IS.	Approved Drg/Datasheet Relevant IS.	Inspection Report	PW	W	

NOTES:

- Customer's specification for painting shall be included in the technical specification. In the absence of Customer's spec. for painting, vendor to obtain BHEL's approval on their painting specification / procedure.
- Copies of all TC's (Test Certificates) for components shall be submitted to BHEL for verification and acceptance.
- BHEL reserves the right to conduct repeat tests, if required.

LEGENDS:

*RECORDS, IDENTIFIED WITH "TICK"(✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION, D: DOCUMENTATION,
 ** M: SUPPLIER/ MANUFACTURER/ SUB-SUPPLIER, C: MAIN SUPPLIER/ BHEL/ THIRD PARTY INSPECTION AGENCY, N: CUSTOMER,
 P: PERFORM, W: WITNESS, V: VERIFICATION, AS APPROPRIATE
 MA: MAJOR, MI: MINOR, CR: CRITICAL

BHEL				BIDDER/ SUPPLIER				FOR CUSTOMER REVIEW & APPROVAL					
ENGINEERING		QUALITY		Sign & Date		Sign & Date		Doc No:		Sign & Date		Seal	
Prepared by:	Signature	Name	Checked by:	Signature	Name	Reviewed by:	Signature	Name	Reviewed by:	Signature	Name	Approved by:	Signature
		CHE TAN MALIK			KUNDAN PRASAD								
Reviewed by:	Signature	RK RAINA	Reviewed by:	Signature	RK JAISWAL								

THIS IS PART OF TECHNICAL SPECIFICATION PE-TS-468-571-A901 REV 00.



CLAUSE NO.	TECHNICAL REQUIREMENTS			
	TYPE TEST REQUIREMENTS			
1.00.00	TYPE TEST REQUIREMENTS			
1.01.00	General Requirements			
1.01.01	<p>The Contractor shall furnish the type test reports of all type tests as per relevant standards and codes as well as other specific tests indicated in this specification. A list of such tests are given for various equipment in table titled 'TYPE TEST REQUIREMENT FOR C&I SYSTEMS' at the end of this chapter and under the item Special Requirement for Solid State Equipments/Systems. For the balance equipment instrument, type tests may be conducted as per manufactures standard or if required by relevant standard.</p> <p>(a) Out of the tests listed, the Bidder/ sub-vendor/ manufacturer is required to conduct certain type tests specifically for this contract (and witnessed by Employer or his authorized representative) even if the same had been conducted earlier, as clearly indicated subsequently against such tests.</p> <p>(b) For the rest, submission of type test results and certificate shall be acceptable provided.</p> <p>i. The same has been carried out by the Bidder/ sub-vendor on exactly the same model /rating of equipment.</p> <p>ii. There has been no change in the components from the offered equipment & tested equipment.</p> <p>iii. The test has been carried out as per the latest standards alongwith amendments as on the date of Bid opening but not more than five (5) year back.</p> <p>(c) In case the approved equipment is different from the one on which the type test had been conducted earlier or any of the above grounds, then the tests have to be repeated and the cost of such tests shall be borne by the Bidder/ sub-vendor within the quoted price and no extra cost will be payable by the Employer on this account.</p>			
1.01.02	As mentioned against certain items, the test certificates for some of the items shall be reviewed and approved by the main Bidder or his authorized representative and the balance have to be approved by the Employer.			
	LOT-2 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(2)-9	PART-B SUB-SECTION-III-C6 TYPE TEST REQUIREMENTS	PAGE 1 OF 7



CLAUSE NO.	TECHNICAL REQUIREMENTS		
1.01.03	The schedule of conduction of type tests/ submission of reports shall be submitted and finalized during pre-award discussion.		
1.01.04	For the type tests to be conducted, Contractor shall submit detailed test procedure for approval by Employer. This shall clearly specify test setup, instruments to be used, procedure, acceptance norms (wherever applicable), recording of different parameters, interval of recording precautions to be taken etc. for the tests to be carried out.		
1.01.05	The Bidder shall indicate in the relevant BPS schedule, the cost of the type test for each item only for which type tests are to be conducted specifically for this project. The cost shall only be payable after conduction of the respective test in presence of authorize representative of Employer. If a test is waived off, then the cost shall not be payable.		
2.00.00	SPECIAL REQUIREMENT FOR SOLID STATE EQUIPMENTS/ SYSTEMS		
2.01.00	<p>The minimum type test reports, over and above the requirements of above clause, which are to be submitted for each of the major C&I systems Analyzer instruments, various PLCs etc. shall be as indicated below:</p> <p>i) Surge Protections for Solid State Equipments/ Systems</p> <p>All solid state systems/ equipments shall be able to withstand the electrical noise and surges as encountered in actual service conditions and inherent in a power plant. All the solid state systems/ equipments shall be provided with all required protections that needs the surge withstand capability as defined in ANSI 37.90a/ IEEE-472. Hence, all front end cards which receive external signals like Analog input & output modules, Binary input & output modules etc. including power supply, data highway, data links shall be provided with protections that meets the surge withstand capability as defined in ANSI 37.90a/ IEEE-472. Complete details of the features incorporated in electronics systems to meet this requirement, the relevant tests carried out, the test certificates etc. shall be submitted alongwith the proposal. As an alternative to above, suitable class of IEC-60255-4 which is equivalent to ANSI 37.90a/ IEEE-472 may also be adopted for SWC test.</p> <p>ii) Dry Heat test as per IEC-68-2-2 or equivalent.</p> <p>iii) Damp Heat test as per IEC-68-2-3 or equivalent.</p> <p>iv) Vibration test as per IEC-68-2-6 or equivalent.</p> <p>v) Electrostatic discharge tests as per IEC 61000-4-2 or equivalent.</p>		
<p>LOT-2 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p>TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(2)-9</p>	<p>PART-B SUB-SECTION-III-C6 TYPE TEST REQUIREMENTS</p>	<p>PAGE 2 OF 7</p>



CLAUSE NO.

TECHNICAL REQUIREMENTS

vi) Radio frequency immunity test as per EN 50082-2 or equivalent.

vii) Electromagnetic immunity as per EN 61131-2 or equivalent.

Test listed at item no. v, vi, vii, above are applicable for front end cards only as defined under item (i) above.

LOT-2 PROJECTS
FLUE GAS DESULPHURISATION (FGD)
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PART-B
SUB-SECTION-III-C6
TYPE TEST
REQUIREMENTS

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3.00.00 TYPE TEST REQUIREMENT FOR C&I SYSTEMS

SI No	Item	Test requirement	Standard	Test to be specifically conducted	NTPC's approval req. On test certificate	Remarks
Col 1	Col 2	Col 3	Col 4	Col 5	Col 6	Col 7
1	Elect. Metering instruments	As per standard (col 4)	IS-1248	No	Yes	
2	Electronic transmitter	As per standard (col 4)	BS-6447 / IEC-60770	No	Yes	
3	INSTRUMENTATION CABLES TWISTED & SHIELDED					
4	Pressure gauge	Degree of protection test	IS-2147	No	No	
		Temp interference test	IS -3624	No	No	
5	Temperature gauge	Degree of protection test	IS-2147	No	No	
6	Pressure & DP switch	Degree of protection test	IS-2147	No	No	
		As per standard (col 4)	BS 6134	No	No	
7	Level switch	Degree of protection test	IS-2147	No	No	
8	Control valves	CV Test	ISA 75.02	No	Yes	
9	Flow Nozzles & Orifice plate	Calibration	ASME PTC , BS 1042	No	Yes	
10	PLCs	All tests as per IEC-1131	IEC-601131	No	Yes	

LOT-2 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION - VI BID DOC. NO.:CS-0011-108(2)-9	PART-B SUB-SECTION-III-C6 TYPE TEST REQUIREMENTS	PAGE 4 OF 7
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SI No	Item	Test requirement	Standard	Test to be specifically conducted	NTPC's approval req. On test certificate	Remarks
Col 1	Col 2	Col 3	Col 4	Col 5	Col 6	Col 7
11	Junction Box	Degree of protection test	IS-13947	No	Yes	
12	Battery charger (Not required for inbuilt chargers)	Degree of protection test	IS-13947	No	No	
		Short circuit current capability	IEC-60146-2	No	Yes	
		Temp rise test without redundant fans	Approved procedure, IEC 60146-2	No	Yes	
		SWC test	Approved procedure	No	Yes	
		Burn-in-test	Approved procedure	No	Yes	
		Efficiency	IEC-60146-2,	No	Yes	
		Audible Noise Test	IEC 60146-2	No	Yes	
		Fuse Clearing Capability	Approved procedure	No	Yes	
		Relative harmonic content	Approved procedure	No	Yes	

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SI No	Item	Test requirement	Standard	Test to be specifically conducted	NTPC's approval req. On test certificate	Remarks
Col 1	Col 2	Col 3	Col 4	Col 5	Col 6	Col 7
		ESD immunity test	IEC-61000-4-2-9(1)	No	Yes	
		Radio interference	IEC 60146-2	No	Yes	
		Over Load Test on Inverter & charger	Approved procedure	No	Yes	
		Restart Test	IEC 60146-2	No	Yes	
		Output voltage tolerance	Approved	No	Yes	
		Output voltage Harmonic content	Approved procedure	No	Yes	
		Insulation test	IEC 60146	No	Yes	
		Load Tests	Approved procedure	No	Yes	
		Preliminary light load test	IEC 60146	No	Yes	
		Current division / Voltage division	IEC 60146-2	No	Yes	
13	Battery	As per standard (col 4)	IEC -623 / IS 10918 for Ni-Cd IS-1652 for Plante Lead Acid	No	Yes	
14	Voltage stabilizers	Over Load Test	Approved procedure	No	Yes	

LOT-2 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION - VI BID DOC. NO.:CS-0011-108(2)-9	PART-B SUB-SECTION-III-C6 TYPE TEST REQUIREMENTS	PAGE 6 OF 7
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SI No	Item	Test requirement	Standard	Test to be specifically conducted	NTPC's approval req. On test certificate	Remarks
Col 1	Col 2	Col 3	Col 4	Col 5	Col 6	Col 7
		Temp rise test without redundant fans	Approved procedure	No	Yes	

LOT-2 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION - VI BID DOC. NO.:CS-0011-108(2)-9	PART-B SUB-SECTION-III-C6 TYPE TEST REQUIREMENTS	PAGE 7 OF 7
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**C&I SPECIFICATION FOR
GYPSUM DEWATERING EQUIPMENT**

SECTION: C
SUB SECTION: C&I

MANDATORY SPARES

Refer Annexure II of Sub Section D of Section I for the list of mandatory spares pertaining to C&I scope.



**C&I SPECIFICATION FOR
GYPSUM DEWATERING EQUIPMENT**

SECTION: C
SUB SECTION: C&I

SUB VENDOR LIST

PACKAGE WISE REGISTERED SUPPLIER LIST AS ON 19/5/2020

SI No	Package Name	Supplier Name	Supplier Communication Address	Supplier Works Address
1	CONTROL VALVE	Valvitalia S.P.A. ,	Mr. Salvatore Ruggeri Via Tortona 69, Rivanazzano (Pavia) Phone- +39-03839459875 Pincode : 27055 Email : dario.torluccio@valviatalia.com	Works-1->Mr. Salvatore Ruggeri Via Tortona 69,Rivanazzano (Pavia) -- Italy Phone- +39-03839459875 FAX : Pincode : 27055 Email : dario.torluccio@valviatalia.com; diego.poletti@valvitalia.com; caloc@bhgassociatoc.com
2	CONTROL VALVE	R.K.CONTROL INSTRUMENTS PVT. LTD.	PLOT NO.A-250, OPP.POLICE STATION, WAGLE INDUSTRIAL ESTATE, THANE Phone- 25820943/2331 Pincode : 400604 Email : rkcipl@vsnl.com ; rkcinpvt@bol.net.in	Works-1->SAVITH KUMAR PLOT NO. A-250, OPP.POLICE STATION,WAGLE INDUSTRIAL ESTATE, THANE -THANE-MAHARASHTRA INDIA Phone- 022-'66060942 FAX : 022-25820801 Pincode : 400 604 Email : rkadmin@rkcipl.co.in
3	CONTROL VALVE	Mascot Valves Pvt. Ltd.	166-167 GIDC Naroda Ahmedabad Phone- 0792282 1619 Pincode : 382330 Email : dom.sales@mascotvalves.com	Works-1->Varun Patel Dir 166-167 ,GIDC Naroda -Ahmedabad-GUJARAT India Phone- 0792282 1619 / 3369 FAX : Pincode : 382330 Email : dom_sales@mascotvalves.com
4	CONTROL VALVE	EMERSON PROCESS MANAGEMENT CHENNAI LIMITED	147, KARAPAKKAM VILLAGE, CHENNAI Phone- 23722184, 23716242 Pincode : 600096 Email : jatinder_singh@emerson.com	Works-1->Mr. Rangarajan (Head - Lean and Manufact 147,Karapakkam Village, -Chennai-TAMIL NADU India Phone- 0444903 4395 FAX : Pincode : 600097 Email : Rangarajan.M@emerson.com
5	CONTROL VALVE	Severn Glocon India Pvt. Ltd.	F96 & F97, Sipcot Industrial Park, Irungattukottai, Chennai, Phone- 044-47104200, Pincode : 602117, Email : info@severnglocon.co.in,	Works-1->Mr. K.Kaushik, F96 & F97, Sipcot Industrial Park,Irungattukottai, -Chennai-TAMIL NADU India Phone- 044-47104200, FAX : 044-47100073, Pincode : 602117, Email : info@severnglocon.co.in
6	CONTROL VALVE	BOMAFA SPECIAL VALVE SOLUTIONS PVT LTD	Mr. K.M. Anklesaria/ R. M. Anklesaria Plot No: 285/2, Panchratna Estate, Near Ramol Bridge, Vatva Ahmedabad Phone- 079-40083825 Pincode : 382445 Email : info@bomafa-india.com	Works-1->Mr. K.M. Anklesaria/ Mr. R.M. Anklesaria Dir Plot No: 285/2, Panchratna Estate, Near Ramol Bridge, Vatva, - Ahmedabad-GUJARAT INDIA Phone- 079-40083825 FAX : Pincode : 382445 Email : info@bomafa-india.com
7	CONTROL VALVE	FORBES MARSHALL ARCA PVT.LTD.	A-34/35 , MIDC ESTATE, H-BLOCK, PIMPRI, PUNE, Phone- 020-27442020, Pincode : 411018 Email : mnadgaundi@forbesmarshall.com	Works-1->Mr. Sanjeev Shinde A-34/35 MIDC Estate,H Block, Pimpri, -Pune-MAHARASHTRA India Phone- 9323176406 FAX : 020-27442040 Pincode : 411018 Email : sshinde@forbesmarshall.com
8	CONTROL VALVE	INSTRUMENTATION LTD.	KANJIKODE WEST, PALALKKAD, PALAKKAD Phone- 2566127-130,2567128 Pincode : 678623 Email : icvldil@gmail.com;fa2@ilpgt.com	Works-1->D.SASIDHARAN, AGM(Works&PPC) KANJIKODE WEST, - PALAKKAD-KERALA INDIA Phone- 0491-2566536 FAX : 0491-2566135 Pincode : 678623 Email : sasiharan@ilpgt.com;mraj@ilpgt.com;gireesh@ilpgt.com, commercial@ilpgt.com;fa2@ilpgt.com;nazeera@ilpgt.com;pkv@ilpgt.com;remith@ilpgt.com
9	CONTROL VALVE	Koso India Private Limited,	H 33 & 34, MIDC, Ambad, Nashik, Phone- 09650233433 Pincode : 422010, Email : jetmal.gour@koso.co.in	Works-1->P.J.ASHOK KUMAR/SEEMA ANAND Control Valve Division, H-33&34, MIDC, Ambad, -Nashik-MAHARASHTRA India Phone- 91 944 744 3198 FAX : 0491 - 5269914 Pincode : 422010 Email : pja@koso.co.in;enquiry@koso.co.in Works-2->+P.J.ASHOK KUMAR/SEEMA ANAND J-1,MIDC,Ambad -Nashik-MAHARASHTRA India Phone- 91 944 744 3198 FAX : 0491 - 5269914 Pincode : 422010 Email : pja@koso.co.in;enquiry@koso.co.in

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10	CONTROL VALVE	SAMSON CONTROLS PVT. LTD.	Mr. Atul raje-MD D 281, MIDC Ranjangaon Ta Shirur Pune Phone- 02067246600 Pincode : 412220 Email : sales@samsoncontrols.net	Works-1-> Others D 281, MIDC Ranjangaon -Pune-MAHARASHTRA India Phone- 02067246600,8554997963 FAX : Pincode : 412220 Email : sales@samsoncontrols.net
11	CONTROL VALVE	KSB MIL CONTROLS LTD.	Mr.Jacob Cherian/Mr.Geo Jolly Meladoor, Annamanada P.O. MALA, Thrissur Phone- 0480-2695700 Pincode : 680741 Email : hiiu_simon@ksb.com	Works-1->Mr.Biju Simon/Mr.Jose Paul Meladoor, Annamanada, -Thrissur-KERALA INDIA Phone- 9447555500 FAX : 91 480 2890952 Pincode : 680741 Email : jose_naul@ksb.com
12	CONTROL VALVE	SUZHOU DELAN ENERGY SCIENCE & TECHNOLOGY CO., LTD.	No 566 Fangqiao Road Caohu Industrial Park, Xiangcheng Economic Development Zone, Suzhou Phone- 008618012776062 Pincode : 215143 Email : jeanielei@delan-valve.com	Works-1->Mr. Zong Xin CEO No 566 Fangqiao Road Caohu Industrial Park,Xiangcheng E. Z. -Suzhou-Foreign Country CHINA Phone- 008618012776062 FAX : Pincode : 215143 Email : jeanielei@delan-valve.com
13	CONTROL VALVE	WALDEMAR PRUSS ARMATURENFABRIK GMBH	Mr. Winfried Dremhel Schulenburgerlandstrasse 261, Hannover Phone- +49-511279260 Pincode : 30419 Email : dremhel@pruss.de; wvoel@pruss.de	Works-1->Mr. Winfried Dremhel CEO Schulenburgerlandstrasse 261, -Hannover-GERMANY Phone- +49-511279260 FAX : Pincode : 30419 Email : dremhel@pruss.de
14	PRESSURE SWITCH/DIFF. PRESSURE SWITCH	Kaustubha Udyog,	S.No. 36/1/1, Sinhgad Road, Vadgaon Khurd, Near Lokmat Press, Pune, Phone- 020-24393577, Pincode : Email : npressure@vsnl.com	
15	PRESSURE SWITCH/DIFF. PRESSURE SWITCH	PRECISION MASS PRODUCTS PVT. LTD.	Mr. Nishit Patel/Mr. Anuj Verma Plot No.2306, Phase II, GIDC Chhatral Kalol Phone- 9999464663 Pincode : 382729 Email : sales@precisionmass.com	Works-1->Mr. Hitesh Parmar/Mr. Hitesh Parmar Plot No.2306, Phase II, GIDC Chhatral, -Kalol-GUJARAT INDIA Phone- 9327359227 FAX : 02764-233440 Pincode : 382729 Email : hitesh_parmar@ashcroftindia.com
16	PRESSURE SWITCH/DIFF. PRESSURE SWITCH	SWITZER PROCESS INSTRUMENTS PVT. LTD.	Mr. V S Jayaprakash, 128, SIDCO North Phase, Ambattur Estates CHENNAI Phone- 044-26252017/2018 Pincode : 600050 Email : sales@switzerprocess.co.in	Works-1->C S Shankar 127, Sidco North Phase, Ambattur Estates, -CHENNAI-TAMIL NADU INDIA Phone- 8754491904 FAX : 044-26248849 Pincode : 600050 Email : cservice@switzerinstrument.com
17	PRESSURE SWITCH/DIFF. PRESSURE SWITCH	GENERAL INSTRUMENTS CONSORTIUM	Mr. Amarendra Kulkarni 194/195, Gopi Tank Road, Off. Pandurang Naik Marg, Mahim Mumbai Phone- 9323195251 Pincode : 400016 Email : amarendra@general-gauges.com	
18	PRESSURE SWITCH/DIFF. PRESSURE SWITCH	Barksdale GmbH, Germany	Michael Weileder Dorn Assenheimer, Strasse 27 Reichelsheim Phone- +91-9999107840 Pincode : D-61203 Email : msingh@barksdale.de	
19	PRESSURE SWITCH/DIFF. PRESSURE SWITCH	DRESSER INDUSTRIES INC.	Mr. Nishit Patel/Mr. Anuj Verma Plot No.2306, Phase II, GIDC Chhatral Kalol Phone- 02764-233682 Pincode : 382729 Email : Nishit_patel@ashcroftindia.com	
20	PRESSURE SWITCH/DIFF. PRESSURE SWITCH	SOR INC.	LARRY DEGARMO/Avdhesh Chandra, 14685 W. 105TH STREET LENEXA Phone- 09810905139, Pincode : 66215 Email : Ldegarmo@sorinc.com, avdhesh@sherman-india.com,	Works-1->LARRY DEGARMO/ ROY STUMBOUGH 14685 W. 105TH STREET, LENEXA -KANSAS- USA Phone- 913-888-0767 FAX : 913-888-0767 Pincode : 66215 Email : rstumbough@sorinc.com
21	PRESSURE SWITCH/DIFF. PRESSURE SWITCH	INDFOS INDUSTRIES LIMITED	B-20-21, INDUSTRIAL AREA, MEERUT ROAD, GHAZIABAD Phone- 0120-2712016 Pincode : Email : mkto@indfos.com	

22	PRESSURE SWITCH/DIFF. PRESSURE SWITCH	INDFOS (INDIA) LIMITED	MR.L.C.VENKATRANGAN/MR.B.KANNAN New No.17, II Floor, Adwate Towers, Dr.Sevalia Shivaji Salai, T.Nagar Chennai Phone- +91 44 24353407 Pincode : 600017 Email : delhi@indfos.com	
23	PRESSURE GAUGE/DIFF.PRESSURE GAUGE	A.N. INSTRUMENTS PVT. LTD.	MARKETING DIVISION, 5th FLOOR, 59-B, CHOWRINGHEE ROAD, KOLKATA Phone- 24757784,22472509 Pincode : 700020 Email : anidel@bol.net.in	Works-1->Mr. Gautam Mukherjee Kusumba,Sonarpur Station Road,P.O. - Narendrapur, -Kolkata-WEST BENGAL INDIA Phone- 9836878855 FAX : 033-24342748 Pincode : 700103 Email : gkm_ani@hotmail.com
24	PRESSURE GAUGE/DIFF.PRESSURE GAUGE	BOSE PANDA INSTRUMENTS PVT.LTD.	Mr. Partha Bose 44, Saheed Hemanta Kumar Bose, Sarani, Kolkata Phone- +91 33 2548 7220 Pincode : 700074 Email : parthabosebpi@gmail.com; bosepanda@vsnl.net	Works-1->Mr. Partha Bose 44, Saheed Hemanta Kumar Bose,Sarani, -Kolkata-WEST BENGAL India Phone- +91 33 2548 7220 FAX : +91 33 2548 0429, Pincode : 700074 Email : parthabosebpi@gmail.com bosepanda@vsnl.net
25	PRESSURE GAUGE/DIFF.PRESSURE GAUGE	H.GURU INDUSTRIES	Mr. G. D. Hazra/Mr. P. K. Mitra 10 B, HO-CHI-MINH SARANI, KOLKATA Phone- 033 2282 2463 / 1637 Pincode : 700071 Email : mguru@vsnl.net	Works-1->NA NA -- Phone- FAX : Pincode : Email :
26	PRESSURE GAUGE/DIFF.PRESSURE GAUGE	FORBES MARSHALL (HYD) LTD.	MR SAILESH PATALAY/MR. M K SRINIVASAN PLOT NO.A-19/2, & T-4/2, IDA, NACHARAM, HYDERABAD Phone- 9849913704 Pincode : 500 076 Email : mksrinivasan@forbesmarshall.com	Works-1->MR G.SRINIVASAN/MR ANUJ MALPANI PLOT NO:A-19/2 & T-4/2,I.DA. NACHARAM , -HYDERABAD-TELANGANA INDIA Phone- 09866550762 FAX : 040 27152193 Pincode : 560076 Email : gshrinivasan@forbesmarshall.com
27	PRESSURE GAUGE/DIFF.PRESSURE GAUGE	PRECISION MASS PRODUCTS PVT. LTD.	Mr. Nishit Patel/Mr. Anuj Verma Plot No.2306, Phase II, GIDC Chhatral Kalol Phone- 9999464663 Pincode : 382729 Email : sales@precisionmass.com	Works-1->Mr. Hitesh Parmar/Mr. Hitesh Parmar Plot No.2306, Phase II, GIDC Chhatral, -Kalol-GUJARAT INDIA Phone- 9327359227 FAX : 02764-233440 Pincode : 382729 Email : hitesh.parmar@ashcroftindia.com
28	PRESSURE GAUGE/DIFF.PRESSURE GAUGE	Baumer Technologies India Pvt. Ltd.	Mr. Shyam Warilani/Mr. V Suresh Babu 36, DAMJI SHAMJI INDUSTRIAL COMPLEX, OFF.-MAHAKALI CAVES ROAD, ANDHERI(E) MUMBAI Phone- +91 99589 25151 Pincode : 400093 Email : sales.in@baumer.com	Works-1->Mr. Shyam Warilani/Mr. V Suresh Babu Plot No 34 A GIDC A Phase 1, -VAPI-GUJARAT INDIA Phone- +91 11 4161 7111 FAX : 022 2687 3613 Pincode : 396 195 Email : pbajaj@baumer.com
29	PRESSURE GAUGE/DIFF.PRESSURE GAUGE	H.GURU INSTRUMENTS (SOUTH INDIA) P. LTD	32,INDUSTRIAL SUBURB YESWANTHAPUR BANGALORE Phone- 080-23370300, Pincode : 560022 Email : info@hgurusouth.com	Works-1->Shikha Hazra/ Shyamal Hazra 32, Industrial Suburb,Yeshwanthpur - BANGALORE-KARNATAKA INDIA Phone- 080-23370300 FAX : 080-23379890 Pincode : 560022 Email : shikhabazra@hgurusouth.com
30	PRESSURE GAUGE/DIFF.PRESSURE GAUGE	GAUGE BOURDON INDIA PVT. LTD.	194/195, Gopi Tank Road, Off Pandurang Naik Marg, Mahim Mumbai, Phone- 011-41607463, Pincode : 400016, Email : gicdelhi@general-gauges.com,	Works-1->Gauge Bourdon India Pvt. Ltd., Plot No-4, 5, 6,Jawahar Co-operative Industrial Estate, -Kalamboli Taluka Panvel-MAHARASHTRA India Phone- 022-27421095, FAX : 022-27421901, Pincode : 410209, Email : info@general-gauges.com
31	PRESSURE GAUGE/DIFF.PRESSURE GAUGE	Nesstech Instruments Private Limited	26/2, G Type, Global Industrial Park Near Nahuli Railway Crossing, Valvada Vapi Phone- 9920576002 Pincode : 396105 Email : sales@nesstech.co.in	Works-1-> Others 26/2, G Type, Global Ind. Park Near Nahuli Railway Crossing, -Vapi-GUJARAT INDIA Phone- 9920576002 FAX : Pincode : 396105 Email : sales@nesstech.co.in, hkanadia@nesstech.co.in
32	PRESSURE GAUGE/DIFF.PRESSURE GAUGE	SCIENTIFIC DEVICES (BOMBAY) PVT LTD,	Office no. 53, Shree Manoshi Complex, Plot No. 5 & 6, Sec-3, Ghansoli (East), Navi Mumbai, Phone- 9892230623, Pincode : 400 701, Email : sdbnl@vsnl.com	Works-1->Scientific Center, Others By-Pass Junction,Near Kalsekar College kausa, mumbra,Thane -Mumbai-MAHARASHTRA INDIA Phone- 022-25491409,9892230623 FAX : Pincode : 400612 Email : sdbnl@vsnl.com

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34	TEMPERATURE GAUGE	GAUGE BOURDON INDIA PVT. LTD.	194/195, Gopi Tank Road, Off Pandurang Naik Marg, Mahim Mumbai, Phone- 011-41607463, Pincode : 400016, Email : gicdelhi@general-gauges.com,	Works-1->Gauge Bourdon India Pvt. Ltd., Plot No-4, 5, 6, Jawahar Co-operative Industrial Estate, -Kalamboli Taluka Panvel- MAHARASHTRA India Phone- 022-27421095, FAX : 022-27421901, Pincode : 410209, Email : info@general-gauges.com
35	TEMPERATURE GAUGE	H.GURU INDUSTRIES	Mr. G. D. Hazra/Mr. P. K. Mitra 10 B, HO-CHI-MINH SARANI, KOLKATA Phone- 033 2282 2463 / 1637 Pincode : 700071 Email : mguru@vsnl.net	Works-1->NA NA -- Phone- FAX : Pincode : Email :
36	TEMPERATURE GAUGE	GOA THERMOSTATIC INSTRUMENTS PVT.LTD.	FLAT -B , GF, HILL CROWN APTS., COLLEGE ROAD, MAPUSA Phone- Pincode : 403525 Email : gtilworks@pyro-electric.in	Works-1->Mrs Saanvi Naik BICHOLIM, - BICHOLIM-GOIA INDIA Phone- 959585152 FAX : Pincode : 403 529 Email : saanvi.naik@thermostatic.in
37	TEMPERATURE GAUGE	A.N. INSTRUMENTS PVT. LTD.	MARKETING DIVISION, 5th FLOOR, 59-B, CHOWRINGHEE ROAD, KOLKATA Phone- 24757784, 22472509 Pincode : 700020 Email : anidel@bol.net.in	Works-1->Mr. Gautam Mukherjee Kusumba, Sonarpur Station Road, P.O. - Narendrapur, -Kolkata-WEST BENGAL INDIA Phone- 9836878855 FAX : 033-24342748 Pincode : 700103 Email : gkm_ani@hotmail.com
38	TEMPERATURE GAUGE	FORBES MARSHALL (HYD) LTD.	MR SAILLESH PATALAY/MR. M K SRINIVASAN PLOT NO.A-19/2, & T-4/2, IDA, NACHARAM, HYDERABAD Phone- 9849913704 Pincode : 500 076 Email : mksrinivasan@forbesmarshall.com	Works-1->MR G.SRINIVASAN/MR ANUJ MALPANI PLOT NO:A-19/2 & T-4/2, I.DA. NACHARAM, -HYDERABAD-TELANGANA INDIA Phone- 09866550762 FAX : 040 27152193 Pincode : 560076 Email : gshrinivasan@forbesmarshall.com
39	TEMPERATURE GAUGE	GOA INSTRUMENTS INDUSTRIES PVT.LTD.,	D2/5, Mapusa Industrial Estate, Mapusa, Goa, Phone- 09326054551, Pincode : 403507, Email : sumukh@goainstruments.com	Works-1->Mr. S.G. Dixit D2/5, Mapusa Industrial Estate, -Mapusa-GOIA INDIA Phone- 09326054551 FAX : 0832-2262331 Pincode : 403 507 Email : sumukh@goainstruments.com
40	TEMPERATURE GAUGE	PRECISION MASS PRODUCTS PVT. LTD.	Mr. Nishit Patel/Mr. Anuj Verma Plot No.2306, Phase II, GIDC Chhatral Kalol Phone- 9999464663 Pincode : 382729 Email : sales@precisionmass.com	Works-1->Mr. Hitesh Parmar/Mr. Hitesh Parmar Plot No.2306, Phase II, GIDC Chhatral, -Kalol-GUJARAT INDIA Phone- 9327359227 FAX : 02764-233440 Pincode : 382729 Email : hitesh.parmar@ashcroftindia.com
41	TEMPERATURE GAUGE	Baumer Technologies India Pvt. Ltd.	Mr. Shyam Warilani/Mr. V Suresh Babu 36, DAMJI SHAMJI INDUSTRIAL COMPLEX, OFF.- MAHAKALI CAVES ROAD, ANDHERI(E) MUMBAI Phone- +91 99589 25151 Pincode : 400093 Email : sales.in@baumer.com	Works-1->Mr. Shyam Warilani/Mr. V Suresh Babu Plot No 34 A GIDC A Phase 1, -VAPI-GUJARAT INDIA Phone- +91 11 4161 7111 FAX : 022 2687 3613 Pincode : 396 195 Email : pbajaj@baumer.com
42	LEVEL GAUGE	TOSHWIWAAL BROTHERS PVT.LTD.	WORKS:TOSHWIWAAL IND.PVT.LTD, INDUSTRIAL ESTATE MAKHUPURA, AJMER Phone- 441171 Pincode : 305002 Email : toshniwalprocess@gmail.com	
43	LEVEL GAUGE	BLISS ANAND PVT. LTD.	Mr. Vikas Anand/ Mr.RGRajan 92B & 93 B , IMT MANESAR Gurgaon Phone- 0124-4366000 TO 9 Pincode : 122001 Email : sales@blissanand.com	Works-1->Mr. Bharat Kumar/ Mr. Sasi Kumar Plot No. 92B & 93B, Sec-V, IMTManesar -GURGAON-HARYANA INDIA Phone- 0124-4366000 TO 9 FAX : 0124-2290884 Pincode : 122002 Email : bharat@blissanand.com

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45	FLOW ELEMENT	TM TECNOMATIC SPA	MR. ANTONIO NOVIELLO/Mrs. Enrica Bazzocci VIA DELLE INDUSTRIE, 36 CREMONA Phone- 39037221574 Pincode : 26100 Email : info@tmtecnomatic.com	Works-1->Mrs. Enrica Bazzocchi VIA DELLE INDUSTRIE, 36, -CREMONA- Italy Phone- 39037221574 FAX : 39037228318 Pincode : 26100 Email : sales@tmtecnomatic.com
46	FLOW ELEMENT	STAR-MECH CONTROLS (I) PVT.LTD.	SUSHILLOTAM, SUSHILLOTAM, 29/3A/3, SASANE NAGAR, HADAPSAR, PUNE Phone- 02026970450 Pincode : 411028 Email : marketing@starmech.net	Works-1->VIVEK GOTE/ MAHUNDRABANSODE Sr no.54, Plot No.110,Swami Vivekanand Industrial Est.LHADAPS -PUNE-MAHARASHTRA INDIA Phone- 02026970450 FAX : 02026970470 Pincode : 411028 Email : marketing@starmech.net
47	FLOW ELEMENT	INSTRUMENTATION LTD.	KANJIKODE WEST, PALALKKAD, PALAKKAD Phone- 2566127-130,2567128 Pincode : 678623 Email : icvldil@gmail.com;fa2@ilpgt.com	
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49	TEMP. ELEMENT	DETRIVE INSTRUMENTATION & ELECTRONICS LTD.	320, TV INDUSTIAL ESTATE, OFF.DR.A.BESANT ROAD, BEHIND GLAXO, WORLI, MUMBAI Phone- 24934125,24938403 Pincode : 400025 Email : trivtech@vsnl.com	Works-1->Mr. A.D.Solomon J-14, MIDC, TARAPORE, BOISER STN., -THANE-MAHARASHTRA India Phone- FAX : Pincode : Email : trivtech@vsnl.com
50	TEMP. ELEMENT	Nesstech Instruments Private Limited	26/2, G Type, Global Industrial Park Near Nahuli Railway Crossing, Valvada Vapi Phone- 9920576002 Pincode : 396105 Email : sales@nesstech.co.in	Works-1-> Others 26/2, G Type, Global Ind. Park Near Nahuli Railway Crossing, -Vapi-GUJARAT INDIA Phone- 9920576002 FAX : Pincode : 396105 Email : sales@nesstech.co.in, bkanadia@nesstech.co.in
51	TEMP. ELEMENT	Thermal Instrument India Pvt. Ltd.	Mr. Raghavendra M. Kulkarni 194/195, Gopi Tank Road Behind Citylight Cinema,Mahim Mumbai Phone- 09322664709 Pincode : 400016 Email : ramk@nicoinindia.com	Works-1->Mr. Raghavendra M. Kulkarni Survey No. 250A/B, Post-Mangaon,Tal.-Kudal, Dist.- Sindhudurg, --MAHARASHTRA India Phone- 09322664709 FAX : 022-24455026 Pincode : 416519 Email : ramk@nicoinindia.com
52	TEMP. ELEMENT	Tempsens Instrument (I) Pvt Ltd	MR. V.P.RATHI/MR. HEMANT RATHI B-188A ROAD NO.5 , M.I.A UDAIPUR Phone- 09352420069 Pincode : 313003 Email : info@tempsens.com	Works-1->Mr. S.D Deval B-188A ROAD NO.5 ,M.I.A -UDAIPUR-RAJASTHAN INDIA Phone- 9352501530 FAX : 0294-3057750 Pincode : 313003 Email : deval@tempsens.com
53	TEMP. ELEMENT	Baumer Technologies India Pvt. Ltd.	Mr. Shyam Warilani/Mr. V Suresh Babu 36, DAMJI SHAMJI INDUSTRIAL COMPLEX, OFF.- MAHAKALI CAVES ROAD, ANDHERI(E) MUMBAI Phone- +91 99589 25151 Pincode : 400093 Email : caloc.in@baumer.com	Works-1->Mr. Shyam Warilani/Mr. V Suresh Babu Plot No 34 À GIDC À Phase 1, -VAPI-GUJARAT INDIA Phone- +91 11 4161 7111 FAX : 022 2687 3613 Pincode : 396 195 Email : pbajaj@baumer.com
54	TEMP. ELEMENT	GOA INSTRUMENTS INDUSTRIES PVT.LTD.,	D2/5, Mapusa Industrial Estate, Mapusa, Goa, Phone- 09326054551, Pincode : 403507, Email : sumukh@goainstruments.com	Works-1->Mr. S.G. Dixit D2/5, Mapusa Industrial Estate, -Mapusa-GOA INDIA Phone- 09326054551 FAX : 0832-2262331 Pincode : 403 507 Email : sumukh@goainstruments.com

55	TEMP. ELEMENT	PYRO ELECTRIC INSTRUMENTS GOA PVT.LTD.	M. D. BICHU/R. M. BICHU G.B, HILL CROWN APARTMENTS, COLLEGE ROAD, MAPUSA Phone- 9326114601 Pincode : 403507 Email : priyanka.marketing@pyro-electric.in	Works-1->A A KULKARNI/ VINOD C G PLOT NO. 71,BICHOLIM INDUSTRIAL ESTATE - BICHOLIM-GOIA INDIA Phone- 9326114409 FAX : 91 832 2363381 Pincode : 403529 Email : pyroworks@pyro-electric.in
56	TEMP. ELEMENT	GAUGE BOURDON INDIA PVT. LTD.	194/195, Gopi Tank Road, Off Pandurang Naik Marg, Mahim Mumbai, Phone- 011-41607463, Pincode : 400016, Email : gicdelhi@general-gauges.com,	Works-1->Gauge Bourdon India Pvt. Ltd., Plot No-4, 5, 6,Jawahar Co-operative Industrial Estate, -Kalamboli Taluka Panvel-MAHARASHTRA India Phone- 022-27421095, FAX : 022-27421901, Pincode : 410209, Email : info@general-gauges.com
57	TEMP. ELEMENT	TOSHNIWAL INDUSTRIES PVT. LTD.,	Industrial Estate, Makhapura, Ajmer, Phone- 9352009000, Pincode : 305002, Email : info@tipl.com,	Works-1-> Khasra No.: 218-230& 235, Industrial Estate,Makhapura, -Ajmer-RAJASTHAN India Phone- 9887865856, FAX : 0145-2695174, Pincode : 305002, Email : raieev.gunta@tipl.com
58	TEMP. ELEMENT	SCIENTIFIC DEVICES (BOMBAY) PVT LTD,	Office no. 53, Shree Manoshi Complex, Plot No. 5 & 6, Sec-3, Ghansoli (East), Navi Mumbai, Phone- 9892230623, Pincode : 400 701, Email : sdbnl@vsnl.com	Works-1->Scientific Center, Others By-Pass Junction,Near Kalsekar College kausa, mumbra,Thane -Mumbai-MAHARASHTRA INDIA Phone- 022-25491409,9892230623 FAX : Pincode : 400612 Email : sdbnl@vsnl.com
59	TRANSMITTERS	YOKOGAWA INDIA LIMITED,	PLOT NO.96, ELECTRONICS CITY COMPLEX, HOSUR ROAD, BANGALORE, Phone- 080-41586000, Pincode : Email : uday.shankar@in.yokogawa.com,	Works-1-> PLOT NO.96, ELECTRONICS CITY COMPLEX, HOSUR ROAD, -BANGALORE-KARNATAKA INDIA Phone- 080-41586000, FAX : 080-28521442, Pincode : Email : uday.shankar@in.yokogawa.com
60	TRANSMITTERS	TOSHNIWAL INDUSTRIES PVT. LTD.,	Industrial Estate, Makhapura, Ajmer, Phone- 9352009000, Pincode : 305002, Email : info@tipl.com,	Works-1-> Khasra No.: 218-230& 235, Industrial Estate,Makhapura, -Ajmer-RAJASTHAN India Phone- 9887865856, FAX : 0145-2695174, Pincode : 305002, Email : raieev.gunta@tipl.com
61	TRANSMITTERS	ABB INDIA LIMITED	MR. RAJIV GOVIL 14, MATHURA ROAD, FARIDABAD Phone- 09971085678 Pincode : 121003 Email : vipin.swami@in.abb.com	
62	TRANSMITTERS	V. AUTOMAT & INSTRUMENTS (P) LTD.	Mr. R. K. BASSI/Mr. PRAVEEN KUMAR F-61, OKHLA INDL.AREA, PH-1 NEW DELHI Phone- 9810005826 Pincode : 110 020 Email : sales@vautomat.com	Works-1->Mr. BHAGWAN SINGH/ Mr. NANDAN SINGH F-61, OKHLA INDL.AREA,PHASE-I -NEW DELHI-DELHI INDIA Phone- 011-47627200 Extn. 3 FAX : 011- 26819440 Pincode : 110 020 Email : production@vautomat.com
63	TRANSMITTERS	Pune Techtrol Pvt. Ltd.	N.P.Khatan/Sudhakar Badiger S-18, MIDC Bhosari, Pune Phone- 9850560042 Pincode : 411 026 Email : ho@punetechtrol.com	
64	TRANSMITTERS	PANAM ENGINEERS	Mr. Santosh Shukla 203, Jaisingh Business,Parsiwada, Sahar road,Andheri(East), Mumbai, Phone- 9892179529, Pincode : 400099, Email : santosh@panamengineers.com	Works-1->Mr. Santosh Shukla Others R-628,TTC Industrial Area, MIDC Rabale, -Navi Mumbai-MAHARASHTRA India Phone- 9821350761, FAX : 022-27695559, Pincode : 400701, Email : sales@panamengineers.com
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66	TRANSMITTERS	SBEM PVT. LTD.	MR.N.K. BEDARKAR/MR. VISHWANATH KARANDIK 39, ELECTRONIC CO.OP. ESTATE, PUNE SATARA ROAD PUNE, Phone- 912041030100 Pincode : 411009 Email : newdelhi@sbem.co.in	Works-1->MR. MOHAN PADWAL 691/A/2,BIBWEWADI INDL ESTATE -PUNE-MAHARASHTRA INDIA Phone- 918600042374 FAX : 912024215670 Pincode : 411037 Email : wm@sbem.co.in

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68	TRANSMITTERS	SIEMENS LIMITED	Dr. Armin Bruck/Sandeep Mathur 130, Pandurang Budhkar Marg Worli Mumbai Phone- 0124 383 7377 Pincode : 400018 Email : ankit.varshney@siemens.com	Works-1->Ankit Varshney Kalwa Works, Thane-Belapur Road, Thane, -MUMBAI- MAHARASHTRA INDIA Phone- FAX : Pincode : 400708 Email :
69	TRANSMITTERS	Moore Industries International Inc.	Leonard.W. Moore/ Matt Moren 16650 Schoenborn St. North Hills Phone- +1 818 830 5548 Pincode : 91343 Email : mmoren@miinet.com	Works-1->Matt Moren/Gina Cruz 16650 Schoenborn St., North Hills -CALIFORNIA- USA Phone- +1 818 894 7111, ext FAX : +1 818 830 5588 Pincode : 91343 Email : acruz@miinet.com
70	TRANSMITTERS	EMERSON PROCESS MANAGEMENT (INDIA) PVT.LTD.	Mr. Amit Paithankar/Vikram Raj Singh 206-210,BALARAMA BUILDING 2ND FLR. BANDRA EAST MUMBAI Phone- 9619121500 Pincode : 400051 Email : vikramraj_cingh@emerson.com	Works-1->Kalpesh Chandan/Hrishikesh Aghor Plot No. A 145/4 TTC IND AREA,MIDC, PAWANE, -NAVI MUMBAI-MAHARASHTRA INDIA Phone- 9619688001 FAX : 022- 66736000 Pincode : 400 705 Email : Kalpesh.chandan@emerson.com
71	TRANSMITTERS	NIVO CONTROLS PVT. LTD.	Mr. Praveen Toshniwal 104-115, Electronic Complex, Indore Phone- 0731-4081305 Pincode : 452010 Email : sales@nivocontrols.com	Works-1->Mr. S L Sadani Others 104 - 115,Electronic Complex -Indore-MADHYA PRADESH INDIA Phone- 0731-4081307 FAX : Pincode : 452010 Email : sales@nivocontrols.com;sadanis@nivocontrols com
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73	TEMPERATURE SWITCH	TOSHWIHAL BROTHERS PVT.LTD.	WORKS:TOSHWIHAL IND.PVT.LTD, INDUSTRIAL ESTATE MAKHUPURA, AJMER Phone- 441171 Pincode : 305002 Email : toshniwalprocess@gmail.com	
74	TEMPERATURE SWITCH	DRESSER INDUSTRIES INC.	Mr. Nishit Patel/Mr. Anuj Verma Plot No.2306, Phase II, GIDC Chhatral Kalol Phone- 02764- 233682 Pincode : 382729 Email : Nishit_patel@ashcroftindia.com	
75	TEMPERATURE SWITCH	INDFOS (INDIA) LIMITED	MR.L.C.VENKATRANGAN/MR.B.KA NNAN New No.17, II Floor, Adwave Towers, Dr.Sevalia Shivaji Salai, T.Nagar Chennai Phone- +91 44 24353407 Pincode : 600017 Email : delhi@indfos.com	
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77	TEMPERATURE SWITCH	SOR INC.	LARRY DEGARMO/Avdhesh Chandra, 14685 W. 105TH STREET LENEXA Phone- 09810905139, Pincode : 66215 Email : Ldegarmo@sorinc.com, avdhesh@sherman-india.com,	Works-1->LARRY DEGARMO/ ROY STUMBOUGH 14685 W. 105TH STREET, LENEXA -KANSAS- USA Phone- 913-888-0767 FAX : 913-888-0767 Pincode : 66215 Email : rstumbough@sorinc.com

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79	SIGHT FLOW INDICATORS	SCIENTIFIC DEVICES (BOMBAY) PVT LTD,	Office no. 53, Shree Manoshi Complex, Plot No. 5 & 6, Sec-3, Ghansoli (East), Navi Mumbai, Phone- 9892230623, Pincode : 400 701, Email : sdbnl@vsnl.com	
80	SIGHT FLOW INDICATORS	BLISS ANAND PVT. LTD.	Mr. Vikas Anand/ Mr.RGRajan 92B & 93 B , IMT MANESAR Gurgaon Phone- 0124-4366000 TO 9 Pincode : 122001 Email : sales@blissanand.com	Works-1->Mr. Bharat Kumar/ Mr. Sasi Kumar Plot No. 240, Sector-3, HSIIDC, Bawal -Rewari-HARYANA INDIA Phone- 0124-4366000 TO 9 FAX : 0124-2290884 Pincode : 123501 Email : bharat@blissanand.com
81	SIGHT FLOW INDICATORS	B.K.EQUIPMENTS PVT.LTD.	T. BALAKRISHNAN/S.VENKATESH 217 , ARCOT ROAD PORUR , CHENNAI Phone- 9444057761 Pincode : 600116 Email : bkequip@gmail.com	Works-1->V.KARUNANIDHI/P.BABU 217 , ARCOT ROAD,PORUR , -CHENNAI-TAMIL NADU INDIA Phone- 9444131187 FAX : 044-24766852 Pincode : 600116 Email : bkequip@gmail.com
82	SIGHT FLOW INDICATORS	SIGMA INSTRUMENTS CO.	Gopal Kannan/R Gopinath 201, ANANDRAJ INDUSTRIAL ESTATE, OFF.LBS MARG, SONAPUR LANE, BHANDUP (W) MUMBAI Phone- +919821038162 Pincode : 400078 Email : sales@sigmainstruments.co.in	Works-1->R Gopinath 27 Nahur Udyog Industrial Premises,M.M.Malviya Road, Mulund(-MUMBAI-MAHARASHTRA INDIA Phone- +912225918567 FAX : +912225918566 Pincode : 400080 Email : sales@sigmainstruments.co.in
83	SIGHT FLOW INDICATORS	INSTRUMENTATION ENGINEERS PVT LTD	SH.N.V.RAM GOPAL/MS. N.NIHARIKA PLOTS 1,2,3, PHASE-III, IDA, JEEDIMETLA HYDERABAD Phone- 9848407365 Pincode : 500055 Email : iedelhi@ieflowmeters.com	Works-1->MR. A.V.MURTHY/MR. K.T. RAVISANKER PLOTS 1,2,3, PHASE-III,IDA, JEEDIMETLA -HYDERABAD-TELANGANA INDIA Phone- 9885107312 FAX : 040-23096401 Pincode : 500055 Email : sales@ieflowmeters.com
84	DIFFERENTIAL PRESSURE SWITCH	SOR INC.	LARRY DEGARMO/Avdhesh Chandra, 14685 W. 105TH STREET LENEXA Phone- 09810905139, Pincode : 66215 Email : Ldegarmo@sorinc.com, avdhesh@sherman-india.com,	
85	JUNCTION BOX	K.S.INSTRUMENTS PVT.LTD.	S Raghavan No. 72, 3rd Main, 1st Stage Industrial Suburb, Yeshwanthpur Bangalore Phone- 9880385770 Pincode : 560022 Email : sales1@ksinstruments.net	
86	JUNCTION BOX	SUCHITRA INDUSTRIES	NO-2,OPP-27 AECS LAYOUT 2ND STG REJAMAHALVILAS EXTN 2ND STG BANGALORE Phone- Pincode : Email : suchitra.industriesblr@gmail.com	Works-1->B. Srinivas Suchitra Industries, Opp No 53, Muneshwara Black Devinagar, Lottagal hal -BANGALORE-KARNATAKA INDIA Phone- 080-23511247 FAX : Pincode : 560094 Email : suchitra_industries@vahoo.com
87	JUNCTION BOX	Shrenik & Company,	Mr. Mitesh Shah/Mr. Pulin Shah 39 A/3 ,Panchratna Industrial Estate, Sarkhej-Bavla Road Ahmedabad Phone- 9825024921 Pincode : 382213 Email : sales@pustron.com, pulin@sumip.com	Works-1->Mr.Pulin Shah/ Mr. Kaloesh Parmar 39 A/3 ,Panchratna Industrial Est,Sarkhej-Bavla Road, Changodhar - Ahmedabad-GUJARAT INDIA Phone- 98250 80339 1 FAX : 079-26932424 Pincode : 382213 Email : sales@sumip.com
88	JUNCTION BOX	FLEXPRO ELECTRICALS PVT. LTD.	Mr. Dineshbhai Zaveri C-1/ 27&37, GIDC, Kabilpore, Navsari Phone- 02637-265140,265003 Pincode : 396424 Email : flexpro@flexproltd.com	Works-1->Mr. Dineshbhai Zaveri CEO C-1/ 27&37, GIDC, Kabilpore, -Navsari-GUJARAT INDIA Phone- 02637-265140,265003 FAX : 02637-265308 Pincode : 396424 Email : flexpro@flexproltd.com

89	JUNCTION BOX	AJMERA INDUSTRIAL & ENGINEERING WORKS	JIGNESH MAHENDRA AJMERA DENA BANK BLDG.,SHREE NAGESH INDL. ESTATE,STATION ROAD, MUMBAI Phone- 022 67973578 Pincode : 400 088 Email : ajmera@ajmera.net, ajmera@yahoo.com	Works-1->JIGNESH MAHENDRA AJMERA DENA BANK BLDG., SHREE NAGESHINDL. ESTATE,STATION ROAD, -MUMBAI- MAHARASHTRA INDIA Phone- 022 67973578 FAX : Pincode : 400 088 Email : ajmera@ajmera.net
90	INSTRUMENTS TUBE FITTINGS	VIKAS INDUSTRIAL PRODUCTS	S.R.SINGH/NAVEEN SINGH B - 2, SECTOR - 6, NOIDA Phone- +91-9810122070 Pincode : 201301 Email : naveensingh@vsnl.com	Works-1->S.R.SINGH/ NAVEEN SINGH B - 2, SECTOR - 6, -NOIDA-UTTAR PRADESH INDIA Phone- 0120-4352940 FAX : 0120- 4352940 Pincode : 201301 Email : naveensingh@vsnl.com
91	INSTRUMENTS TUBE FITTINGS	AURA INCORPORATED	NIRAJ SHARAN/SUJIT KUMAR W- 167A, GREATER KAILASH-II NEW DELHI Phone- 9810182430 Pincode : 110048 Email : niraj@aurainc.com	
92	INSTRUMENTS TUBE FITTINGS	PRECISION ENGINEERING INDUSTRIES	K. SITARAM/ K. SRINIVAS 7,SIDHAPURA INDUSTRIAL ESTATE S.V. ROAD,GOREGAON(W) MUMBAI Phone- 022 42631700 Pincode : 400 062 Email : peiks@vsnl.com	Works-1->ALEX BAPTIST/ K. SRINIVAS 7. SIDHAPURA INDUSTRIAL ESTATE,SV ROAD, GOREGAON(WEST) -MUMBAI-MAHARASHTRA INDIA Phone- 022-42631700 FAX : 022- 40035259 Pincode : 400 062 Email : srinivas@precision-engg.com
93	INSTRUMENTS TUBE FITTINGS	Fluid Controls Pvt. Ltd.	Sophie Y. Mochhala/Mayur Rajput J.V.PATEL, I.T.I CMPD, B.MADHUKAR MARG, ELPHINSTONE ROADSTN.(WR), MUMBAI Phone- (022) 43338000 Pincode : 400013 Email : sales@fluidcontrols.com	Works-1->Mr. Tansen Choudhari/Mr. Mahesh Darekar Shed No.8, Lonavla Indl.Co- op.Estate Ltd,Nagargaon, -Lonavla- MAHARASHTRA INDIA Phone- 9823951347 FAX : (02114) 271132 Pincode : 410 401 Email : factory@hyd-air.com
94	ROTAMETER	INSTRUMENTATION ENGINEERS PVT LTD	SH.N.V.RAM GOPAL/MS. N.NIHARIKA PLOTS 1,2,3, PHASE- III, IDA, JEEDIMETLA HYDERABAD Phone- 9848407365 Pincode : 500055 Email : iedelhi@iefflowmeters.com	Works-1->MR. A.V.MURTHY/MR. K.T. RAVISANKER PLOTS 1,2,3, PHASE-III,IDA, JEEDIMETLA -HYDERABAD-TELANGANA INDIA Phone- 9885107312 FAX : 040- 23096401 Pincode : 500055 Email : sales@iefflowmeters.com
95	ROTAMETER	Flow Star Engineering Pvt. Ltd.,	MR. KHALID AKHTAR/MR. TAPAN KUMAR JANA Plot No-7 F/2, Northern India Industrial 20/3, Mathura Road FARIDABAD Phone- 9818176380 Pincode : 121005 Email : khalid@flowstar.co.in	Works-1->MR. KHALID AKHTAR/MR. TAPAN KUMAR JANA Plot No-7 F/2, Northern India Complex,20/3, Mathura Road -FARIDABAD- HARYANA INDIA Phone- 0129-4069661, FAX : 0129-4069663 Pincode : 121005 Email : tkjana@flowstar.co.in
96	ROTAMETER	TANSA EQUIPMENTS PVT. LTD.	Mr. Vardhan Tamhankar, Unit No35/36/41,Om Anand Industrial Est. Mohanjee Sundarjee Road,Raghunath Nagar, Thane Phone- 022-25832323 Pincode : 400604 Email : tansaIndia@gmail.com	Works-1-> Others Mohanjee Sundarjee Road, Raghunath Nagar, Thane -Mumbai- MAHARASHTRA INDIA Phone- FAX : Pincode : 400604 Email :
97	ROTAMETER	EUREKA INDUSTRIAL EQUIPMENTS PVT.LTD.	Mr V. K. Pandit/Mr Ashish Shaha 17-20, Royal chambers, Paud Road Pune Phone- 9370469466 Pincode : 411038 Email : sales@eurekaflow.com	Works-1->Mr S. M. Alawani/Mr V. V. Deshpande J-501, M.I.D.C. Pimpri, -PUNE- MAHARASHTRA INDIA Phone- 9325751732 FAX : 020-30681731 Pincode : 411018 Email : works@eurekaflow.com
98	ROTAMETER	SCIENTIFIC DEVICES (BOMBAY) PVT LTD,	Office no. 53, Shree Manoshi Complex, Plot No. 5 & 6, Sec-3, Ghansoli (East), Navi Mumbai, Phone- 9892230623, Pincode : 400 701, Email : sdhnl@vsnl.com	Works-1->Scientific Centre, S.No. 65, Hissa No. 7,By-Pass Junction, Kausa, -Mumbai- MAHARASHTRA INDIA Phone- 9892230623, FAX : 022-25491408/9 Pincode : 400 612, Email : sales@scientificdevices.com

99	LEVEL SWITCH-CAPACITANCE TYPE	SIGMA INSTRUMENTS CO.	Gopal Kannan/R Gopinath 201, ANANDRAJ INDUSTRIAL ESTATE, OFF.LBS MARG, SONAPUR LANE, BHANDUP (W) MUMBAI Phone- +919821038162 Pincode : 400078 Email : sales@sigmainstruments.co.in	Works-1->R Gopinath 27 Nahur Udyog Industrial Premises,M.M.Malviya Road, Mulund(-MUMBAI-MAHARASHTRA INDIA Phone- +912225918567 FAX : +912225918566 Pincode : 400080 Email : sales@sigmainstruments.co.in
100	LEVEL SWITCH-CAPACITANCE TYPE	V. AUTOMAT & INSTRUMENTS (P) LTD.	Mr. R. K. BASSI/Mr. PRAVEEN KUMAR F-61, OKHLA INDL.AREA, PH-1 NEW DELHI Phone- 9810005826 Pincode : 110 020 Email : sales@vautomat.com	Works-1->Mr. BHAGWAN SINGH/ Mr. NANDAN SINGH F-61, OKHLA INDL.AREA,PHASE-I -NEW DELHI-DELHI INDIA Phone- 011-47627200 Extn. 3 FAX : 011- 26819440 Pincode : 110 020 Email : production@vautomat.com
101	LEVEL SWITCH-CAPACITANCE TYPE	SCIENTIFIC DEVICES (BOMBAY) PVT LTD,	Office no. 53, Shree Manoshi Complex, Plot No. 5 & 6, Sec-3, Ghansoli (East), Navi Mumbai, Phone- 9892230623, Pincode : 400 701, Email : sdbhl@vsnl.com	Works-1->Scientific Center, Others By-Pass Junction,Near Kalsekar College kausa, mumbra,Thane -Mumbai-MAHARASHTRA INDIA Phone- 022-25491409,9892230623 FAX : Pincode : 400612 Email : sdbhl@vsnl.com
102	LEVEL SWITCH-CAPACITANCE TYPE	LEVCON INSTRUMENTS PVT. LTD.	Mr Shayak Gupta/Badal Jana Rajkamal', 7th floor, 13, Camac Street KOLKATA Phone- 0 33 2283 2766 Pincode : 700017 Email : b_jana@levcongroup.com	
103	LEVEL SWITCH-CAPACITANCE TYPE	Flow Star Engineering Pvt. Ltd.,	MR. KHALID AKHTAR/MR. TAPAN KUMAR JANA Plot No-7 F/2, Northern India Industrial 20/3, Mathura Road FARIDABAD Phone- 9818176380 Pincode : 121005 Email : khalid@flowstar.co.in	Works-1->MR. KHALID AKHTAR/MR. TAPAN KUMAR JANA Plot No-7 F/2, Northern India Complex,20/3, Mathura Road -FARIDABAD-HARYANA INDIA Phone- 0129-4069661, FAX : 0129-4069663 Pincode : 121005 Email : tkjana@flowstar.co.in
104	LEVEL SWITCH-CAPACITANCE TYPE	Pune Techtrol Pvt. Ltd.	N.P.Khatan/Sudhakar Badiger S-18, MIDC Bhosari, Pune Phone-9850560042 Pincode : 411 026 Email : ho@punetechtrol.com	
105	LEVEL SWITCH-CAPACITANCE TYPE	Baumer Technologies India Pvt. Ltd.	Mr. Shyam Warilani/Mr. V Suresh Babu 36, DAMJI SHAMJI INDUSTRIAL COMPLEX, OFF.- MAHAKALI CAVES ROAD, ANDHERI(E) MUMBAI Phone- +91 99589 25151 Pincode : 400093 Email : sales@baumer.com	Works-1->Mr. Shyam Warilani/Mr. V Suresh Babu Plot No 34 A GIDC A Phase 1, -VAPI-GUJARAT INDIA Phone- +91 11 4161 7111 FAX : 022 2687 3613 Pincode : 396 195 Email : pbajaj@baumer.com
106	LEVEL SWITCH-CONDUCTIVITY TYPE	Sapcon Instrument Pvt Ltd.	131, PALSHIKAR COLONY Contact Person- Mr. Ashwin (9826080207) INDORE Phone- +91-731-4085751, Pincode : 452004 Email : sales@sapconinstruments.com	Works-1->Mr. Ashwin R Palshikar/Mr. Navin Bodse 131 PALSHIKAR COLONY, -INDORE-MADHYA PRADESH INDIA Phone- 9754261005 FAX : 0731-2475475 Pincode : 452004 Email : sales@sapcon.in
107	LEVEL SWITCH-CONDUCTIVITY TYPE	LEVCON INSTRUMENTS PVT. LTD.	Mr Shayak Gupta/Badal Jana Rajkamal', 7th floor, 13, Camac Street KOLKATA Phone- 0 33 2283 2766 Pincode : 700017 Email : b_jana@levcongroup.com	Works-1-> 38G, PICNIC GARDEN ROAD, -KOLKATA-WEST BENGAL INDIA Phone- FAX : Pincode : Email :
108	LEVEL SWITCH-CONDUCTIVITY TYPE	BLISS ANAND PVT. LTD.	Mr. Vikas Anand/ Mr.RGRajan 92B & 93 B, IMT MANESAR Gurgaon Phone- 0124-4366000 TO 9 Pincode : 122001 Email : sales@blissanand.com	Works-1->Mr. Bharat Kumar/ Mr. Sasi Kumar Plot No. 92B & 93B,Sec-V, IMTManesar -GURGAON-HARYANA INDIA Phone- 0124-4366000 TO 9 FAX : 0124-2290884 Pincode : 122002 Email : bharat@blissanand.com
109	LEVEL SWITCH-CONDUCTIVITY TYPE	V. AUTOMAT & INSTRUMENTS (P) LTD.	Mr. R. K. BASSI/Mr. PRAVEEN KUMAR F-61, OKHLA INDL.AREA, PH-1 NEW DELHI Phone- 9810005826 Pincode : 110 020 Email : sales@vautomat.com	Works-1->Mr. BHAGWAN SINGH/ Mr. NANDAN SINGH F-61, OKHLA INDL.AREA,PHASE-I -NEW DELHI-DELHI INDIA Phone- 011-47627200 Extn. 3 FAX : 011- 26819440 Pincode : 110 020 Email : production@vautomat.com

110	LEVEL SWITCH- CONDUCTIVITY TYPE	HI-TECH SYSTEMS & SERVICES LTD.	Mr. Vikash Agrawal/Mr. Tarun Debnath 119, PARK STREET , KOLKATA Phone- 033-22290045 Pincode : 700016 Email : sandeen@hitech.in	Works-1->Mr. Jitendra Kumar/Mr. Debasis Dey 82/1, Sarsuna Main Road, -KOLKATA- WEST BENGAL INDIA Phone- 9883994030 FAX : Pincode : 700061 Email : jitendra@hitech.in
111	LEVEL SWITCH- CONDUCTIVITY TYPE	RAMAN INSTRUMENTS PVT.LTD.	Mr. N R Shenoy/Mr G B Viji 8, First Floor.Plot : 160A Bait-Ush-Sharaf, 29th Road,Bandra(W) MUMBAI Phone- 09892331381 Pincode : 400050 Email : ramanbpl@vsnl.com	Works-1->NA -- Phone- FAX : Pincode : Email :
112	LEVEL SWITCH- CONDUCTIVITY TYPE	SIGMA INSTRUMENTS CO.	Gopal Kannan/R Gopinath 201, ANANDRAJ INDUSTRIAL ESTATE, OFF.LBS MARG, SONAPUR LANE, BHANDUP (W) MUMBAI Phone- +919821038162 Pincode : 400078 Email : sales@sigmainstruments.co.in	Works-1->R Gopinath 27 Nahur Udyog Industrial Premises,M.M.Malviya Road, Mulund(-MUMBAI-MAHARASHTRA INDIA Phone- +912225918567 FAX : +912225918566 Pincode : 400080 Email : sales@sigmainstruments.co.in
113	LEVEL SWITCH- CONDUCTIVITY TYPE	SOR INC.	LARRY DEGARMO/Avdhesh Chandra, 14685 W. 105TH STREET LENEXA Phone- 09810905139, Pincode : 66215 Email : Ldegarmo@sorinc.com, avdhesh@sherman-india.com,	Works-1->LARRY DEGARMO/ ROY STUMBOUGH 14685 W. 105TH STREET, LENEXA -KANSAS- USA Phone- 913-888-0767 FAX : 913-888-0767 Pincode : 66215 Email : rstumbough@sorinc.com
114	LEVEL SWITCH-FLOAT TYPE	Pune Techrol Pvt. Ltd.	N.P.Khatan/Sudhakar Badiger S-18, MIDC Bhosari, Pune Phone- 9850560042 Pincode : 411 026 Email : ho@punetechrol.com	
115	LEVEL SWITCH-FLOAT TYPE	D.K. INSTRUMENTS PVT.LTD.	N.SIKDAR/ SUMIT SIKDAR 76/2,SELIMPUR RD DHAKURIA Kolkata Phone- 033-2415-1310. Pincode : 700031 Email : rkinst@vsnl.net	
116	LEVEL SWITCH-FLOAT TYPE	V. AUTOMAT & INSTRUMENTS (P) LTD.	Mr. R. K. BASSI/Mr. PRAVEEN KUMAR F-61, OKHLA INDL.AREA, PH-1 NEW DELHI Phone- 9810005826 Pincode : 110 020 Email : sales@vautomat.com	Works-1->Mr. BHAGWAN SINGH/ Mr. NANDAN SINGH F-61, OKHLA INDL.AREA,PHASE-I -NEW DELHI-DELHI INDIA Phone- 011-47627200 Extn. 3 FAX : 011- 26819440 Pincode : 110 020 Email : production@vautomat.com
117	LEVEL SWITCH-FLOAT TYPE	SCIENTIFIC DEVICES (BOMBAY) PVT LTD,	Office no. 53, Shree Manoshi Complex, Plot No. 5 & 6, Sec-3, Ghansoli (East), Navi Mumbai, Phone- 9892230623, Pincode : 400 701, Email : sdbpl@vsnl.com	Works-1->Scientific Center, Others By-Pass Junction,Near Kalsekar College kausa, mumbra,Thane -Mumbai-MAHARASHTRA INDIA Phone- 022-25491409,9892230623 FAX : Pincode : 400612 Email : sdbpl@vsnl.com
118	LEVEL SWITCH-FLOAT TYPE	LEVCON INSTRUMENTS PVT. LTD.	Mr Shayak Gupta/Badal Jana Rajkamal', 7th floor, 13, Camac Street KOLKATA Phone- 0 33 2283 2766 Pincode : 700017 Email : b_jana@levcongroup.com	
119	LEVEL SWITCH-FLOAT TYPE	GENERAL INSTRUMENTS CONSORTIUM	Mr. Amarendra Kulkarni 194/195, Gopi Tank Road, Off. Pandurang Naik Marg, Mahim Mumbai Phone- 9323195251 Pincode : 400016 Email : amarendra@general-gauges.com	
120	LEVEL SWITCH-FLOAT TYPE	SBEM PVT. LTD.	MR.N.K. BEDARKAR/MR. VISHWANATH KARANDIK 39, ELECTRONIC CO.OP. ESTATE, PUNE SATARA ROAD PUNE, Phone- 912041030100 Pincode : 411009 Email : newdelhi@sbem.co.in	Works-1->MR. MOHAN PADWAL 691/A/2,BIBWEWADI INDL ESTATE -PUNE- MAHARASHTRA INDIA Phone- 918600042374 FAX : 912024215670 Pincode : 411037 Email : wm@sbem.co.in

121	LEVEL SWITCH-FLOAT TYPE	Baumer Technologies India Pvt. Ltd.	Mr. Shyam Warilani/Mr. V Suresh Babu 36, DAMJI SHAMJI INDUSTRIAL COMPLEX, OFF.-MAHAKALI CAVES ROAD, ANDHERI(E) MUMBAI Phone- +91 99589 25151 Pincode : 400093 Email : sales.in@baumer.com	Works-1->Mr. Shyam Warilani/Mr. V Suresh Babu Plot No 34 A GIDC A Phase 1, -VAPI-GUJARAT INDIA Phone- +91 11 4161 7111 FAX : 022 2687 3613 Pincode : 396 195 Email : pbajaj@baumer.com
122	LEVEL SWITCH-FLOAT TYPE	SIGMA INSTRUMENTS CO.	Gopal Kannan/R Gopinath 201, ANANDRAJ INDUSTRIAL ESTATE, OFF.LBS MARG, SONAPUR LANE, BHANDUP (W) MUMBAI Phone- +919821038162 Pincode : 400078 Email : sales@sigmainstruments.co.in	Works-1->R Gopinath 27 Nahur Udyog Industrial Premises,M.M.Malviya Road, Mulund(-MUMBAI-MAHARASHTRA INDIA Phone- +912225918567 FAX : +912225918566 Pincode : 400080 Email : sales@sigmainstruments.co.in
123	LEVEL SWITCH-FLOAT TYPE	SOR INC.	LARRY DEGARMO/Avdresh Chandra, 14685 W. 105TH STREET LENEXA Phone- 09810905139, Pincode : 66215 Email : Ldegarmo@sorinc.com, avdresh@sherman-india.com,	Works-1->LARRY DEGARMO/ ROY STUMBOUGH 14685 W. 105TH STREET, LENEXA -KANSAS- USA Phone- 913-888-0767 FAX : 913-888-0767 Pincode : 66215 Email : rstumbough@sorinc.com
124	INSTRUMENTS PIPE FITTINGS	VIKAS INDUSTRIAL PRODUCTS	S.R.SINGH/NAVEEN SINGH B - 2, SECTOR - 6, NOIDA Phone- +91-9810122070 Pincode : 201301 Email : naveensingh@vsnl.com	Works-1->S.R.SINGH/ NAVEEN SINGH B - 2, SECTOR - 6, -NOIDA-UTTAR PRADESH INDIA Phone- 0120-4352940 FAX : 0120-4352940 Pincode : 201301 Email : naveensingh@vsnl.com
125	INSTRUMENTS PIPE FITTINGS	Fluid Controls Pvt. Ltd.	Sophie Y. Moochhala/Mayur Rajput J.V.PATEL, I.T.I CMPD, B.MADHUKAR MARG, ELPHINSTONE ROADSTN.(WR), MUMBAI Phone- (022) 43338000 Pincode : 400013 Email : sales@fluidcontrols.com	Works-1->Mr. Tansen Choudhari/Mr. Mahesh Darekar Shed No.8, Lonavla Indl.Co-op.Estate Ltd,Nagargaon, -Lonavla-MAHARASHTRA INDIA Phone- 9823951347 FAX : (02114) 271132 Pincode : 410 401 Email : factory@hyd-air.com
126	INSTRUMENTS PIPE FITTINGS	PRECISION ENGINEERING INDUSTRIES	K. SITARAM/ K. SRINIVAS 7,SIDHAPURA INDUSTRIAL ESTATE S.V. ROAD,GOREGAON(W) MUMBAI Phone- 022 42631700 Pincode : 400 062 Email : peiks@vsnl.com	Works-1->ALEX BAPTIST/ K. SRINIVAS 7. SIDHAPURA INDUSTRIAL ESTATE,SV ROAD, GOREGAON(WEST) -MUMBAI-MAHARASHTRA INDIA Phone- 022-42631700 FAX : 022-40035259 Pincode : 400 062 Email : srinivas@precision-engg.com
127	INSTRUMENTS PIPE FITTINGS	AURA INCORPORATED	NIRAJ SHARAN/SUJIT KUMAR W-167A, GREATER KAILASH-II NEW DELHI Phone- 9810182430 Pincode : 110048 Email : niraj@aurainc.com	
128	ULTRASONIC FLOW METERS	Electronet Equipments Pvt Ltd.	Mr. Rajendra Nagaonkar/MD, Plot No. 84, 85 & 86, Tiny Industrial Estate Kondhwa Budruk, Pune Phone- 9822015256 Pincode : 411048 Email : ho@eeplindia.com	Works-1-> Others Plot No. 84, 85 & 86, Tiny Industrial Estate, Kondhwa Budruk - Pune-MAHARASHTRA INDIA Phone- 20-26932039 FAX : 20-26934122 Pincode : 411048 Email : ho@eeplindia.com
129	ULTRASONIC FLOW METERS	Adept Fluidyne Pvt. Ltd.	Vinayak Gadre Plot No 4,S.No.17/1-B Kothrud Industrial Estate Pune Phone- 020 25464551 Pincode : 411038 Email : info@adeptfluidyne.com	Works-1-> Plot No 4,S.No.17/1-B Kothrud Industrial Estate -Pune-MAHARASHTRA india Phone- 020 25464551 FAX : Pincode : 411038 Email : info@adeptfluidyne.com
130	ULTRASONIC FLOW METERS	FLEXIM Flexible Industriemesstechnik GmbH	Boxberger Str., 4, Berlin Berlin Phone- 0049 30 93 66 76 60 Pincode : 12681 Email : info@flexim.de	Works-1-> Others Boxberger Str. 4, -Berlin-GERMANY Phone- 0049 30 93 66 76 60 FAX : Pincode : 12681 Email : info@flexim.de
131	ULTRASONIC FLOW METERS	Rockwin Flowmeter India Pvt. Ltd.	B-24, Site-IV, Sahibabad Industrial Area Ghaziabad, Phone- 9810129687 Pincode : 201010, Email : amiva@rockwin.com	Works-1->MR Rajiv PRAKASH B-24, Site-IV, Sahibabad Industrial Area, -Ghaziabad-UTTAR PRADESH India Phone- 9810129687 FAX : 01202895450 Pincode : 201010, Email : rajiv@rockwin.com

132	ULTRASONIC FLOW METERS	FLASH FORGE PVT LTD	Mr. Gautam Makker, 503, 'A'-wing, Delphi, Orchard Avenue Road, Powai Mumbai Phone- 022-42784300 Pincode : 400076 Email : hemendrapatil@f-f.co.in	Works-1-> Others M/s Endress & Hauser, Aurangabad, Maharashtra -Aurangabad-MAHARASHTRA INDIA Phone- FAX : Pincode : Email : Works-2->+ Others M/s Endress & Hauser, Bhiwandi,Thane -Thane-MAHARASHTRA INDIA Phone- FAX : Pincode : Email :
133	ULTRASONIC FLOW METERS	NIVUS GMBH	Mr. Marcus Fischer Im Taele 2, D - 75031 Eppingen Phone- 00491712233770 Pincode : Email : carolin.schuster@nivus.com	Works-1->Mr. Marcus Fischer CEO Im Taele 2, Eppingen, -Baden Wuerttemberg,-Foreign Country GERMANY Phone- 0049-726291910 FAX : Pincode : 75031 Email : carolin.schuster@nivus.com
134	FLOW ELEMENT - ORIFICE	MINCO (INDIA) PRIVATE LIMITED	Mr. Rajeev Vasudeva, D/35, TIVIM INDUSTRIAL ESTATE, KARASWADA, MAPUSA, Goa, Phone- 9313637073 Pincode : 403526, Email : nicdelhi@general-gauges.com	Works-1-> D/35,TIVIM INDUSTRIAL ESTATE, KARASWADA,MAPUSA, -Goa-Goa India Phone- 9320197825, FAX : 0832-2257262, Pincode : 403526, Email : santoshkumar@general-gauges.com
135	FLOW ELEMENT - ORIFICE	TANSA EQUIPMENTS PVT. LTD.	Mr. Vardhan Tamhankar, Unit No35/36/41,Om Anand Industrial Est. Mohanjee Sundarjee Road,Raghunath Nagar, Thane Phone- 022-25832323 Pincode : 400604 Email : tansaindia@gmail.com	Works-1-> Others Mohanjee Sundarjee Road, Raghunath Nagar, Thane -Mumbai-MAHARASHTRA INDIA Phone- FAX : Pincode : 400604 Email :
136	FLOW ELEMENT - ORIFICE	SCIENTIFIC DEVICES (BOMBAY) PVT LTD,	Office no. 53, Shree Manoshi Complex, Plot No. 5 & 6, Sec-3, Ghansoli (East), Navi Mumbai, Phone- 9892230623, Pincode : 400 701, Email : sdhnl@vsnl.com	Works-1->Scientific Center, Others By-Pass Junction,Near Kalsekar College kausa, mumbra,Thane -Mumbai-MAHARASHTRA INDIA Phone- 022-25491409,9892230623 FAX : Pincode : 400612 Email : sdhnl@vsnl.com
137	FLOW ELEMENT - ORIFICE	Electronet Equipments Pvt Ltd.	Mr. Rajendra Nagaonkar/MD, Plot No. 84, 85 & 86, Tiny Industrial Estate Kondhwa Budruk, Pune Phone- 9822015256 Pincode : 411048 Email : ho@eeplindia.com	Works-1-> Others Plot No. 84, 85 & 86, Tiny Industrial Estate, Kondhwa Budruk - Pune-MAHARASHTRA INDIA Phone- 20-26932039 FAX : 20-26934122 Pincode : 411048 Email : ho@eeplindia.com
138	FLOW ELEMENT - ORIFICE	INSTRUMENTATION LTD.	KANJIKODE WEST, PALALKKAD, PALAKKAD Phone- 2566127-130,2567128 Pincode : 678623 Email : icvdlil@gmail.com;fa2@ilpgt.com	Works-1->D.SASIDHARAN, AGM(Works&PPC) KANJIKODE WEST, -PALAKKAD-KERALA INDIA Phone- 0491-2566536 FAX : 0491-2566135 Pincode : 678623 Email : sasiharan@ilpgt.com;mrj@ilpgt.com;gireesh@ilpgt.com, commercial@ilpgt.com;fa2@ilpgt.com;nazeera@ilpgt.com;pkv@ilpgt.com;remith@ilpgt.com
139	FLOW ELEMENT - ORIFICE	HYDROPNEUMATICS PVT. LTD.	Mr. DM Bichu G/B, Hill Crown Apts., College Road Mapusa Phone- 0832-2360364 Pincode : 403507 Email : aiavrc@hydronneumatics.co.in	Works-1->Mr. DM Bichu D2/6, Bicholim Industrial Estate, -Bicholim-Goa India Phone- 0832-2360364 FAX : 0832-2360368 Pincode : 403529 Email : aiavrc@hydronneumatics.co.in
140	FLOW ELEMENT - ORIFICE	Flow Star Engineering Pvt. Ltd.,	MR. KHALID AKHTAR/MR. TAPAN KUMAR JANA Plot No-7 F/2, Northern India Industrial 20/3, Mathura Road FARIDABAD Phone- 9818176380 Pincode : 121005 Email : khalid@flowstar.co.in	Works-1->MR. KHALID AKHTAR/MR. TAPAN KUMAR JANA Plot No-7 F/2, Northern India Complex,20/3, Mathura Road -FARIDABAD-HARYANA INDIA Phone- 0129-4069661, FAX : 0129-4069663 Pincode : 121005 Email : tkjana@flowstar.co.in
141	FLOW ELEMENT - ORIFICE	MICRO PRECISION PRODUCTS PVT. LTD.	Mr. Anil Bhati, H.B. No.-40, Revenue Estate, Village-Dudhola, Tehsil & Distt. Palwal FARIDABAD Phone- 9560742713;095607427 Pincode : 121002 Email : anil.bhati@wika.com	Works-1->Mr. SANJEEV CHAUHAN ,H.B. No.-40 Others Revenue Estate, Village-Dudhola, Tehsil & Distt. -Palwal -Faridabad-Haryana India Phone- 9560742713 FAX : Pincode : 121002 Email : anil.bhati@wika.com
142	FLOW ELEMENT - ORIFICE	MINCO (INDIA) FLOW ELEMENTS PVT. LTD.	Mr. Raghavendra M. Kulkarni D2-49/50, Tivim Industrial Estate, Karaswada Mapusa Phone- 0832-2257059 Pincode : 403526 Email : gicflowelement@aiconindia.com	Works-1->Mr. Raghavendra M. Kulkarni Dir D2-49/50, Tivim Industrial Estate,Karaswada - Mapusa-GOA INDIA Phone- 0832-2257059 FAX : 022-24455026 Pincode : 403526 Email : gicflowelement@aiconindia.com

143	FLOW ELEMENT - ORIFICE	STAR-MECH CONTROLS (I) PVT.LTD.	SUSHILLOTAM, SUSHILLOTAM, 29/3A/3, SASANE NAGAR, HADAPSAR, PUNE Phone- 02026970450 Pincode : 411028 Email : marketing@starmech.net	Works-1->VIVEK GOTE/ MAHUNDRABANSODE Sr no.54, Plot No.10,Swami Vivekanand Industrial Est.HADAPS -PUNE-MAHARASHTRA INDIA Phone- 02026970450 FAX : 02026970470 Pincode : 411028 Email : marketing@starmech.net
144	FLOW ELEMENT - ORIFICE	CHEMTROLS INDUSTRIES PVT. LTD.	Mr. K. NANDAKUMAR AMAR HILL, SAKI VIHAR ROAD, POWAI, MUMBAI Phone- 022-67151261 Pincode : 400072 Email : manikandan@chemtrols.com	Works-2->+Works -II :M/s Chemtrols Samil (I) Pvt. Ltd.,Plot No.F-43,44 Others Additional Ambemath Industrial ,M.I.D.C., Ambemath -Thane-MAHARASHTRA INDIA Phone- 22-67151261,9821014902 FAX : 91-22-28571913 Pincode : 421503 Email : manikandan@chemtrols.com
145	FLOW ELEMENT - ORIFICE	INSTRUMENTATION ENGINEERS PVT LTD	SH.N.V.RAM GOPAL/MS. N.NIHARIKA PLOTS 1,2,3, PHASE-III, IDA, JEEDIMETLA HYDERABAD Phone- 9848407365 Pincode : 500055 Email : iedelhi@iefflowmeters.com	Works-1->MR. A.V.MURTHY/MR. K.T. RAVISANKER PLOTS 1,2,3, PHASE-III,IDA, JEEDIMETLA -HYDERABAD-TELANGANA INDIA Phone- 9885107312 FAX : 040-23096401 Pincode : 500055 Email : sales@iefflowmeters.com
146	FLOW ELEMENT - ORIFICE	DYNAFLUID VALVES AND FLOW CONTROLS (P) LTD.	Mr. Yogish M. Kulkarni Plot # 23, Udyambag, Belgaum Phone- 0831-4210386 Pincode : 590008 Email : yogish@dynafluid.com	Works-1->Mr. Yogish M. Kulkarni Dir Plot # 23, Udyambag, -Belgaum-KARNATAKA INDIA Phone- 0831-4210386 FAX : 0831-4210386 Pincode : 590008 Email : yogish@dynafluid.com
147	INSTRUMENT FITTINGS	HP VALVES & FITTINGS INDIA PVT. LTD.	S. Harichandran/P.S. Pandi B-11, Mugappair Industrial Estate, CHENNAI Phone- 044 26252537 Pincode : 600037 Email : sales@hpvalvesindia.com	Works-1->S. Harichandran/ P.S. Pandi B-11, Mugappair Industrial Estate, -CHENNAI-TAMIL NADU INDIA Phone- 044-25252537 FAX : 044-26252538 Pincode : 600037 Email : sales@hpvalvesindia.com
148	INSTRUMENT FITTINGS	AURA INCORPORATED	NIRAJ SHARAN/SUJIT KUMAR W-167A, GREATER KAILASH-II NEW DELHI Phone- 9810182430 Pincode : 110048 Email : niraj@aurainc.com	
149	INSTRUMENT FITTINGS	PRECISION ENGINEERING INDUSTRIES	K. SITARAM/ K. SRINIVAS 7,SIDHAPURA INDUSTRIAL ESTATE S.V. ROAD,GOREGAON(W) MUMBAI Phone- 022 42631700 Pincode : 400 062 Email : peiks@vsnl.com	Works-1->ALEX BAPTIST/ K. SRINIVAS 7. SIDHAPURA INDUSTRIAL ESTATE,SV ROAD, GOREGAON(WEST) -MUMBAI-MAHARASHTRA INDIA Phone- 022-42631700 FAX : 022-40035259 Pincode : 400 062 Email : srinivas@precision-engg.com
150	INSTRUMENT FITTINGS	Comfit & Valve Pvt. Ltd.	Mr. Jeetu Jain/Mr. Vinay Sosa Survey No. 23/1, Part 2, Ahmedabad-Mehsana Highway Laxmipura, Nandasan Phone- 02764-267036/37 Pincode : 382705 Email : marketing@comfit.com	Works-1->Miss Sonal Pithadia/Miss Pavan Chavda Survey No. 23/1, Part 2, Ahmedabad-Mehsana Highway, Laxmipura -Nandasan-GUJARAT INDIA Phone- 8460848087 FAX : 2764-267036/37 Pincode : 382705 Email : domestic@com-fit.com
151	INSTRUMENT FITTINGS	Perfect Instrumentation Control (India) Pvt. Ltd.	MD Hussain Shaikh/Shahanawaz Khan Gala No. 168, Loheki Chwal,216/ 218, Maulana Azad Rd. Nagpada Junction Mumbai Phone- 91-9324383121 Pincode : 400008 Email : shahanawaz.khan@perfectinstrumentation.com	Works-1->Shahanawaz Khan Vishweshwar Ind. Premises Co-op Soc. Ltd,F-18/19, Pradhikaran,Bhosadi MIDC -PUNE-MAHARASHTRA INDIA Phone- 020-30694134 FAX : 022-23013010 Pincode : 411026 Email : shahanawaz.khan@perfectinstrumentation.com
152	INSTRUMENT FITTINGS	Arya Crafts & Engineering Pvt. Ltd.	Mr.Sanjay Brahman/Mr.Shyam Vazirani 102, Vora Industrial Estate No.4 Navghar, Vasai Road (E) Dist.Thane, Mumbai Phone- +91-250-2392246 Pincode : 401210 Email : arya@aryacrafts.com	
153	INSTRUMENT FITTINGS	FLUIDFIT ENGINEERS PVT. LTD.	Mr. Abbas Bhola Potia Building No. 2, Office No. 3,292, Bellasis Road,Mumbai Central (East) Mumbai Phone- 9920044113 Pincode : 400008 Email : ab@fluidfitengg.com	Works-1->Mr. Abbas Bhola Unit No. 16, Supreme Industrial Estate,Kaman Bhiwandi Road,Devdal, -Vasai East-MAHARASHTRA India Phone- 9920044113 FAX : 07303178243 Pincode : 401208 Email : ab@fluidfitengg.com

154	INSTRUMENT FITTINGS	VIKAS INDUSTRIAL PRODUCTS	S.R.SINGH/NAVEEN SINGH B - 2, SECTOR - 6, NOIDA Phone- +91-9810122070 Pincode : 201301 Email : naveensingh@vsnl.com	Works-1->S.R.SINGH/ NAVEEN SINGH B - 2, SECTOR - 6, -NOIDA-UTTAR PRADESH INDIA Phone- 0120-4352940 FAX : 0120-4352940 Pincode : 201301 Email : naveensingh@vsnl.com
155	INSTRUMENT FITTINGS	Fluid Controls Pvt. Ltd.	Sophie Y. Mochhala/Mayur Rajput J.V.PATEL, I.T.I CMPD, B.MADHUKAR MARG, ELPHINSTONE ROADSTN.(WR), MUMBAI Phone- (022) 43338000 Pincode : 400013 Email : sales@fluidcontrols.com	Works-1->Mr. Tansen Choudhari/Mr. Mahesh Darekar Shed No.8, Lonavla Indl.Co-op.Estate Ltd,Nagargaon, -Lonavla-MAHARASHTRA INDIA Phone- 9823951347 FAX : (02114) 271132 Pincode : 410 401 Email : factory@hyd-air.com
156	INSTRUMENT FITTINGS	PANAM ENGINEERS	Mr. Santosh Shukla 203, Jaisingh Business,Parsiwada, Sahar road,Andheri(East), Mumbai, Phone- 9892179529, Pincode : 400099, Email : santosh@panamengineers.com	Works-1->Mr. Santosh Shukla Others R-628,TTC Industrial Area, MIDC Rabale, -Navi Mumbai-MAHARASHTRA INDIA Phone- 9821350761, FAX : 022-27695559, Pincode : 400701, Email : sales@panamengineers.com
157	ELECTROMAGNETIC FLOW METER	V.A Valves	Mr.Vishal Jain, Udyog Nagar, Gadaipur, Jalandhar Phone- 9872626376 Pincode : 144004 Email : support@fedrelflowmeters.com	Works-1->Mr.Vishal Jain Dir Udyog Nagar, Gadaipur, -Jalandhar-PUNJAB INDIA Phone- 01812601741,9872626376 FAX : Pincode : 144004 Email : support@fedrelflowmeters.com
158	ELECTROMAGNETIC FLOW METER	Adept Fluidyne Pvt. Ltd.	Vinayak Gadre Plot No 4,S.No.17/1-B Kothrud Industrial Estate Pune Phone- 020 25464551 Pincode : 411038 Email : info@adeptfluidyne.com	Works-1-> Plot No 4,S.No.17/1-B Kothrud Industrial Estate -Pune-MAHARASHTRA india Phone- 020 25464551 FAX : Pincode : 411038 Email : info@adeptfluidyne.com
159	ELECTROMAGNETIC FLOW METER	Electronet Equipments Pvt Ltd.	Mr. Rajendra Nagaonkar/MD, Plot No. 84, 85 & 86, Tiny Industrial Estate Kondhwa Budruk, Pune Phone- 9822015256 Pincode : 411048 Email : ho@eeplindia.com	Works-1-> Others Plot No. 84, 85 & 86, Tiny Industrial Estate, Kondhwa Budruk - Pune-MAHARASHTRA INDIA Phone- 20-26932039 FAX : 20-26934122 Pincode : 411048 Email : ho@eeplindia.com
160	ELECTROMAGNETIC FLOW METER	SCIENTIFIC DEVICES (BOMBAY) PVT LTD,	Office no. 53, Shree Manoshi Complex, Plot No. 5 & 6, Sec-3, Ghansoli (East), Navi Mumbai, Phone- 9892230623, Pincode : 400 701, Email : sdhnl@vsnl.com	Works-1->Scientific Center, Others By-Pass Junction,Near Kalsekar College kausa, mumbra,Thane -Mumbai-MAHARASHTRA INDIA Phone- 022-25491409,9892230623 FAX : Pincode : 400612 Email : sdhnl@vsnl.com
161	ELECTROMAGNETIC FLOW METER	NIVO CONTROLS PVT. LTD.	Mr. Praveen Toshniwal 104-115, Electronic Complex, Indore Phone- 0731-4081305 Pincode : 452010 Email : sales@nivocontrols.com	Works-1->Mr. S L Sadani Others 104 - 115,Electronic Complex -Indore-MADHYA PRADESH INDIA Phone- 0731-4081307 FAX : Pincode : 452010 Email : sales@nivocontrols.com;sadanis@nivocontrols.com



NSPCL BHILAI (2X250MW)
GYPSUM DEWATERING EQUIPMENT
TECHNICAL SPECIFICATION

SPECIFICATION No: PE-TS-468-571-A901

SECTION : I

Sub Section : D

REV. 00

SECTION: I

SUB SECTION: D

TECHNICAL SPECIFICATION

LIST OF ANNEXURES ENCLOSED:

ANNEXURE-I	LIST OF MAKES OF SUB-VENDOR ITEMS
ANNEXURE-II	MANDATORY SPARE LIST
ANNEXURE-III	INSPECTION AND TESTING, QUALITY PLAN
ANNEXURE-IV	INPUT DRAWINGS (PID/ MECHANICAL LAYOUT DRAWINGS SHOWING LOCATION OF EQUIPMENT/ PLOT PLAN)
ANNEXURE-V	MASTER DRAWING LIST WITH SCHEDULE OF SUBMISSION
ANNEXURE-VI	PACKING PROCEDURE
ANNEXURE-VII	SEA-WORTHY PACKING PROCEDURE
ANNEXURE-VIII	PIPE & VALVE MATERIAL SPECIFICATION


THIS IS PART OF TECHNICAL SPECIFICATION PE-TS-468-571-A901 REV 00.

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SUB-VENDOR LIST	SHEET 1 OF 1		

ANNEXURE-I

1. REFER ELECTRICAL AND C&I SPECIFICATION FOR APPLICABLE SUB-VENDOR LIST FOR THE RELEVANT ITEMS.
2. THE LIST OF ALL BOUGHT OUT ITEMS WITH MAKES AND COUNTRY OF ORIGIN AND CONTACT DETAILS OF THE MANUFACTURERS TO BE MENTIONED ALONG WITH OFFER TO BE SUBMITTED IN THE FORMAT ATTACHED IN SECTION III AS AN INFORMATION TO BHEL.
3. ACCEPTANCE OF MAKES SHALL BE SUBJECT TO BHEL/ END-CUSTOMER ACCEPTANCE DURING THE DETAILED ENGINEERING WITHOUT COST AND DELIVERY IMPLICATION TO BHEL.


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	GYPSUM DEWATERING EQUIPMENT	SECTION : I	
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	TECHNICAL SPECIFICATION MANDATORY SPARES LIST	REV. 00	
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ANNEXURE-II


MANDATORY SPARES LIST

THIS IS PART OF TECHNICAL SPECIFICATION PE-TS-468-571-A901 REV 00.

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	MANDATORY SPARES LIST	REV. 00	SHEET 2 OF 6

I. MECHANICAL		
Sl. NO.	PARTICULARS	QUANTITY
1.	Hydro-cyclones (Gypsum Primary Dewatering, Secondary Waste Water and any other Hydrocyclone)	
a.	Hydro-cyclone Isolation Valve	10% of each type OR 1 no. whichever is higher
b.	Hydro-Cyclone	10% of each type OR 1 no. whichever is higher
c.	Hydro-Cyclone rubber lining-Feed chamber and Overflow chamber	10% of each type OR 1 no. whichever is higher
d.	Vortex finder & Apex inserts	10% of each type OR 1 no. whichever is higher
2.	Vacuum Belt Filter	
a.	Filter Cloth	4 sets
b.	Belt	1 sets
c.	Vacuum Box Seals	2 sets
d.	Drive Motor	1 no.
3.	Vacuum Pumps	
a.	Pump Impeller Assembly	1 no.
b.	Pump Bearing	1 set
c.	Seals	1 set
d.	Motor	1 no.
4.	Vacuum Breaker Valves	
a.	Valve Assembly	1 no.
b.	Actuator	1 no.
5.	Slurry Pumps	
a.	Impeller Assembly	4 no. of each type and size
b.	Complete Casing	1 no. of each type and size
c.	Casing Liners (where replaceable liners are provided)	1 set*
d.	Seals	4 set of each type and size
e.	Bearings	1 no. of each type and size
f.	Motor	1 no. of each type and size
g.	Gear Box	1 no. of each type and size of pump
h.	Motor-Pump Coupling	1 no. of each type
6.	Slurry Valves	4 nos. of each type and size

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	MANDATORY SPARES LIST	REV. 00	SHEET 3 OF 6

7.	Slurry Line Bends	4 nos. of each type and size
8.	Horizontal Centrifugal Pumps	
a.	Complete Impeller Assembly	1 nos. of each type
b.	Casing Liners	1 set* of each type
c.	Bearing	1 set*
d.	Motor	1 no. of each type
e.	Pump discharge valve assembly	1 nos. of each type

Any change in size, material, design etc., which obviates one to one replacement of the part shall be considered a different type.

*Unless otherwise stated, a set shall mean complete replacement for one equipment.

Note(s):

1. One set means 100% complete replacement of the particular component/equipment, as mentioned i.e., Set for the particular equipment, would include all components required to replace the item. For example, a set of bearing shall include all hardware normally required while replacing the bearings. It is further, intended that the assembly / sub-assembly which have different orientation (like left hand or right hand, top or bottom), different direction of rotation or mirror image positioning or any other reasons which result in maintaining two different sets of the spares to be used for the subject assembly / sub-assembly, these shall be considered as different types of assembly/sub-assembly.

2. Wherever the quantities have been indicated for each type, size, thickness, material, radius, range etc. these shall cover all the items supplied and installed.


3. In case spares indicated in the list are not applicable to the particular design offered by the bidder, the bidder should offer spares applicable to offered design with quantities generally in line with the approach followed in the above list.

4. Any item which is quoted as "not applicable" in the above list and is found to be "applicable" at a later date shall be supplied by the Bidder without any commercial implications. The Bidder shall note that if there is any change/ variation in equipment/ system during detail engineering which causes any change/ variation in the essential spares quantity, the same shall be supplied without any commercial implications. The price indicated for the mandatory spares shall be considered for the purpose of evaluation.

5. Mandatory spares shall not be dispatched before dispatch of corresponding main equipment. The spares shall be treated and packed for a long storage under the climatic condition prevailing at site.

6. All spares supplied under this contract shall be strictly interchangeable with parts for which they are intended for replacements. These spares should include all mounted accessories like components, boards, add or items, fitting, connectors etc. and be complete in all respects so that the replacement of the main items by these spares does not require any additional item. The vendors must conform the pair to pair compatibility of each electrical spares modules with the modules should be supplied in the original package. All electronic modules should be pre-set and/or pre-programmed for ready use at site. Alternatively, suitable instruction sheet indicating the details of required PCB jumper

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TECHNICAL SPECIFICATION MANDATORY SPARES LIST	SHEET 4 OF 6		

position, BCD which is setting, EPROM/PROM listing etc should be packed along with each module. Also a caution mark sign should be put on all such module which needs pre-setting/pre-programming before putting them in to service. The spare shall be treated and properly packed for long term storage.


7. Each spare shall be clearly marked and labelled on the outside of the packing with its description. When more than one spare part is packed in single case, a general description of the contents shall be shown on the outside of such case and a detailed list enclosed. All cases, containers and other packages must be suitably marked and numbered for the purpose of identification.

II. MANDATORY SPARES - CONTROL & INSTRUMENTATION		
SI. NO.	PARTICULARS	QUANTITY
1.01.00	MEASURING INSTRUMENTS	
1.01.01	(i) Transmitters of all types and model no. (for measurement of pressure, differential pressure, flow, level, temp, etc.). This shall include magnetic/ electromagnetic flow meter, mass flow meter also.	10% or 1 no. of each type and model, whichever is more.
1.01.02	Temp Elements along with thermo-well (except winding temp elements of motor)	10% or 2 no. of each type, model length, whichever is more.
1.01.03	(i) Process Actuated Switches (Pressure, Differential pressure, flow, level, temp) (ii) Limit switches (for pneumatic and manual valves)	10% or 2 no. of each type and model, whichever is more.
1.01.04	Local Gauges for Pressure, Differential pressure, flow, level, temp	5% or 1 no. of each type, model and range, whichever is more.
1.02.00	PROCESS CONNECTION PIPING (For Impulse Piping / Tubing and Air Supply Piping as Applicable)	
a.	Valves of all types and models	10% or 1 no. of each type, class, size and model whichever is more.
b.	2 way, 3way, 5way valve manifolds	10% or 1 no. of each type, class, size and model whichever is more.
c.	Fittings	10% or 1 packet of each type, class, size and model whichever is more.
d.	Purge meters	5% of each model or 1 no. whichever is more.
e.	Filter regulators	20% of each model or 2 nos. whichever is more.
1.03.00	CONTROL VALVES, ACTUATORS & ACCESSORIES (Following items shall be provided under this clause for all modulating control valves being supplied under this package)	
a.	Pneumatic and electro-hydraulic actuator assembly	10% or 1 no. of each type, model and rating, whichever is more.

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b.	Valve trim (including cage, plug, stem, seat rings, guide bushings etc.)	1 set for each type of control valve.	THIS IS PART OF TECHNICAL SPECIFICATION PE-TS-468-571-A901 REV 00.
c.	Diaphragms, O' rings, seals etc. of all types make etc.	100%	
d.	Pressure Gauges of all types, make, rating etc.	10% or 2 nos. of each type whichever is more	
e.	Solenoid valves (if applicable)	10% or 2 nos. of each type whichever is more	
f.	Positioner units (complete unit)& accessories (link assembly)	10% or 1 no. of each type whichever is more	
g.	Pneumatic air-filter/Regulator of each type, make rating etc.	10% or 2 Nos., whichever is more	
h.	Air lock relays	10% or 2 nos. of each type whichever is more	
1.04.00	PNEUMATICS ISOLATION / BLOCK VALVES, ACTUATORS & ACCESSORIES (For all ON/OFF valves supplied under this package)		
a.	Pneumatic actuator assembly	10% or 1 no. of each type, model and rating, whichever is more.	
b.	Diaphragms, O' rings, seals etc. of all types make etc.	100%	
c.	Limit switches (complete unit) & accessories (link assembly)	10% or 2 Nos., whichever is more	
d.	Pneumatic air-filter/Regulator of each type, make rating etc.	10% or 2 Nos., whichever is more	
1.05.00	ELECTRICAL ACTUATORS		
a.	Actuators	1 no of each type and rating	
b.	Electronic PCB of all types	10% of each type & model	
c.	Absolute Encoder (replaceable part)	5% of each type & model	
d.	Electronic Torque sensor	5% of each type & model	
1.06.00	SOLENOID VALVES		
a.	Solenoid Valves	10% of each type, rating and model	
b.	Solenoid Valve COILS	10% of each type, rating and model	
1.07.00	VFD SYSTEM		
a.	Electronic cards		
	(i) Control modules	1 nos. of each type & rating	
	(ii) I/O module	1 nos. of each type & rating	
	(iii) Power supply modules	1 nos. of each type & rating	
	(iv) Gate module including gate transformer	100% of one channel	
b.	Power device (Thyristor, IGBT etc.) bridge leg	1no.(Qty. for one ph.)	

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c.	Over voltage limiter and surge suppressor network	1 set
d.	Semi conductor fuses for Power device (thyristor, IGBT etc.)	1 set
e.	Power & Control fuse	25% of installed quantity
f.	Control Transformer	1 nos. of each type & rating
g.	Contactor/Breaker	1 no.
h.	CT/VT	1 nos. of each type & rating
i.	Indicating lamps	100% of each type & rating
l.	Auxiliary contactors & relays	1 no. of each type & rating
k.	Indicating lamp holder full set	15% of each type and colour
l.	Panel mounted meters	1 nos. of each type & rating
NOTE:		
1	Wherever set is mentioned, one set of the spares of that item shall be for complete replacement of that particular item for one equipment.	
2	Any fraction of a item shall mean the next higher.	
3	Wherever quantity has been specified as percentage (%), the quantity of mandatory spares to be provided by contractor shall be the specified percentage (%) of the total population of the plant. In case, the quantity so calculated happens to be fraction, the same shall be rounded off to next higher whole number.	
4	Wherever the quantities have been indicated for each type, size, thickness, material, radius, range, etc., these shall cover all the items supplied and installed and the breakup for these shall be furnished in the bid.	
5	In case, spares indicated in the list are not applicable to the particular design offered by the bidder, the bidder should offer spares applicable to offered design with quantities generally in line with the approach followed in the above list.	


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		SHEET 1 OF 7	
INSPECTION AND TESTING			

ANNEXURE- III**1.01.00 INSPECTION AND TESTS DURING MANUFACTURE**

- 1.01.01 The method and techniques to be used by the Bidder for the control of quality during manufacture of all plant and equipment shall be agreed with the Owner.
- 1.01.02 The Owner's general requirements with respect to quality control and the required shop tests are set out elsewhere in this specification.
- 1.01.03 Before any item of plant or equipment leaves its place of manufacture, the Owner shall be given the option of witnessing inspections and tests for compliance with the specification and related standards.
- 1.01.04 Advance notice shall be given to the Owner as agreed in the Contract, prior to the stage of manufacture being reached, and the piece of plant must be held at this stage until the Owner has inspected the piece, or has advised in writing that inspection is waived. If having consulted the Owner and given reasonable notice in writing of the date on which the piece of plant will be available for inspection, the Owner does not attend, the Bidder may proceed with manufacturing having forwarded to the Owner duly certified copies of his own inspection and test results.
- The owner's representative shall have at all reasonable times access to bidder's or his sub-vendor's premises and shall have power to inspect/ examine materials and workmanship or equipment under manufacture.
- The Bidder shall forthwith forward to the engineer duly certified copies of the Test Certificates in six copies (one to the Purchaser and five to the Consulting Engineer) for approval. Further nine (9) copies of Shop Test Certificates shall be bound with Instruction Manuals referred to elsewhere in the specification.
- For electrical equipment, routine tests as per relevant IS/International standard as detailed in the specification are to be carried out on all equipments. Type tests are also to be carried out on selected equipment as detailed in the specifications of the electrical equipment concerned.
- 1.01.05 Under no circumstances, any repair or welding of castings be carried out without the consent of the Engineer. Proof of the effectiveness of each repair by radiographic and/or other non-destructive testing technique, shall be provided to the Engineer.
- 1.01.06 All the individual and assembled rotating parts shall be statically and dynamically balanced at the works. Where accurate alignment is necessary for component parts of machinery normally assembled on site, the Bidder shall allow for trial assembly prior to dispatch from place of manufacture.
- 1.01.07 All materials used for the manufacture of equipment covered under this specification shall be of tested quality. Relevant test certificates shall be made available to the Purchaser. The certificates shall include tests for mechanical properties and chemical analysis of representative

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material. Equipment or parts coming under any statutory Regulations shall be certified by a Competent Authority under the regulations in the specified format.

1.01.08 All pressure parts connected to pumping main shall be subjected to hydraulic testing at a pressure of 150% of shut-off head for a period not less than 30 minutes. Other parts shall be tested for one and half times the maximum operating pressure, for a period not less than 30 minutes.

1.01.09 All necessary non-destructive examinations shall be performed to meet the applicable code requirements.

1.01.10 All welding procedures adopted for performing welding work shall be qualified in accordance with the requirements of Section-IX of ASME code or IBR as applicable. All welded joints for pressure parts shall be tested by liquid penetrant examination according to the method outlined in ASME Boiler and Pressure Vessel code. Radiography, magnetic particle examination magnaflux and ultrasonic testing shall be employed wherever necessary/ recommended by the applicable code. At least 10% of all major butt welding joints shall be radiographed unless otherwise stipulated.

Bidder's scope shall include to preparation of all necessary documents, co-ordination and follow up for above approval related to bidder's works. Owner shall only forward assistance/ endorsement of documents /design /drawings /reports/records to be submitted for approval as Stipulated/ required by Statutory Authorities till registration of the unit and clearance for commercial operation.


1.02.00 PERFORMANCE TESTS AT SITE

1.02.01 The full requirements for testing the system shall be agreed between the Owner and the Bidder prior to Award of Contract. The completely erected System shall be tested by the Bidder on site under normal operating conditions. The Bidder shall also ensure the correct performance of the System under abnormal conditions, i.e. the correct working of the various emergency and safety devices, interlocks, etc.

1.02.02 The Bidder shall provide complete details of his normal procedures for testing, for the quality of erection and for the performance of the erected plant. These tests shall include site pressure test on all erected pipe work to demonstrate the quality of the piping and the adequacy of joints made at site.

1.02.03 The Bidder shall furnish the quality procedures to be adopted for assuring quality from the receipt of material at site, during storage, erection, pre-commissioning to tests on completion and commissioning of the complete system/equipment.

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1.03.00	SPECIFIC INSPECTION REQUIREMENT FOR COMPONENTS/EQUIPMENTS
1.	Hydro-cyclones
a.	Visual
b.	Dimensional etc.
2.	Pumps :
c.	All pressure parts shall be hydraulically tested at 150% of the shut-off head or 200% of rated head, whichever is higher for 30 minutes. No leakage is allowed.
d.	Impeller and rotor shall be first statically balanced and then dynamically balanced according to ISO 1940 (in the case of impellers this shall be done before and after mounting of the service rotor shaft).
e.	Vibration levels measured on the non-rotating parts shall not exceed the zone limit "B" as defined in ISO 10816 at steady conditions and shall not exceed the zone limit "C" as defined in ISO 10816 at transient conditions.
f.	List of Non-Destructive test over and above the material test are as follows: Casing: Material test, Magnetic particle (MPI), DP and Hydro test, as applicable Impeller- DPT and MPI as applicable Shaft- Ultrasonic (UT), DPT and MPI Sleeve- DP and Hardness test/ Manufacturer's recommendation Mechanical Seal- Manufacturer's recommendation. Base Plate- Stress relieving of weld. Replaceable Rubber liner- Shore Hardness, Class and Type certificate
g.	Vibration test and Noise level test shall be witnessed at shop. (as already stated above.)
h.	Mechanical running and the performance test shall be conducted for Pump at the Bidder's works before dispatch or where the test facilities are available. All pumps to be performance tested as per Hydraulic Institute Standard/Indian Standard. Performance test to include check for noise, vibration level and temperature rise.
i.	The Bidder shall conduct performance test for the remaining pump and submit the reports.
3.	Vacuum Belt Filters:
a.	Impeller, casing and shaft of vacuum pumps shall be tested for chemical and mechanical properties as per relevant standard. All plates above 40 mm shall be 100% Ultrasonically tested.
b.	UT on shaft (if greater or equal to 40mm) and impeller shall be carried out.
c.	All vacuum pumps shall be tested at shop for capacity, power, pressure, efficiency, noise and vibration etc.
d.	Filter cloths and belts shall be tested for physical properties as per relevant Standard.

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NSPCL BHILAI (2X250 MW)
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4. General Inspection Requirements to be considered are as below:				
1.	Sl.No.	Item	Inspection & Test Item	Remarks
	1.	Hydro-cyclones	Material certificate check	
			Dimensional Inspection	
	2.	Pumps	Material certificate check	Shaft & impeller only
			Dimensional inspection	
			Non-destructive testing	DPT on shaft & impeller
			Hydrostatic test	
			Balancing Test	Static & dynamic
			Performance test	Incl. Noise & Vibration
	3.	Motors	Material certificate check	
			Non Destructive Testing	
			Dimensional inspection	
			Balancing Test	Static & dynamic
			Function test	
	4.	Vacuum Belt filter (with Accessories)	Material certificate check	
			Dimensional inspection	
			Function test	Short time no load test
	5.	Vacuum Receiver	Material certificate check	
			Dimensional inspection	
			Hydrostatic Test	
	6.	Belt Filter Vent Fan	Material certificate check	
			Dimensional inspection	
			Performance Test	
	7.	Conveyor & Silo Extraction Device	Material certificate check	
			Dimensional inspection	
			Function Test	Short time no load test
	8.	Rubber lining Pipe	Dimensional inspection	
			Visual Inspection	
			Spark Test	
9.	Flow Nozzles	Material certificate check		
		Dimensional Inspection		

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	10.	Control Panel	Insulation Resistance Test	
			Dielectric Strength Test	
			Function Test	
			Dimensional Inspection	
	11.	Control valve & valves	Material certificate check	
			Hydrostatic test	
			Seat leak test	
			Function test	
			Dimensional Inspection	
	12.	RTD	Material certificate check	
			Performance test	
			Hydrostatic test	
	13.	Shut off valve	Material certificate check	
			Hydrostatic test	
			Seat Leak test	
			Function Test	
			Dimensional Inspection	
	14.	Flow meter	Material certificate check	
			Calibration Test	
			Dimensional Inspection	
Hydrostatic test				
15.	Butterfly Valve	Material Certificate check		
		Non-destructive testing		
		Hydrostatic test		
		Operation test	Motorized valve only	
2.	Valves and Specialties shall be tested as per relevant standards / codes. Seat Leakage and hydraulic test to be carried out as per relevant standards /codes.			
3.	Pipes and fittings shall be tested as per relevant standards/ codes			
4.	MQP (Manufacturing Quality Plan) shall be submitted by the bidder along with the technical offer. Above mentioned item-wise inspection requirement is tentative only and shall be mutually discussed and finalized during detail engineering.			

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5.	Bidder shall furnish written copies of shop production, fabrication and quality test procedures and drawings to be used for review by BHEL / BHEL's Customer prior to manufacture. Inspection of above mentioned tests by BHEL/ BHEL's Customer representative at bidder's works is envisaged
6.	The Bidder shall furnish performance test procedure along with standard. The test procedure will be reviewed and approved by the BHEL / BHEL's Customer.
7.	A dynamic balancing certificates stating that the rotating assembly has been balanced dynamically shall be sent to BHEL/ BHEL's Customer within one (1) week of the successful completion of balancing.
8.	Vibration levels shall be measured during shop running/performance tests.
9.	For surfaces with rubber lining, Welding shall be visually inspected to verify the absence of rough area and unacceptable transition between surfaces which prevent the adequate adherence of rubber. The acceptance criteria shall be as per latest standard.
10.	For surfaces with rubber lining, degree of cleaning shall be visually checked before the application of the coating. There must be no area with oxidation, dirt or partially or generalized corrosion defects.
11.	Test certificates shall be issued for each lot of raw material used in the coating, corresponding to specific weight and traction resistance.
12.	For surfaces with rubber lining, adherence test shall be conducted on production samples. Adherence test shall be conducted on the actual surface through hammering. In order to verify the absence of air pockets (or) surface without adherence.
13.	For surfaces with rubber lining, Coating thickness shall be checked at 100%. A High voltage porosity test will be conducted on 100 % of the coated surface.
14.	Equipment shall not be released for shipment, until shop tests data and performance tests curves have been approved by Owner.
15.	Bidder should furnish performance guarantee as per applicable standard guarantee for the design, manufacture, material and safe operation of the equipment's.
16.	BHEL/BHEL's Customer of their authorized third party inspection agency representative shall witness the test at Bidder's works and a notice of minimum three (3) weeks shall be given for attending the inspection. The charges for Inspection agency (TPIA) in India will be in BHEL scope. However, the charges for inspection outside India will be in bidder's scope.
17.	Bidder to arrange all calibrated gauges, Instruments during inspection at works and also during performance test at site. All inspection, measuring and test equipment(s) used by Bidder shall be calibrated (<i>at accredited laboratory, as applicable</i>) periodically depending on its use and criticality of the test/measurement to be done. The Bidder shall maintain all the relevant records of periodic calibration and instrument identification, and shall produce the same for inspection by the Owner. Wherever asked specifically, the Bidder shall re-calibrate the measuring/test equipment in the presence of Project Manager/Inspector.
18.	Mechanical running test shall be carried out for Vacuum Belt Filter, Vacuum Pump & Belt Filter Wash Pump. Bidder to arrange Motor for the shop test and inspection.
19.	In case, order is placed on a foreign vendor (i.e. supplies from outside India), vendor will tie-up with BHEL approved inspection agency on their own cost and carry out inspection as per the Quality Plan approved by BHEL/ BHEL's Customer. Vendor shall furnish BHEL the inspection reports and other documents required as per approved Quality plan duly signed by the Inspection Agency after their witness for our review and acceptance.

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To be read along with Section I-Sub Section D- Annexure-III
(INSPECTION AND TESTING)

SUB-SECTION-V-QM1

FLUE GAS DESULPHURISATION SYSTEM

THIS IS PART OF TECHNICAL SPECIFICATION PE-TS-468-571-A901 REV 00.

**LOT-2 PROJECTS
FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE**

**TECHNICAL SPECIFICATION
SECTION-VI
BID DOCUMENT NO.: CS-0011-109(2)-9**



CLAUSE NO.	QUALITY ASSURANCE		
FLUE GAS DESULPHURISATION SYSTEM			
1.00.0	FLUE GAS DESULPHURISATION SYSTEM		
1.01.0	Mills:		
1.01.01	Raw material for shaft, coupling, gears and pinions, top and bottom races and other rotating components shall be subjected to UT. MPI/LPI shall be carried out to check surface soundness.		
1.01.02	Wear-resistant parts shall be UT/RT tested to check soundness after suitable heat treatment. Check for chemical composition, hardness and microstructure shall be carried out.		
1.01.03	Butt welds in the tube/separator/body casing of the mill shall be tested by RT and MPI. All other welds in main tube/separator shall be tested by MPI/LPI for acceptance. The tube shall be statically balanced.		
1.01.04	All gearboxes shall be run tested for adequate duration to check rise in oil temperature, noise level and vibration. Check for leak tightness of gear case also shall be performed.		
1.02.0	Feeders:		
1.02.01	Any welds in the casing/pulley fabrication shall be checked with MPI.		
1.02.02	Routine tests shall be done as per relevant Indian Standards or equivalent International Standards.		
1.02.03	All major items like plates for casing, head pulley, tail pulley, pulley shaft and major castings shall be procured with respective material test certificates.		
1.02.04	Calibration check shall be carried out on all feeders.		
1.03.0	Dampers:		
1.03.01	All the dampers shall be subjected to operational test/checks.		
1.03.02	Gas tight Dampers shall be subjected to shop leakage test to demonstrate the guaranteed tightness as per NTPC Tech Specification.		
1.04.0	PIPING, VALVE AND SPECIALITIES:		
1.04.01	All pipes and fittings shall be tested as per applicable code.		
1.04.02	All valves shall be hydraulically/Air tested for body, seat and back-seat (if applicable) as per relevant standard.		
1.04.03	NDT on valves shall be as per relevant standard.		
1.04.04	Valves shall be offered for hydro test in unpainted conditions.		
1.04.05	Functional checks of the valves for smooth opening and closing shall also be done.		
<p style="text-align: center;">LOT-2 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p style="text-align: center;">TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(2)-9</p>	<p style="text-align: center;">PART-B SUB-SECTION-V-QM1 FGD SYSTEM</p>	<p style="text-align: center;">Page 1 of 4</p>

THIS IS PART OF TECHNICAL SPECIFICATION PE-TS-468-571-A901 REV 00.



CLAUSE NO.	QUALITY ASSURANCE
1.05.00	TANKS / VESSELS:
1.05.01	 Atmospheric tanks: i) All welds joints shall be DP tested and complete tanks shall be water fill tested. ii) All atmospheric storage tanks fabricated and erected at site shall be subjected to tests (Hydro, NDT and Vacuum) according to design code as applicable. iii) Rubber lining shall be tested for hardness and spark test, as applicable.
1.05.02	Pressure vessels: 1) NDT on weld joint shall be as per respective code requirements or the minimum as specified as below: i) 100% DPT on root run of butt weld, nozzle welds and finished fillet welds. ii) 10% DPT on all finished butt welds. iii) 10% RT (covering all 'T'/cross joints) of butt welds. 2) Butt welds of dished ends shall be stress relieved and subjected to 100% RT. 3) Each finished vessels shall be hydraulically tested to 150% of the design pressure for a duration of 30 minutes.
1.06.00	HEAT EXCHANGER/HEATER:
1.06.01	All material shall be tested for chemical and mechanical properties and NDT as per relevant standard.
1.06.02	NDT on welds and other checks shall be as per relevant code.
1.06.03	Air heaters shall be subjected to dimensional and clearance checks as per standard practice
1.06.04	Lub. oil system, drive system, soot blowing system etc. of Air heaters shall be checked suitably as per standard practice
1.07.00	PUMPS:
1.07.01	UT on shaft forgings (greater or equal to 40mm) and MPI/DPT shall be done on shafts and impeller to ensure freedom from defects.
1.07.02	The pump casing shall be hydraulically tested at 200% of pump rated head or at 150% of shut off head, whichever is higher. The test pressure shall be maintained for at least half an hour.
1.07.03	The pump rotating parts shall be subjected to static and dynamic balancing.
1.07.04	All pumps shall be tested at shop for capacity, head efficiency and brake horse power at rated speed as per relevant/applicable standard.
1.07.05	Noise and vibration shall be measured during the performance testing at shop.

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CLAUSE NO.	QUALITY ASSURANCE		
<p>1.08.00</p> <p>1.08.01</p> <p>1.08.02</p> <p>1.08.03</p> <p>1.08.04</p>	<p>STRUCTURES , DUCTS, HOPPERS:</p> <p>All materials shall be tested for chemical and mechanical properties as per relevant standard. All plates above 40mm shall be 100% Ultrasonically tested.</p> <p>Visual inspection of all welds shall be performed in accordance with AWS D1.1.</p> <p>NDT requirements of structural steel welds shall be as under:</p> <ul style="list-style-type: none"> i) 100% RT/UT on butt-welds of plate thickness ≥ 32mm. ii) For plates of $25\text{mm} \leq \text{thickness} < 32\text{mm}$-10% RT and 100% MPI. iii) For plates of thickness $< 25\text{mm}$-10% MPI/LPI. <p>Edge for shop and field weld shall be examined by MPI for plate thickness ≥ 32mm.</p>		
<p>1.09.00</p> <p>1.09.01</p> <p>1.09.02</p> <p>1.09.03</p> <p>1.09.04</p> <p>1.09.05</p>	<p>VACUUM BELT FILTER SYSTEM:</p> <p>Impeller, casing and shaft of vacuum pumps shall be tested for chemical and mechanical properties as per relevant standard. All plates above 40mm shall be 100% Ultrasonically tested.</p> <p>UT on shaft (if greater or equal to 40mm) and impeller shall be carried out.</p> <p>All vacuum pumps shall be tested at shop for capacity, power, pressure, efficiency, noise and vibration etc.</p> <p>Filter cloths and belts shall be tested for physical properties as per relevant standard</p> <p>Hydro cyclones shall be checked by visual, dimensional etc.</p>		
<p>1.10.00</p> <p>1.10.01</p> <p>1.10.02</p>	<p>SPRAY NOZZLES:</p> <p>Spray nozzles shall be tested for physical properties</p> <p>Spray nozzles also shall be subjected to performance test.</p>		
<p>1.11.00</p> <p>1.11.01</p> <p>1.11.02</p> <p>1.11.03</p>	<p>AGITATORS:</p> <p>Rubber lining shall be tested for hardness and spark test</p> <p>Impellers shall be tested for dimensional and balancing check</p> <p>Gear Boxes shall be tested for run test as per standard practice</p>		
<p>1.12.00</p> <p>1.12.01</p> <p>1.12.02</p>	<p>FANS:</p> <p>Rotor components shall be subjected to ultrasonic test at mill and magnetic particle inspection / liquid penetrant examination after rough machining.</p> <p>Butt welds in rotor components shall be subjected to 100% RT and all welds shall be magnetic particle/dye penetrant tested after stress relieving.</p>		
<p>LOT-2 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p>TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(2)-9</p>	<p>PART-B SUB-SECTION-V-QM1 FGD SYSTEM</p>	<p>Page 3 of 4</p>

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CLAUSE NO.	QUALITY ASSURANCE		
1.12.03	All rotating components and assemblies of fan shall be balanced dynamically		
1.12.04	Performance test shall be carried out on fans as per Technical specification/ Relevant standard		
1.12.05	Test for Natural Frequency and hardness of Fans blades shall be carried out as per Technical specification/ Relevant standard		
1.13.00	<p>Thermal Insulation, Lagging & Cladding:</p> <p>(a) Lightly resin bonded mineral wool:</p> <p>LRB mattresses/sections of Rockwool/ Glasswool shall conform to & tested as per relevant clauses of Indian Standards and shall meet the requirements of NTPC data sheet. Type tests except Thermal Conductivity shall be regularly carried out once in three months, Thermal Conductivity Type Test shall be carried out minimum once in twelve months by the manufacturer. Requirements of various components like Binding wires, Lacing wires, Wire mesh, etc. shall be as per NTPC approved data sheet / as given in respective Sub-Section of Technical Requirements of Steam Generator & Auxiliaries.</p> <p>(b) Lagging & Cladding:</p> <p>All insulation shall be protected by means of an outer covering of Aluminium sheeting confirming to ASTM B-209-1060 temper H14 from reputed manufacturer meeting the requirements of NTPC data sheet.</p>		
1.14.00	OTHER CRITICAL EQUIPMENTS:		
1.14.01	Checks/ NDTs shall be done as per relevant Indian Standards or equivalent International Standards.		
<p>LOT-2 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p>TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(2)-9</p>	<p>PART-B SUB-SECTION-V-QM1 FGD SYSTEM</p>	<p>Page 4 of 4</p>

	MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS		QUALITY PLAN					SPEC. NO : PE-TS-468-571-A901			DATE:	
			CUSTOMER : M/s NSPCL					QP NO.: PE-V0-468-571-A101			DATE: Nov, 2021	
			PROJECT: 2x250 MW, BHILLAI					PO NO.:			DATE:	
			ITEM: GYPSUM DEWATERING EQUIPMENT		SYSTEM: FGD			SECTION:			SHEET 1 of 9	

SL NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY	REMARKS
1	2	3	4	5	6	7	8	9	*	**
					M C/ N				D	M C N

1.0 RAW MATERIAL (*Material shall be as per Drawing)

1.1	Vacuum pump	Physical & Chemical for impeller, casing, shaft.	MA	Physical	100%	100%	Approved Drawing/Data sheet	Approved Drawing/Data sheet	TC	√	P	V	V	NOTE-5
		NDT of Impeller, casing, shaft, sleeve	MA	DPT	100%	100%	Approved Drawing/Data sheet	Approved Drawing/Data sheet	IR	√	P	V	V	NOTE-5
		Balancing of Rotating Parts	MA	Static & Dynamic Balancing	100%	100%	ISO 1940 Gr.6.3	ISO 1940 Gr.6.3	IR	√	P	V	V	NOTE-5
		NDT of Impeller & Shaft	MA	UT	100%	100%	ASTM A 388/ASME Sec.V	ASTM A 388/ASME Sec.V	IR	√	P	V	V	UT of shaft $\geq \phi$ 40mm NOTE-5
1.2	Speed reducer	Visual, dimensional, Run test including oil leakage, Temp.	MA	Visual	100%	100%	Approved Drawing/ Data sheet	Approved Drawing/ Data sheet	IR	√	P	V	V	

BHEL					
ENGINEERING			QUALITY		
	Sign & Date	Name		Sign & Date	Name
Prepared by:		RAJESH RANJAN	Checked by:		ASHISH PANIGRAHI
Reviewed by:		PANKAJ KR KAPSIMAY	Reviewed by:		RK JAISWAL

BIDDER/ SUPPLIER	
Sign & Date	Seal

FOR CUSTOMER REVIEW & APPROVAL			
Doc No:	Sign & Date	Name	Seal
Reviewed by:			
Approved by:			

THIS IS PART OF TECHNICAL SPECIFICATION PE-TS-468-571-A901 REV 00.

SL NO.		COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY	REMARKS				
1		2	3	4	5	6		7	8	9	*	**			
						M	C/ N				D	M	C	N	
			rise, Noise level and vibration												
1.3		AC Drive	Type, Make, Rating, Routine test.	MA	Visual	100%	100%	Approved Drawing/Data sheet	Approved Drawing/Data sheet	TC	√	P	V	V	Refer Electrical QP for details. NOTE-5
1.4		Belt	Visual & review of test certificate (Tensile, Elongation, Thickness)	MA	Visual	100%	100%	Approved Drawing/Data sheet	Approved Drawing/Data sheet	TC	√	P	V	V	
1.5		Filter Cloth	Physical Properties (Tensile, Elongation, Thickness, air permeability test, etc.)	MA	Physical	100%	100%	Approved Drawing/Data sheet	Approved Drawing/Data sheet	TC	√	P	V	V	
1.6		Water Pump/ Slurry Pump	Chem. & Mech. Properties of Impeller, Casting,	MA	Chemical Mechanical	100%	100%	Approved Drawing/Data sheet/Relevant	Approved Drawing/Data sheet/Relevant	TC	√	P	V	V	UT of shaft $\geq \phi$ 40mm *Lining if applicable

BHEL					
ENGINEERING			QUALITY		
	Sign & Date	Name		Sign & Date	Name
Prepared by:		RAJESH RANJAN	Checked by:		ASHISH PANIGRAHI
Reviewed by:		PANKAJ KR KAPSIMAY	Reviewed by:		RK JAISWAL

BIDDER/ SUPPLIER	
Sign & Date	Seal

FOR CUSTOMER REVIEW & APPROVAL			
Doc No:	Sign & Date	Name	Seal
Reviewed by:			
Approved by:			

THIS IS PART OF TECHNICAL SPECIFICATION PE-TS-468-571-A901 REV 00.



MANUFACTURER/ BIDDER/ SUPPLIER
NAME & ADDRESS

QUALITY PLAN

SPEC. NO : PE-TS-468-571-A901

DATE:

CUSTOMER : M/s NSPCL

QP NO.: PE-V0-468-571-A101

DATE: Nov, 2021

PROJECT: 2x250 MW, BHILLAI

PO NO.:

DATE:

ITEM: GYPSUM DEWATERING EQUIPMENT

SYSTEM: FGD

SECTION:

SHEET 2 of 9

SL NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS	
					OF CHECK					D	**			
					M	C/ N					M	C		N
1	2	3	4	5	6	7	8	9	*					
		Shaft, Lining*					t Standard	t Standard						
		Balancing of Rotating Parts	MA	Static & Dynamic Balancing	100%	100%	ISO 1940 Gr.6.3	ISO 1940 Gr.6.3	IR	√	P	V	V	
		Hydro test of casing	MA	Static pressure testing	100%	100%	Approved Drawing/Data sheet	Approved Drawing/Data sheet	IR	√	P	V	V	Hydrostatic testing of casings for 30min.at 1. times of shut-off head & 2 times pump rated head whichever ever higher.
		NDT of Impeller, casing, shaft, sleeve	MA	DPT	100%	100%	Approved Drawing/Data sheet	Approved Drawing/Data sheet	IR	√	P	V	V	
		NDT of Impeller & Shaft	MA	UT	100%	100%	ASTM A 388/ASME sec.V	ASTM A 388/ASME sec.V	IR	√	P	V	V	UT of shaft ≥φ 40mm

BHEL					
ENGINEERING			QUALITY		
	Sign & Date	Name		Sign & Date	Name
Prepared by:		RAJESH RANJAN	Checked by:		ASHISH PANIGRAHI
Reviewed by:		PANKAJ KR KAPSIMAY	Reviewed by:		RK JAISWAL

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

FOR CUSTOMER REVIEW & APPROVAL			
Doc No:	Sign & Date	Name	Seal
Reviewed by:			
Approved by:			

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MANUFACTURER/ BIDDER/ SUPPLIER
NAME & ADDRESS

QUALITY PLAN

SPEC. NO : PE-TS-468-571-A901

DATE:

CUSTOMER : M/s NSPCL

QP NO.: PE-V0-468-571-A101

DATE: Nov, 2021

PROJECT: 2x250 MW, BHILLAI

PO NO.:

DATE:

ITEM: GYPSUM DEWATERING EQUIPMENT

SYSTEM: FGD

SECTION:

SHEET 3 of 9

SL NO.		COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY	REMARKS	
1		2	3	4	5	6	7	8	9	*	**	
						M C/ N				D	M C N	
1.7		Hydro cyclone	Visual & Dimension	MA	Visual & Measurement	100% 100%	Approved Drawing/Data sheet	Approved Drawing/Data sheet	IR	√	P W V	NOTE-5
1.8		Valves (Control valve & Butterfly Valve etc*)	Material certificate Hydrostatic test Seat leak test Function test DimensionS	MA	Visual	100% 100%	Approved Drawing/Data sheet	Approved Drawing/Data sheet	IR	√	P V V	*As applicable NOTE-5
1.9(a)		Rubber Composition	Material content	MA	Chemical	1/Batch 1/Batch	Approved Drawing/Data sheet	Approved Drawing/Data sheet	COC	√	P V V	
1.9(b)		Rubber lining	Spark test at accessible area	MA	Inspection check	100% 100%	Approved Drawing/Data sheet	Approved Drawing/Data sheet	IR	√	P W V	Spark test 10-12.5KV min.
1.10		LT Motor	Make, Rating, Type, Routine Test, Paint	MA	Visual	100% 100%	Approved Drawing/Data sheet	Approved Drawing/Data sheet	IR	√	P V V	For Motor up to 30KW COC Will be submitted NOTE-5

BHEL					
ENGINEERING			QUALITY		
	Sign & Date	Name		Sign & Date	Name
Prepared by:		RAJESH RANJAN	Checked by:		ASHISH PANIGRAHI
Reviewed by:		PANKAJ KR KAPSIMAY	Reviewed by:		RK JAISWAL

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

FOR CUSTOMER REVIEW & APPROVAL			
Doc No:			
	Sign & Date	Name	Seal
Reviewed by:			
Approved by:			

THIS IS PART OF TECHNICAL SPECIFICATION PE-TS-468-571-A901 REV 00.

SL NO.		COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY	REMARKS				
1		2	3	4	5	6		7	8	9	*	**			
						M	C/ N				D	M	C	N	
1.11		Junction Box	Type Test-Enclosure Protection Test	MA	Visual	One of Design	One of Design	IS:60529	IS:60529	IR	√	P	V	V	NOTE-5
1.12		Instruments (Transmitters, Switches, Gauges, RTD etc.)	COC/Functional Check	MA	Visual	100%	100%	Approved Drawing/Data sheet	Approved Drawing/Data sheet	TC	√	P	V	V	
2.0		FINAL INSPECTION (Vacuum belt filter assembly)													
2.1		Vacuum belt filter assembly	Dimensional	MA	Dimensional	100%	100%	Approved Drawing	Approved Drawing	IR	√	P	W	W	
			Run test(for 30 minutes)	MA	Visual, Measurement	100%	100%	Approved Drawing	Approved Drawing	IR	√	P	W	W	
2.2		All components required paints.	Paint Finish, Paint Thickness, High voltage porosity test	MA	Measurement	100%	100%	Approved Drawing/Data sheet	Approved Drawing/Data sheet	IR	√	P	W	V	

BHEL					
ENGINEERING			QUALITY		
	Sign & Date	Name		Sign & Date	Name
Prepared by:		RAJESH RANJAN	Checked by:		ASHISH PANIGRAHI
Reviewed by:		PANKAJ KR KAPSIMAY	Reviewed by:		RK JAISWAL

BIDDER/ SUPPLIER	
Sign & Date	Seal

FOR CUSTOMER REVIEW & APPROVAL			
Doc No:	Sign & Date	Name	Seal
Reviewed by:			
Approved by:			

THIS IS PART OF TECHNICAL SPECIFICATION PE-TS-468-571-A901 REV 00.

SL NO.		COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY	REMARKS				
1		2	3	4	5	6		7	8	9	*	**			
						M	C/ N				D	M	C	N	
2.3		Vacuum pump/ Water Pump/ Slurry Pump	Capacity, power, pressure, efficiency, noise, vibration, temperature rise	MA	Measurement	100%	100%	Approved Drawing/Data sheet	Approved Drawing/Data sheet	IR	√	P	W	V	NOTE-5
3		VACCUM TANK (RAW MATERIAL INSPECTION)													
3.1		Plates for shell and dished ends & structural	Chemical & Physical	MA	Chemical & Physical	1 /Heat	1 /Heat	Approved Data Sheet /Drawing	Approved Data Sheet /Drawing	TC	√	P	V	V	
4.0		IN PROCESS CONTROLS													
4.1		Welding (As applicable)	WPS,PQR,WPQ	CR	Visual	100%	100%	ASME Sec, IX/Relevant Standard	ASME Sec, IX/Relevant Standard	Report	√	P	V	V	

BHEL					
ENGINEERING			QUALITY		
	Sign & Date	Name		Sign & Date	Name
Prepared by:		RAJESH RANJAN	Checked by:		ASHISH PANIGRAHI
Reviewed by:		PANKAJ KR KAPSIMAY	Reviewed by:		RK JAISWAL

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

FOR CUSTOMER REVIEW & APPROVAL			
Doc No:			
	Sign & Date	Name	Seal
Reviewed by:			
Approved by:			

THIS IS PART OF TECHNICAL SPECIFICATION PE-TS-468-571-A901 REV 00.

SL NO.		COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY	REMARKS				
1		2	3	4	5	6		7	8	9	*	**			
						M	C/ N				D	M	C	N	
4.2		Stress Relieving	Physical	MA	Physical	100%	100%	Relevant Standard/Manufacturer standard	Relevant Standard/Manufacturer standard	HT chart	√	P	V	V	As applicable
4.3		All Weld	Weld Quality	MA	DPT	10%	10%	Relevant Standard /ASME Sec – VIII Div.1	Relevant Standard /ASME Sec – VIII Div.1	IR	√	P	W	V	
4.4		Weld quality of circumferential & longitudinal seams	Weld Defect	CR	RT- Review of documents	10%	10%	Relevant Standard /ASME Sec – VIII Div.1	Relevant Standard /ASME Sec – VIII Div.1	IR	√	P	V	V	
5.0		FINAL INSPECTION (Complete Equipment)													
5.1		Complete Equipment	Dimensional	MA	Dimension	100%	100%			Approved Drawing	√	P	W	V	NOTE-5
			Nozzle Orientation	CR	Dimension	100%	100%	Approved Drawing	Approved Drawing	IR	√	P	W	V	NOTE-5

BHEL					
ENGINEERING			QUALITY		
	Sign & Date	Name		Sign & Date	Name
Prepared by:		RAJESH RANJAN	Checked by:		ASHISH PANIGRAHI
Reviewed by:		PANKAJ KR KAPSIMAY	Reviewed by:		RK JAISWAL

BIDDER/ SUPPLIER	
Sign & Date	Seal

FOR CUSTOMER REVIEW & APPROVAL			
Doc No:	Sign & Date	Name	Seal
Reviewed by:			
Approved by:			

THIS IS PART OF TECHNICAL SPECIFICATION PE-TS-468-571-A901 REV 00.

SL NO.		COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY	REMARKS	
1		2	3	4	5	6	7	8	9	*	**	
						M C/ N				D	M C N	
			Hydro Test	CR	Hydro Test	100% 100%	2X working PR or 1.5x design PR Whichever is higher for 30 minutes	2X working PR or 1.5x design PR Whichever is higher for 30 minutes	IR	√	P W V	NOTE-5
			Pneumatic Test of RF pads for soundness /leakages	CR	Pneumatic Test	100% 100%	ASME SEC – VIII /appd. Drg/appd. Datasheet	ASME SEC – VIII /appd. Drg/appd. Datasheet	IR	√	P W V	*as applicable NOTE-5
5.2(a)	Rubber Lining of tank	Spark test	MA	Electrical	100% 100%	Technical Spec/ Relevant standard	Technical Spec/ Relevant standard	IR	√	P V V	Spark test 10-12.5KV min.	
5.2(b)	Rubber Lining of tank	Hardness testing	MA	Physical	100% 100%	Technical Spec/ Relevant standard	Technical Spec/ Relevant standard	IR	√	P W V	Shore hardness value shall be within 60. NOTE-5	
5.3	Junction Box	Insulation Resistance Test High Voltage Test	MA	Electrical	100 % 10%	Approved Drawing	Approved Drawing	IR	√	P W V	NOTE-5	

BHEL					
ENGINEERING			QUALITY		
	Sign & Date	Name		Sign & Date	Name
Prepared by:		RAJESH RANJAN	Checked by:		ASHISH PANIGRAHI
Reviewed by:		PANKAJ KR KAPSIMAY	Reviewed by:		RK JAISWAL

BIDDER/ SUPPLIER	
Sign & Date	Seal

FOR CUSTOMER REVIEW & APPROVAL			
Doc No:	Sign & Date	Name	Seal
Reviewed by:			
Approved by:			

THIS IS PART OF TECHNICAL SPECIFICATION PE-TS-468-571-A901 (REV 00).

SL NO.		COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY	REMARKS			
1	2	3	4	5	6	7	8	9	*	**				
					M	C/ N			D	M	C	N		
5.4	Painting & Marking	Paint Finish, Thickness, HV porosity test	MA	Visual	100%	100%	Appd. Drg /Data Sheet	Appd. Drg /Data Sheet	IR	√	P	V	V	NOTE-5
5.5	Packing	Proper Packing	MA	Visual	100%	100%	Technical Spec	Technical Spec	Packing List	√	P	V	V	NOTE-2,5
5.6	Quality Dossier	Document	MA	Visual	100%	100%	Compilation of documents	Compilation of documents	Quality Dossier	√	P	V	V	

LEGENDS:


*RECORDS, IDENTIFIED WITH "TICK"(√) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION,
 ** M: SUPPLIER/ MANUFACTURER/ SUB-SUPPLIER, C: MAIN SUPPLIER/ BHEL/ THIRD PARTY INSPECTION AGENCY, N: CUSTOMER,
 P: PERFORM, W: WITNESS, V: VERIFICATION, AS APPROPRIATE
 MA: MAJOR, MI: MINOR, CR: CRITICAL
 IR: INTERNAL REPORT D: DOCUMENTATION
 RT: RADIOGRAPHY TEST UT: ULTRASONIC TEST DPT: DIE PENETRANT TEST

NOTE:

1. ORIGINAL TCS/ PHOTOCOPIES CERTIFIED IN ORIGINAL BY MILL SHALL BE FURNISHED FOR REVIEW.
2. PACKING PHOTO GRAPH IS TO BE SUBMITTED TO BHEL BEFORE DISPATCH.
3. BHEL RESERVES THE RIGHT FOR CONDUCTING REPEAT TEST, IF REQUIRED.
4. DURING TESTING ONLY CALIBRATED MEASURING AND TESTING INSTRUMENT IS TO BE USED AND. CALIBRATION CERTIFICATES ARE NEEDED TO BE FURNISHED DURING INSPECTION.
5. THESE TESTS/CHECKS ARE INDICATIVE ONLY. FURTHER TESTS MAY BE ADDED BASED ON END CUSTOMER REQUIREMENT AND WILL BE FINALISED DURING DETAILED ENGINEERING

BHEL					BIDDER/ SUPPLIER		FOR CUSTOMER REVIEW & APPROVAL			
ENGINEERING			QUALITY		Sign & Date		Doc No:			
	Sign & Date	Name		Sign & Date	Name	Seal		Sign & Date	Name	Seal
Prepared by:		RAJESH RANJAN	Checked by:		ASHISH PANIGRAHI			Reviewed by:		
Reviewed by:		PANKAJ KR KAPSIMAY	Reviewed by:		RK JAISWAL			Approved by:		

THIS IS PART OF TECHNICAL SPECIFICATION PE-TS-468-571-A901 REV 00.

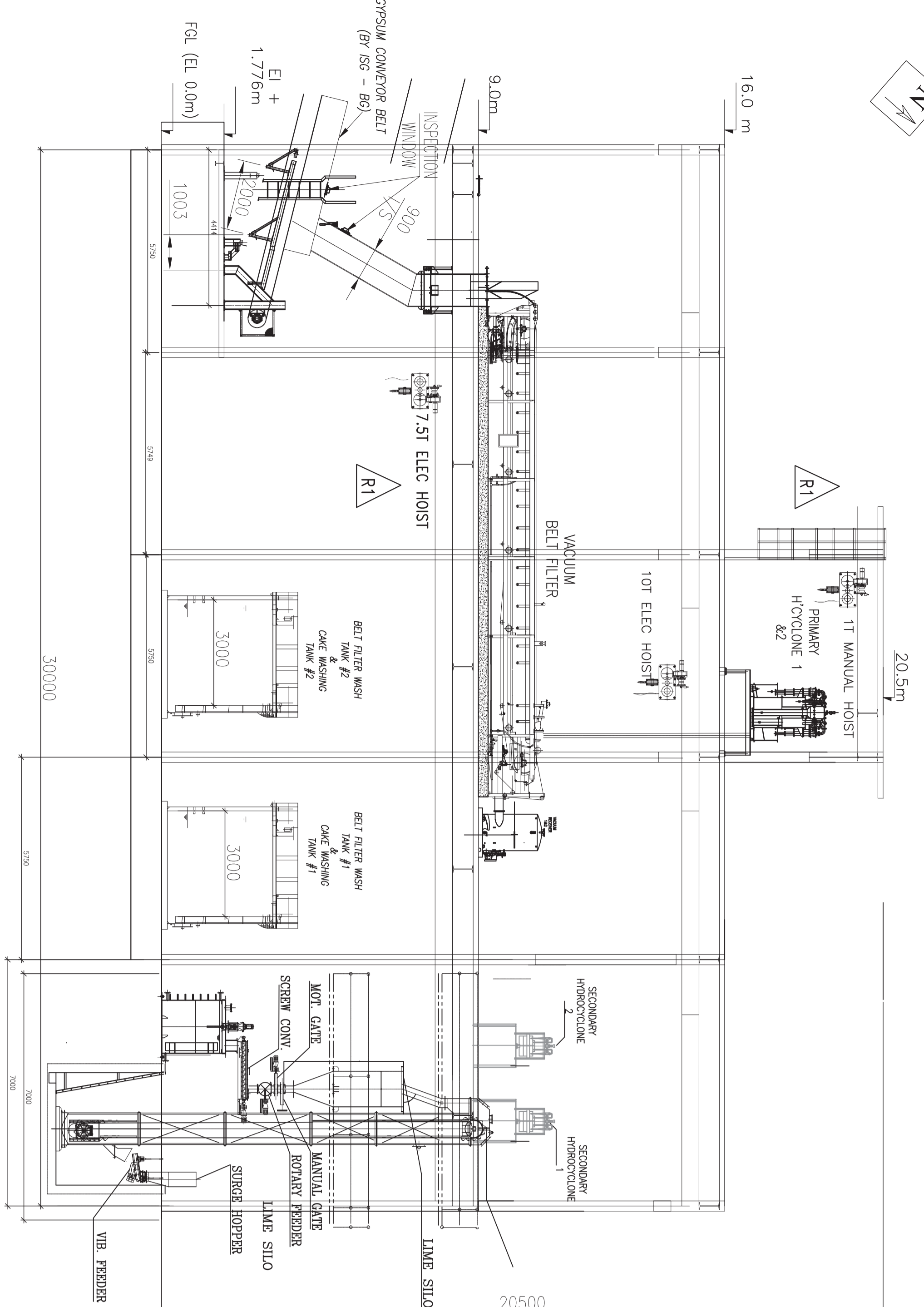
	NSPCL BHILAI (2X250 MW) GYPSUM DEWATERING EQUIPMENT TECHNICAL SPECIFICATION INPUT DRAWING LIST	SPECIFICATION No: PE-TS-468-571-A901	
		SECTION : I	
		SUB-SECTION : D	
		REV. 00	
		SHEET 1 OF 1	

ANNEXURE-IV

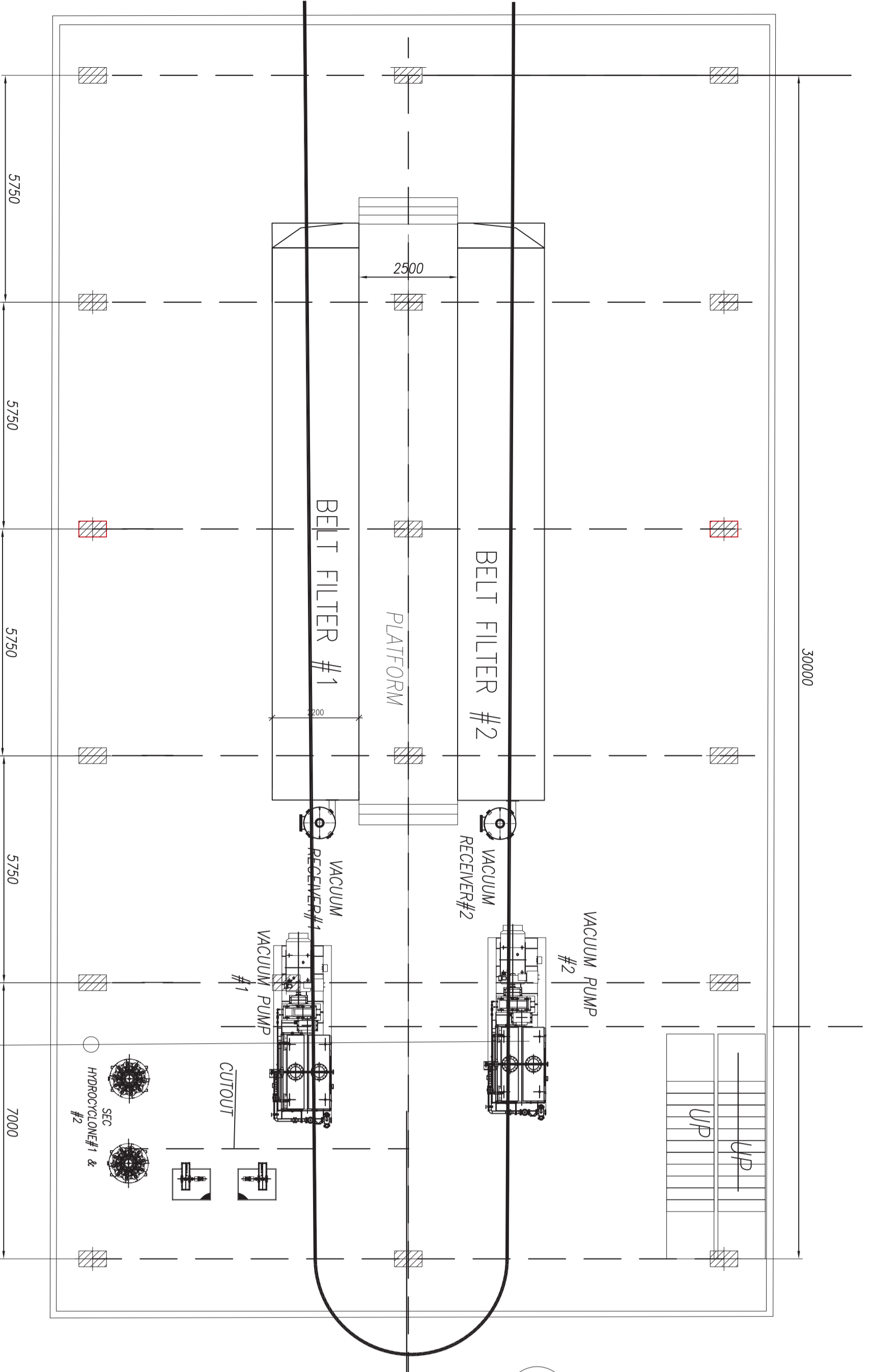
INPUT DRAWINGS/DOCUMENTS BY BHEL

Sl.No.	Drawing/Document Title	NSPCL/BHEL Drawing No.
1.	General Arrangement of Dewatering Building	PE-DG-468-571-A001
2.	P&ID - Legends & Notes	-- (Sheet 1 & 2 of 2)
3.	P&ID - Primary Hydrocyclone Feed Tank	9993-109-PVM-F-044 (Sheet 1 & 2 of 10)
4.	P&ID of Vacuum Belt filter	9993-109-PVM-F-044 (Sheet 5& 6 of 10)
5.	P&ID of Belt Filter washing Tanks & Cake washing Tanks	9993-109-PVM-F-044 (Sheet 7,8,9 & 10 of 10)
6.	P&ID of Secondary Hydrocyclone Tank	9993-109-PVM-F-044 (Sheet 3-4 of 10)
7.	Filtrate Extraction Pump Scheme	PE-FEP-00
8.	P&ID Filtrate water tank	3-FW-000-02071
9.	P&ID Waste Water System	9963-19-PVM-F-046
10.	Plant Layout of FGD System	0-FW-000-01558 (Sheet 1 of 1)

THIS IS PART OF TECHNICAL SPECIFICATION PE-TS-468-571-A901 REV 00.



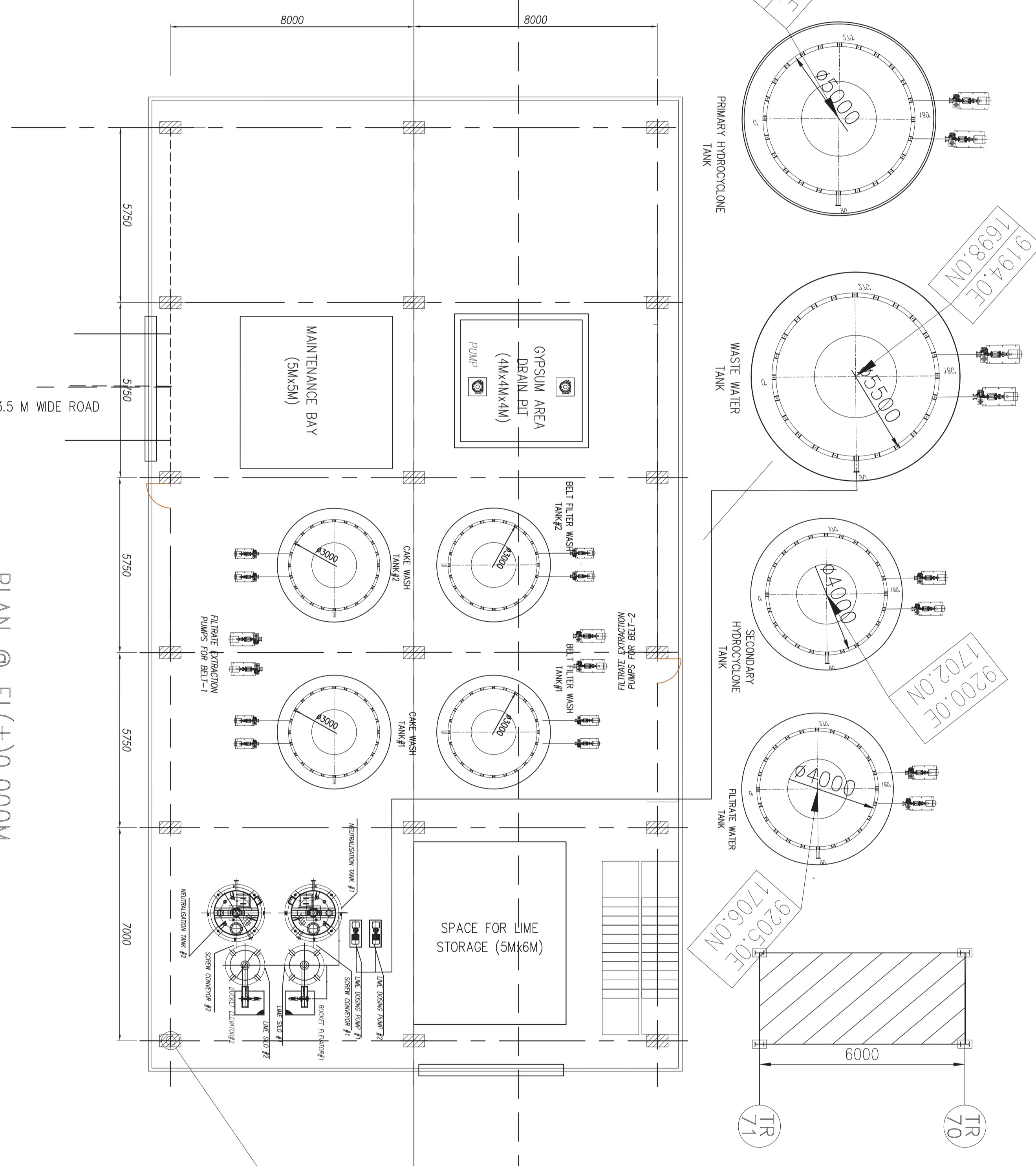
SECTION - BB



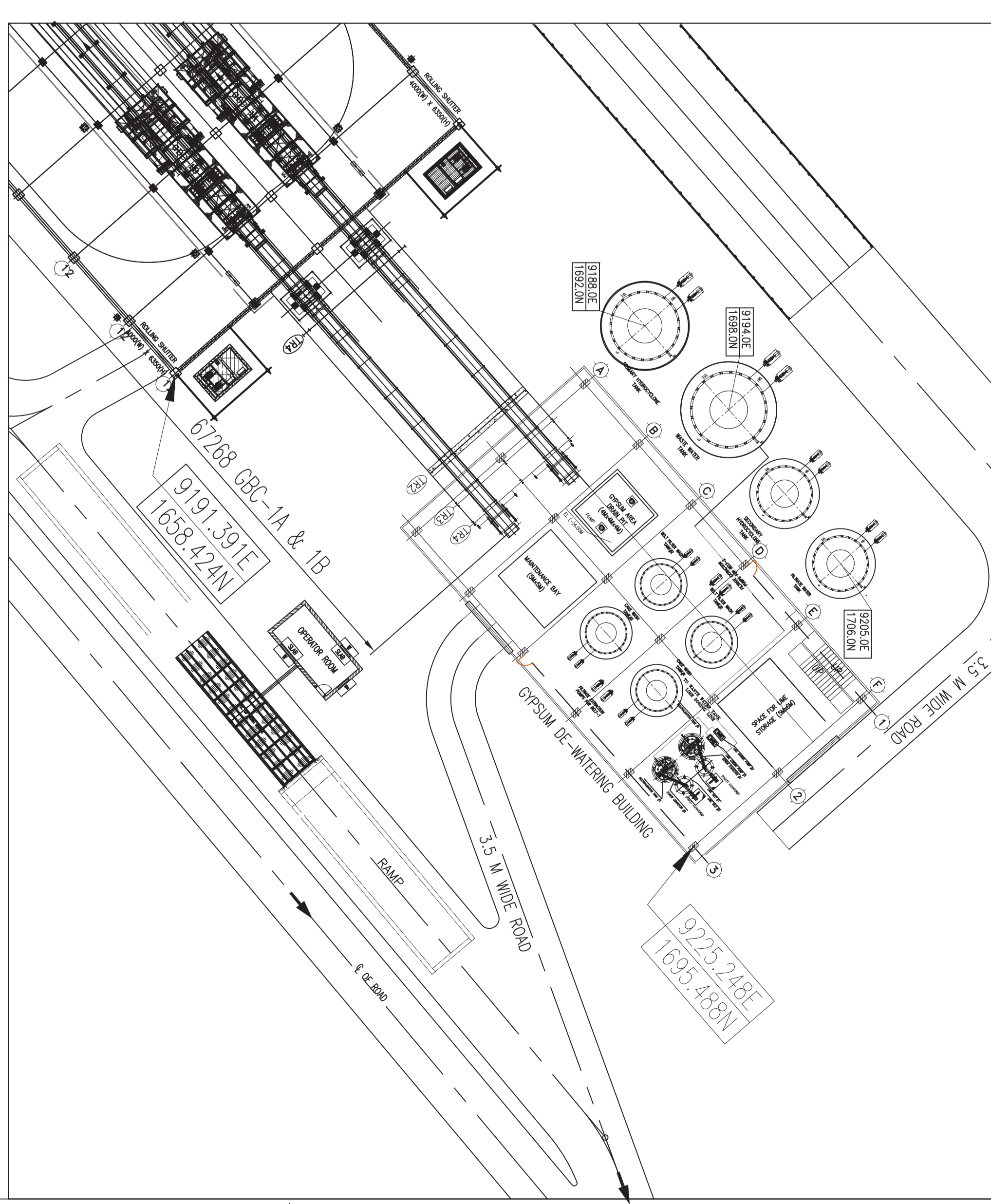
PLAN @ EL (+) 9.00M

B/EPT. QTY.	DISCREPTIONS	AREA WEIGHT OR BULKY MASS OPERATOR	LOCATION IN GYM BUILDING	REMARKS.
1	VACUUM BELT FILTER WITH ACCESSORIES	50 MT	ON FIRST FLOOR EL(+9.00)	THE EQUIPMENT COLUMNS WILL BE SUPPORTED ON THE FLOOR
2	SECONDARY HYDRO TANK	3 MT (INCLUDING SUPPORTING PLATFORMS)	ON FIRST FLOOR EL(+9.00)	THE EQUIPMENT HAS 4 COLUMNS WHICH WILL BE SUPPORTED ON THE FLOOR
3	NEUTRALISATION (LIME DOSING) TANK WITH AGITATION	8 MT	GROUND FLOOR EL(+0.00)	SEPARATE FOUNDATION OR FLOOR MOUNTED AS PER CIVIL DESIGN
4	LIME FEED SCREW CONVERTER	1.5 MT	ABOVE NEUTRALISATION (LIME DOSING) TANK	THE SCREW CONVERTER WILL BE MOUNTED BELOW LIME SLD/HOPPER
5	LIME DOSING SLD/HOPPER, MANUAL OPERATOR	13 MT (COMBINED WITH SUPPORTING STRUCTURE)	ABOVE NEUTRALISATION (LIME DOSING) TANK	LIME SLD WILL BE SUPPORTED ON PLATFORM ON SUPPORTING STRUCTURE
6	PRIMARY HYDROCHLORIC TANK (INCLUDING SUPPORTING PLATFORMS)	4MT	ON SECOND FLOOR EL(+16.50)	PRIMARY HYDRO CYCLONE WILL BE SIMILAR SUPPORTED ON FLOOR
7	VACUUM PUMP & MOTOR	12 MT	GROUND FLOOR EL(+0.00)	FOUNDATION TO BE PROVIDED AS PER CIVIL DESIGN
8	VACUUM RECEIVER	10MT	FIRST FLOOR EL(+9.00)	FLOOR MOUNTED
9	CAKE WASH TANK	AS PER REFERENCE	GROUND FLOOR EL(+9.00)	SEPARATE FOUNDATION OR FLOOR MOUNTED AS PER CIVIL DESIGN
10	BELT FILTER(CLOTH) TANK	AS PER REFERENCE	GROUND FLOOR EL(+9.00)	SEPARATE FOUNDATION OR FLOOR MOUNTED AS PER CIVIL DESIGN
11	BUCKET ELEVATOR ASSY. WITH SING FEEDER & VERMINE FEEDER) FOR LIME FEED	10 T	FROM GROUND FLOOR TO LIME FEED SLD 19'	THE BUCKET ELEVATOR IS MOUNTED ON 1ST FLOOR AND WILL REACH TO LIME SLD TOP THROUGH SUPPORT STRUCTURE
12	BAG FILTER WITH BLOWERS	1 T	ON LIME STORAGE SLD PLATFORM	BAG FILTER WILL BE SUPPORTED ON LIME SLD / PLATFORM WHICH WILL BE SUPPORTED ON FLOOR
13	LIME DOSING PUMPS	0.2 T	GROUND FLOOR EL(+0.00)	FOUNDATION TO BE PROVIDED AS PER CIVIL DESIGN
14	PRIMARY HYDROCHLORIC FEED TANK & PUMPS WITH MOTORS	AS PER REFERENCE	OUTSIDE GYM BUILDING	SEPARATE FOUNDATION OR FLOOR MOUNTED AS PER CIVIL DESIGN
15	PLUMBE WATER TANK & PUMPS WITH MOTORS	AS PER REFERENCE	OUTSIDE GYM BUILDING	FOUNDATION TO BE PROVIDED AS PER CIVIL DESIGN
16	SECONDARY HYDROCHLORIC FEED TANK & PUMPS WITH MOTORS	AS PER REFERENCE	OUTSIDE GYM BUILDING	SEPARATE FOUNDATION OR FLOOR MOUNTED AS PER CIVIL DESIGN
17	WASTE WATER STORAGE TANK & PUMPS WITH MOTORS	AS PER REFERENCE	OUTSIDE GYM BUILDING	FOUNDATION TO BE PROVIDED AS PER CIVIL DESIGN
18	FILTRATE EXTRACTION PUMPS & MOTORS	2.5 T	FIRST FLOOR EL(+9.00)	FOUNDATION TO BE PROVIDED AS PER CIVIL DESIGN
19	CAKE WASH PUMPS & MOTORS	0.2 T	GROUND FLOOR EL(+0.00)	FOUNDATION TO BE PROVIDED AS PER CIVIL DESIGN
20	BELT/CLOTH WASH PUMPS & MOTORS	0.2 T	GROUND FLOOR EL(+0.00)	FOUNDATION TO BE PROVIDED AS PER CIVIL DESIGN
21	PLATFORMS FOR YPR & HYDROCYCLONES	15 T	AS SHOWN	FOUNDATION TO BE PROVIDED AS PER CIVIL DESIGN
22	DISCHARGE CHUTE	-	YPR DISCHARGE CHUTE TO CONVERTOR	FOUNDATION TO BE PROVIDED AS PER CIVIL DESIGN

TABLE OF REQUIREMENTS

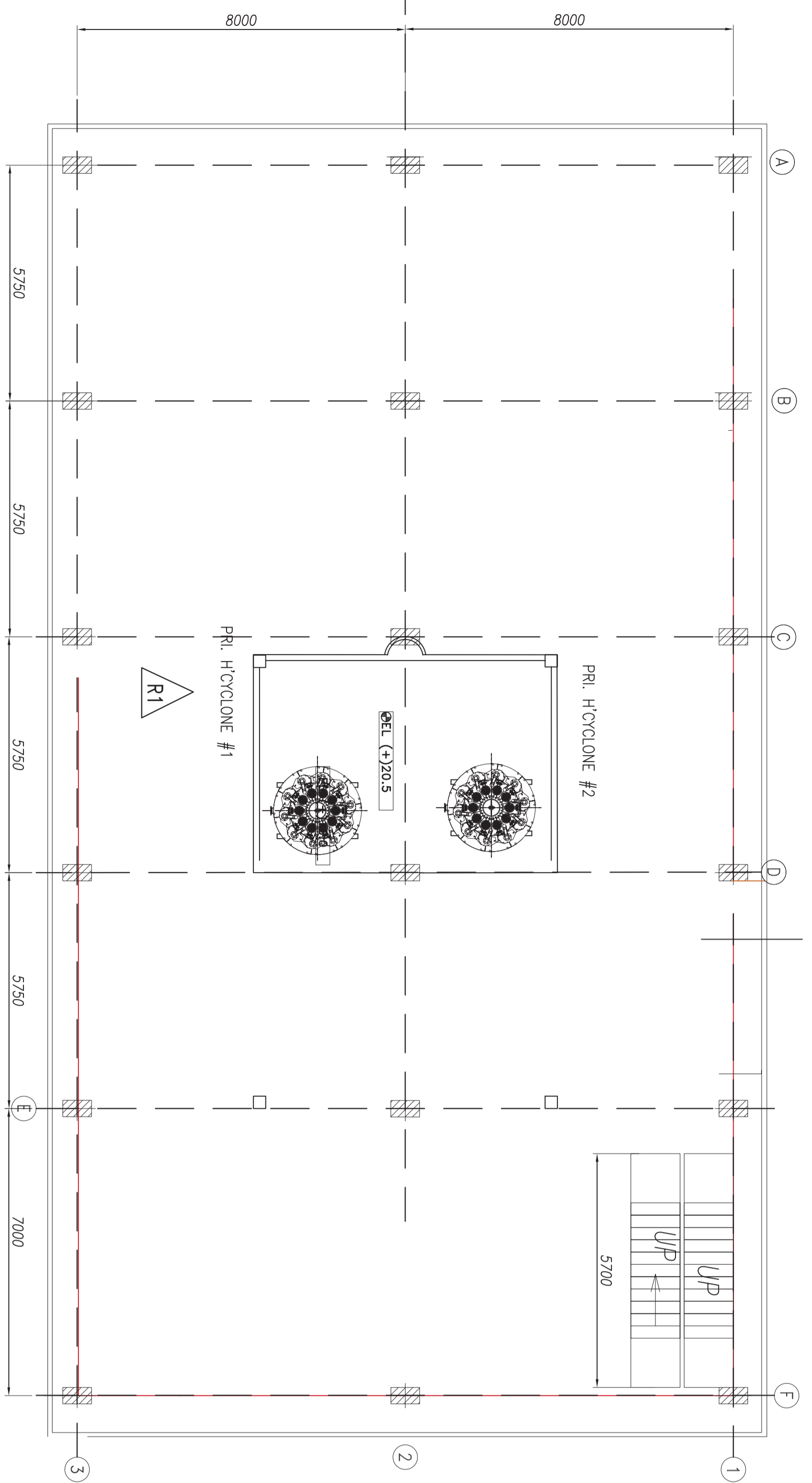
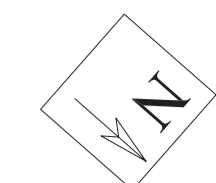


PLAN @ EL(±)0.0000M

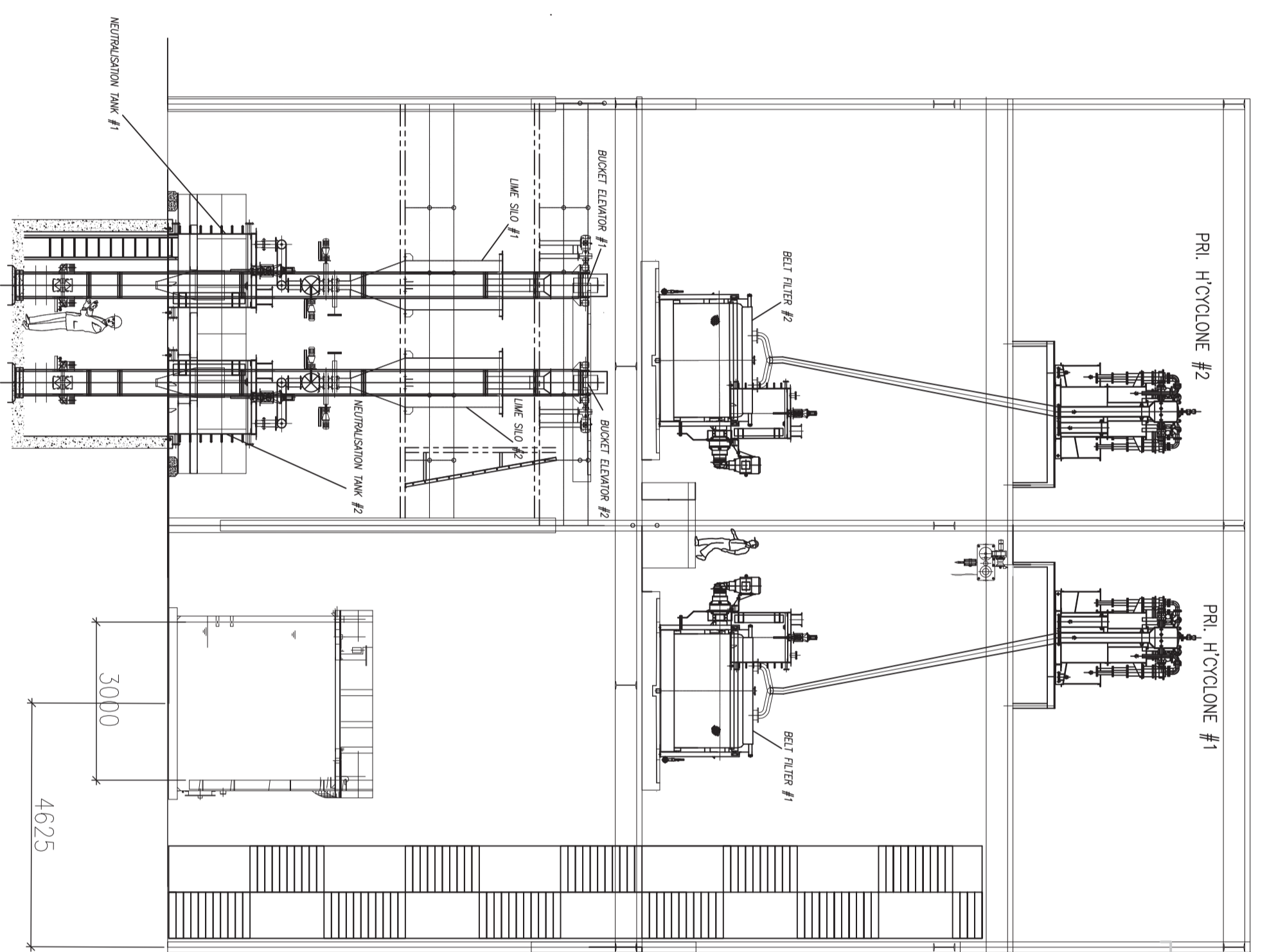


KEY PLAN

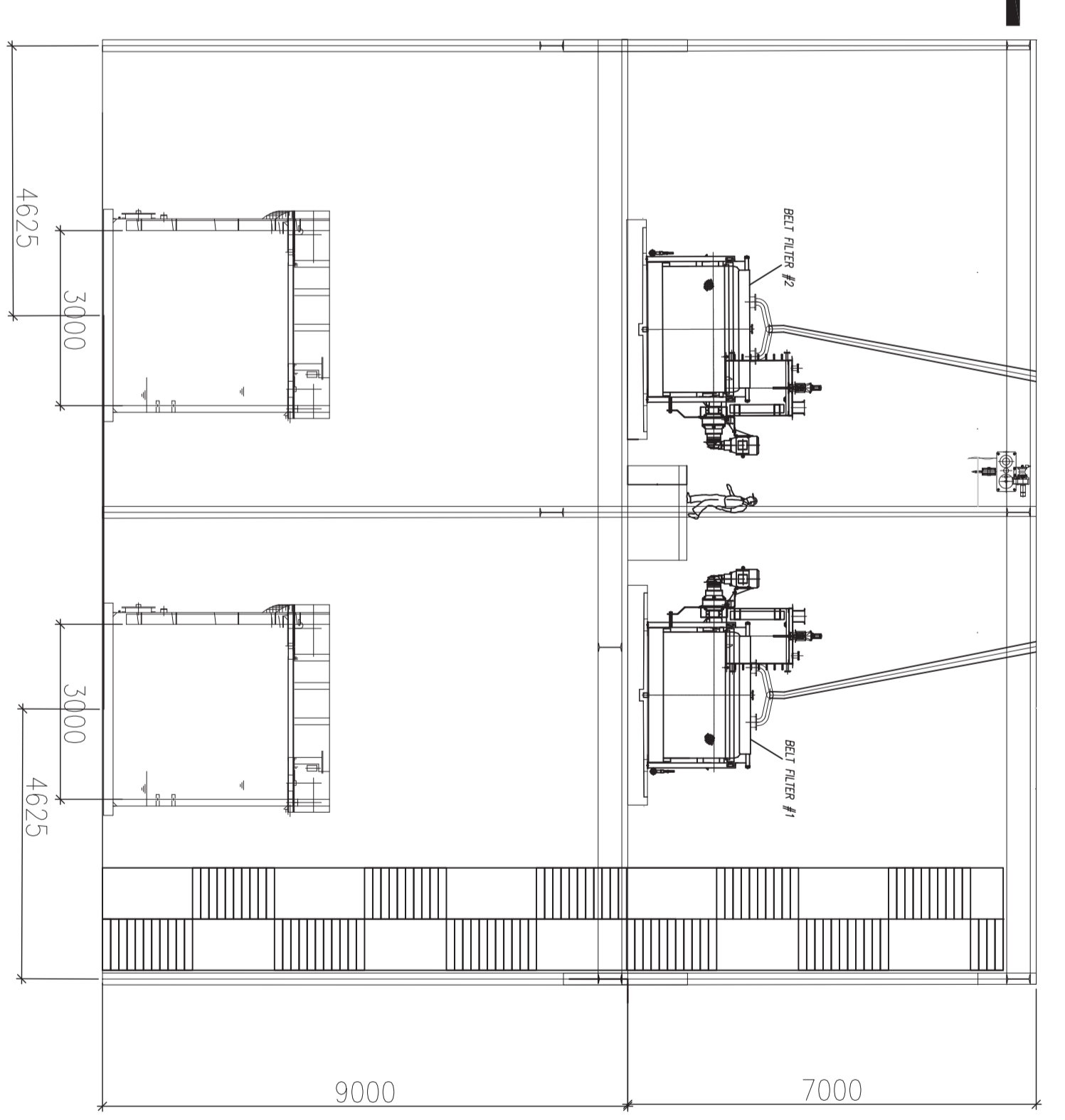
OWNER/PROJECT:		NSPCL BHILAI EXPANSION POWER PROJECT NSPCL BHILAI (2X250MW) - FGD SYSTEM PACKAGE	
PACKAGE VENDOR:		NAME:	SGN
		DATE:	28-11-21
		CHD:	VM
		DATE:	28-11-21
		APPRD:	RR
		DATE:	28-11-21
TITLE:		GA OF GDW BUILDING	
STATUS OF DRG.: FOR APPROVAL		NTPC DWG. NO.: 9993-109-PVM-B-048	
BHEL DWG. NO.:		SHEET NO.:	
PE-DC-468-571-A001		01 OF 02	
REV:		R1	



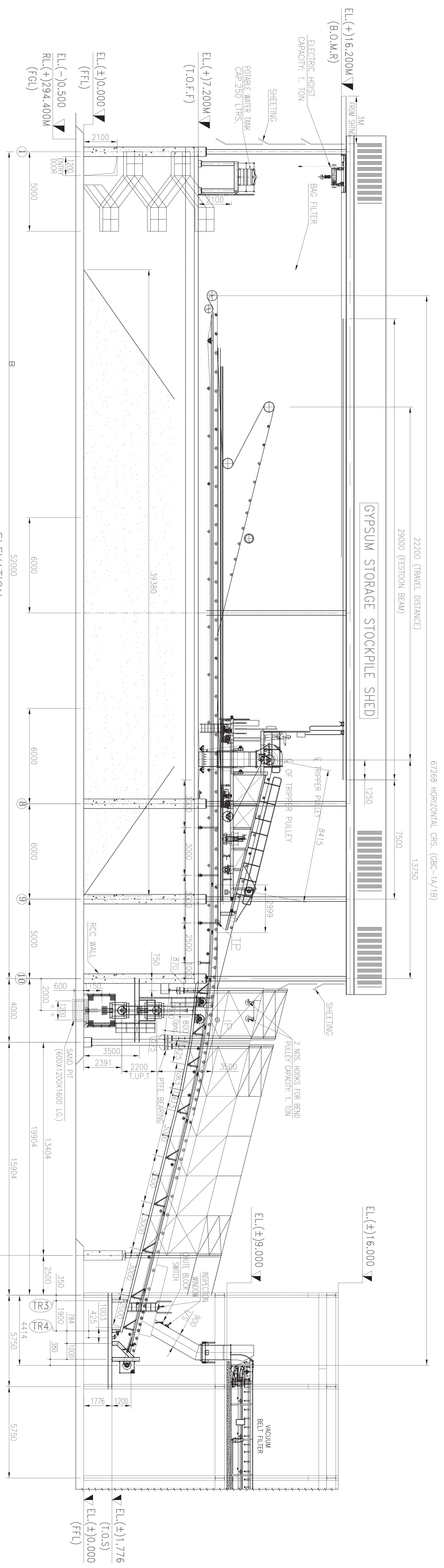
PLAN @ EL (+) 16.00M



SECTION - AA



SECTION - CC



ELEVATION

FOR TYPICAL ARRANGEMENT OF DISCHARGE CHUTE

LIST OF REFERENCE DRAWINGS		
SL. NO	DRAWING NO.	AGENCY
1	9993-109-PWM--F-020	PEM/BAP
2	9993-109-PWM--F-047	PEM/VENDOR
3	9993-109-PWM-B-354	PEM/VENDOR
4	PE-VO-468-167-A003	PEM/VENDOR
5	PE-VO-468-167-A003	PEM/VENDOR
6	PE-VO-468-167-A003	PEM/VENDOR
7	PE-VO-468-167-A003	PEM/VENDOR
8	PE-VO-468-167-A003	PEM/VENDOR
9	PE-VO-468-167-A003	PEM/VENDOR

- Notes:
- All Dimensions are in millimeters and elevations in meters.
 - EL 0.0m corresponds to RL +294.9M
 - This Drawing is tentative considering not-to-exceed loads. Civil drawing shall be prepared accordingly.
 - Gypsum Dewatering System supplier to take of the not to exceed loads of their scope of supply.
 - Seal pit dimension (*) shall be furnished by the bidder.
 - Gypsum Dewatering System Supplier shall confirm the capacity and layout for handling equipments.
 - Details of staircase, suitable doors, windows etc. shall be considered by Civil Designer.
 - Floor openings, pipe crossings shall be finalized during detailed engineering.
 - Building dimensions (building width, length and floor levels) are firm. Floor Plans shown in drawing may slightly vary as per the system requirement and shall be finalized during detail engineering.

OWNER/PROJECT:	NSPCL BHILAI EXPANSION POWER PROJECT		
PACKAGE VENDOR:	NSPCL BHILAI (2X250MW) - FGD SYSTEM PACKAGE		
TITLE:	GA OF GDW BUILDING		
STATUS OF DRG.:	FOR APPROVAL	NTPC DWG. NO.:	9993-109-PWM-B-048
SCALE:	BHEL JOB NO.:	PE-VO-468-571-A001	SHEET NO.:
NTS			02 OF 02
			REV. R1
			DATE
			26-11-21
			26-11-21
			26-11-21

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00 REV 106A-175-894-S-TS-TECHNICAL SPECIFICATION PART 1 SI SHI
 SYMBOLS FOR PIPING PARTS & INSTRUMENT PARTS

THIRD ANGLE PROTECTION	No. REQ'D

DRAWING No. **A3**

SYMBOLS	NAME
	PIPE LINE
	CAPILLARY TUBING
	ELECTRIC SIGNAL
	SOFTWARE LINK
	PRESSURE LEAD
	DUCT

PIPING VALVE SYMBOLS

SYMBOLS	NAME
	GATE VALVE (NOR.CLOSED)
	GLOBE VALVE (NOR.CLOSED)
	BALL VALVE (NOR.CLOSED)
	BUTTERFLY VALVE (NOR.CLOSED)
	DIAPHRAGM VALVE (NOR.CLOSED)
	PINCH VALVE (NOR.CLOSED)
	NEEDLE VALVE (NOR.CLOSED)
	CHECK VALVE
	CHECK VALVE (WATER)
	PRESSURE RELIEF VALVE

INSTRUMENT VALVE SYMBOLS

SYMBOLS	NAME
	ACTUATED BY AIR
	ACTUATED BY MOTOR
	AIR CONTROL VALVE
	SOLENOID ACTUATOR
	SELF REGULATING VALVE
	SELF REGULATING VALVE

TRENCH SYMBOLS

SYMBOLS	NAME
	TO ABSORBER AREA DRAIN SUMP
	TO GYPSUM AREA DRAIN SUMP
	TO LIMESTONE AREA DRAIN SUMP

SYMBOLS FOR VALVE OPERATION

SYMBOLS	NAME
	FAILURE OPEN (THE VALVE OPENS WHEN AIR OR ELECTRICITY FOR ACTUATOR FAILS.)
	FAILURE CLOSE (THE VALVE CLOSES WHEN AIR OR ELECTRICITY FOR ACTUATOR FAILS.)

INSULATION SYMBOLS

SYMBOLS	DESCRIPTION
H10	THERMAL INSULATION (100°C & LOWER)
H15	THERMAL INSULATION (101°C ~ 150°C)
H20	THERMAL INSULATION (151°C ~ 200°C)
H25	THERMAL INSULATION (201°C ~ 250°C)
H30	THERMAL INSULATION (251°C ~ 300°C)
H35	THERMAL INSULATION (301°C ~ 350°C)
H35	THERMAL INSULATION (301°C ~ 350°C)
HF	INSULATION FOR ANTI FREEZING
ET	ELECTRIC TRACE
ST	STEAM TRACE (LOW PRESSURE STEAM)
P10	PERSONAL PROTECTION (100°C & LOWER)
P15	PERSONAL PROTECTION (101°C ~ 150°C)
P20	PERSONAL PROTECTION (151°C ~ 200°C)
P25	PERSONAL PROTECTION (201°C ~ 250°C)
P30	PERSONAL PROTECTION (251°C ~ 300°C)
P35	PERSONAL PROTECTION (301°C ~ 400°C)

DELIVERY LIMITS

SYMBOLS	NAME
	BETWEEN NTPC AND CONTRACTOR
	BETWEEN SUB CONTRACTOR AND VENDOR

SYSTEM

NUMBER	NAME
1	FLUE GAS SYSTEM
2	SO ₂ ABSORPTION OXIDATION SYSTEM
3	REHEATING SYSTEM
4	GYPSUM DEWATERING HANDLING SYSTEM
5	LIMESTONE PREPARATION SYSTEM
6	BLANK
7	SUMP SYSTEM
8	UTILITY SYSTEM

FLUID NAME

FLUID SYMBOL	FLUID NAME	FLUID SYMBOL	FLUID NAME
AC	COMPRESSED AIR	WCS	COOLING WATER SUPPLY
AF	FLUIDIZER AIR	WCR	COOLING WATER RETURN
AI	INSTRUMENT AIR	WD	DRINKING WATER
AO	OXIDATION AIR	WP	PROCESS WATER
AS	SEAL AIR	WR	RAW WATER
DD	DUCT DRAIN	WW	WASTE WATER
FS	FILTRATE SLURRY	WC	Ca(OH) ₂ WATER
GS	GYPSUM SLURRY	VG	VACUUM PUMP VENT
LS	LIMESTONE SLURRY	VBG	BELT FILTER VENT GAS
		LD	LIME/LIMESTONE DEDUSTING
		LOL	LUBE OIL (LOW PRESSURE)
		LOH	LUBE OIL (HIGH PRESSURE)
		CW	CLARIFIED WATER

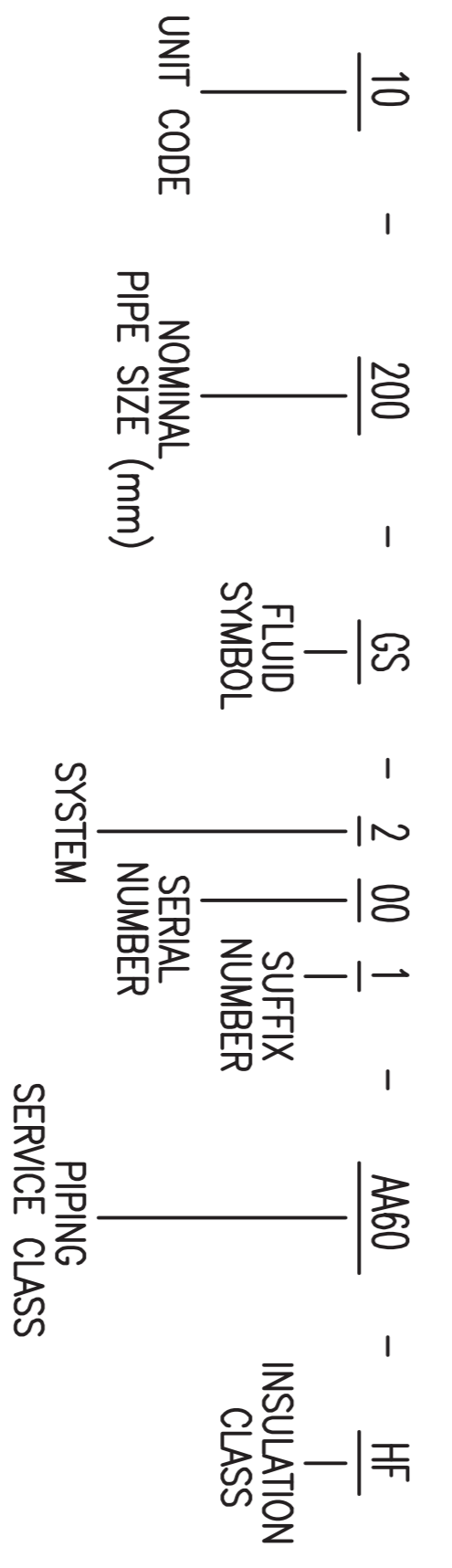
SERVICE CLASS

SERVICE CLASS	MATERIAL	FLUID SYMBOL
AA40	HR RUBBER LINED PIPING	LS, WP, WC
AA60	HR RUBBER LINED PIPING	GS, FS, WW, DD
BA01	Gr.304 STAINLESS STEEL PIPING	A, LOL
BA02	Gr.304 STAINLESS STEEL PIPING	LOH
BA03	Gr.316L STAINLESS STEEL PIPING	WP, AO
CA01	CARBON STEEL GENERAL PIPING	ASA, AO, AC, AF, LD
CC01	CARBON STEEL PRESSURE PIPING	WP, WR, WCS, WCR, VG, AA, CW
DA60	FRP PIPING (PIPE DIA UPTO 250 NB)	GS, FS, WW, DD
DA40	FRP PIPING (PIPE DIA UPTO 250 NB)	LS, WP, WC

UNIT CODE

SYMBOLS	UNIT IDENTIFICATION
00	COMMON
10	UNIT-1 FGD SYSTEM AND AUXILIARIES
20	UNIT-2 FGD SYSTEM AND AUXILIARIES

EXPRESSION OF PIPING LINE



CUSTOMER NOS: G211 & G212

CUSTOMER: NTPC LIMITED.
 PROJECT: BHILAI (2X250MW)
 FGD SYSTEM PACKAGE

BHARAT HEAVY ELECTRICALS LIMITED.
 UNIT: BOILER AUXILIARIES PLANT,
 RAIPUR-832 406.

DEPT	NAME (BHEL)	DATE
CODE/DRN	VIDYALY	19.08.20
CHD	KABLAISH K	19.08.20
APPD	P.NAVIEN	19.08.20

MITSUBISHI HITACHI POWER SYSTEMS, LTD.
 AIR QUALITY CONTROL SYSTEMS TECHNOLOGY DIVISION

P & ID - LEGENDS AND NOTES

NTPC DRG NO: ----

SH 01 of 02

SCALE: NTS

BHEL DRG NO: B240 - 00100

REV NO: 02

CAUTION: THE DRAWING IS THE PROPERTY OF BHARAT HEAVY ELECTRICALS LTD., AND IS NOT TO BE REPRODUCED OR USED TO FURNISH ANY INFORMATION FOR MAKING OF DRAWINGS OF APPARATUS EXCEPT WHERE PROVIDED FOR AGREEMENT WITH SAID COMPANY.

0 1 2 3 4 5 6 7 8 9 10

DRIVER SYMBOLS

SYMBOLS	NAME
	AIR MOTOR
	ELECTRIC MOTOR

OTHER SYMBOLS

SYMBOLS	NAME
	INSERT PIPE / LANCE
	CHUTE
	TRUCK

EQUIPMENT SYMBOLS

SYMBOLS	NAME
	BAG FILTER
	SILO
	SLIDE GATE
	TANDEM LOUVER DAMPER (MULTIVANE)
	SINGLE STAGE LOUVER DAMPER (MULTIVANE)
	LOUVER DAMPER (SINGLE VANE)
	DISTRIBUTION BOX (3WAY)
	DISTRIBUTION BOX (2WAY)
	SUMP
	HEAT EXCHANGER
	SHELL AND TUBE HEAT EXCHANGER
	AIR DRYER
	FILTER
	SPRAY NOZZLE

MACHINERY SYMBOLS

SYMBOLS	NAME
	PUMP
	FAN / BLOWER
	AGITATOR (FLAT BLADE)
	AGITATOR (PROPELLOR)
	ROTARY VALVE
	CRUSHER
	BELT FEEDER
	BELT FILTER
	BALL MILL
	CYCLONE
	MIST ELIMINATOR

INSTRUMENT ABBREVIATION

FIRST-LETTER	MODIFIER	READOUT OR PASSIVE FUNCTION	OUTPUT FUNCTION	MODIFIER
A ANALYSIS		ALARM	BLANK	BLANK
B BURNER, COMBUSTION		BLANK	BLANK	BLANK
C BLANK	DIFFERENTIAL		CONTROL	
D BLANK		SENSOR (PRIMARY ELEMENT)		
E VOLTAGE				
F FLOW RATE	RATIO (FRACTION)			
G BLANK		GLASS, VIEWING DEVICE		
H HAND				HIGH
I CURRENT (ELECTRICAL)		INDICATE		
J POWER	SCAN			
K TIME, TIME SCHEDULE	TIME RATE OF CHANGE		CONTROL STATION	
L LEVEL		LIGHT		LOW
M BLANK	MOMENTARY			MIDDLE, INTERMEDIATE
N BLANK		BLANK	BLANK	BLANK
O BLANK		ORIFICE, RESTRICTION		
P PRESSURE, VACUUM		POINT(TEST) CONNECTION		
Q QUANTITY	INTEGRATE, TOTALIZE			
R RADIATION		RECORD		
S SPEED, FREQUENCY	SAFETY		SWITCH	
T TEMPERATURE			TRANSMIT	
U UNVARIABLE		MULTIFUNCTION	MULTIFUNCTION	MULTIFUNCTION
V VIBRATION, MECHANICAL ANALYSIS			VALVE, DAMPER, LOUVER	
W WEIGHT, FORCE		WELL		
X UNCLASSIFIED	X AXIS	UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED
Y EVENT, STATE OR PRESENCE	Y AXIS		RELAY, COMPUTE, CONVERT	
Z POSITION, DIMENSION	Z AXIS		DRIVER, ACTUATOR, UNCLASSIFIED FINAL CONTROL ELEMENT	

INSTRUMENT SYMBOLS

SYMBOLS	NAME
	FIELD MOUNTED
	FOR CONTROL ROOM
	FOR LOCAL CONTROL PANEL
	FOR DCS
	INTERLOCK LOGIC

PNEUMATIC VALVE ACTUATOR

CODE NO.	ACTUATION
FLXXMA-D	DOUBLE SOLENOID NO LIMIT SWITCH
FLXXMA-DL	DOUBLE SOLENOID WITH LIMIT SWITCH
FLXXMA-S	SINGLE SOLENOID NO LIMIT SWITCH
FLXXMA-SL	SINGLE SOLENOID WITH LIMIT SWITCH

CONFIDENTIAL & PROPRIETARY INFORMATION

CUSTOMER NOS: G211 & G212

CUSTOMER: NTPC LIMITED.
PROJECT: BHILAI (2X250MW)
FGD SYSTEM PACKAGE

DEPT	NAME (GHEU)	DATE
CODE/DRN	VIDYA V	02.04.20
CHD	KABILASH K	02.04.20
APPD	P.NAVEEN	02.04.20

MITSUBISHI HITACHI POWER SYSTEMS, LTD.
AIR QUALITY CONTROL SYSTEMS TECHNOLOGY DIVISION

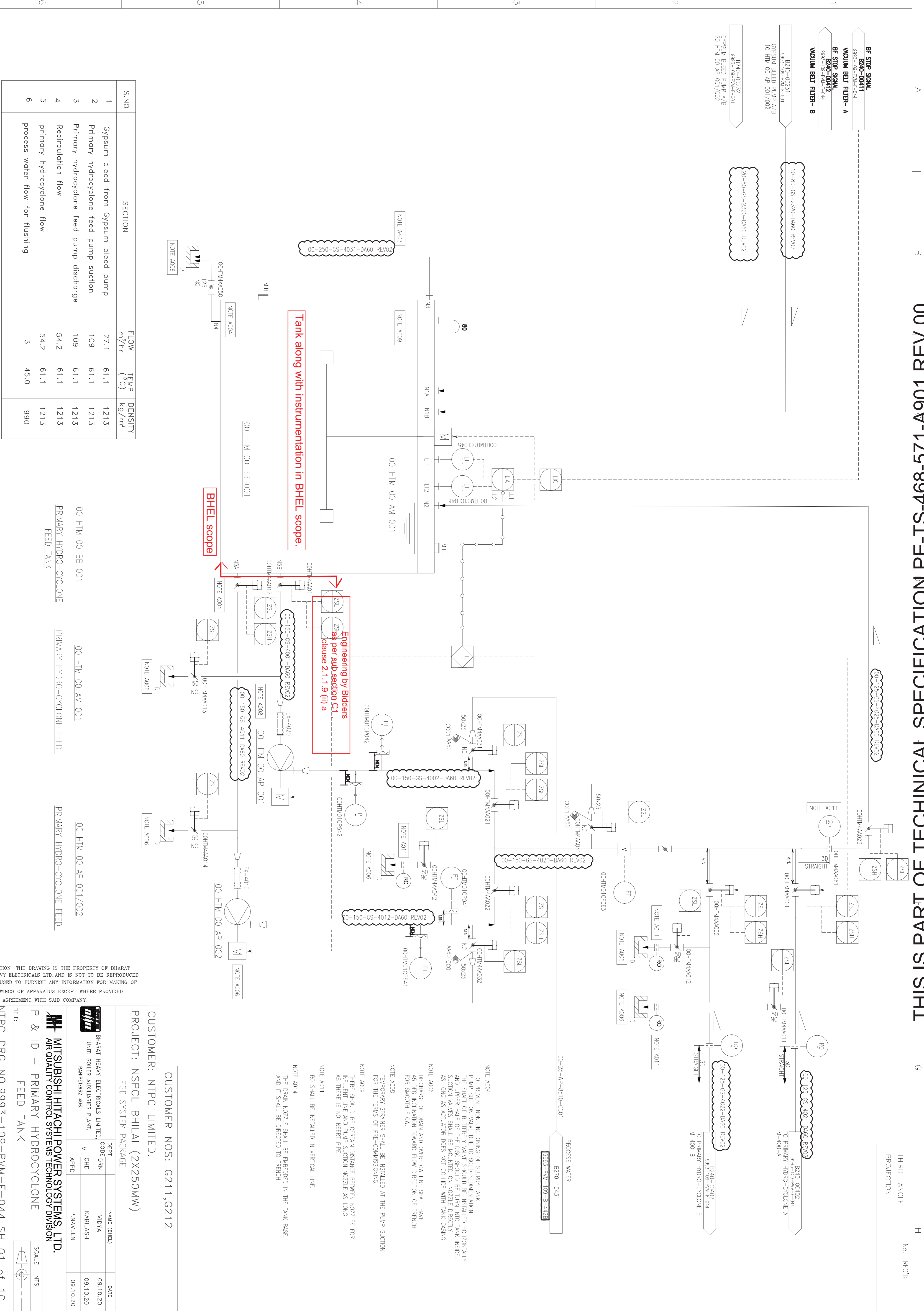
P & ID - LEGENDS AND NOTES

NTPC DRG NO: ---- SH 02 of 02

FILE NO: B240 - 00100 REV NO: 00

CAUTION: THE DRAWING IS THE PROPERTY OF BHARAT HEAVY ELECTRICALS LTD. AND IS NOT TO BE REPRODUCED OR USED TO FURNISH ANY INFORMATION FOR MAKING OF DRAWINGS OF APPARATUS EXCEPT WHERE PROVIDED FOR AGREEMENT WITH SAID COMPANY.

THIS IS PART OF TECHNICAL SPECIFICATION PE-TS-468-571-A901 REV 00.



S.NO	SECTION	FLOW m ³ /hr	TEMP (°C)	DENSITY kg/m ³
1	Gypsum bleed from Gypsum bleed pump	27.1	61.1	1213
2	Primary hydro-cyclone feed pump suction	109	61.1	1213
3	Primary hydro-cyclone feed pump discharge	109	61.1	1213
4	Recirculation flow	54.2	61.1	1213
5	primary hydro-cyclone flow	54.2	61.1	1213
6	process water flow for flushing	3	45.0	990

00 HTM 00 BB 001
PRIMARY HYDRO-CYCLONE FEED TANK

00 HTM 00 AM 001
PRIMARY HYDRO-CYCLONE FEED

00 HTM 00 AP 001/002
PRIMARY HYDRO-CYCLONE FEED

0 1 2 3 4 5 6 7 8 9 10

CAUTION: THE DRAWING IS THE PROPERTY OF BHARAT HEAVY ELECTRICALS LTD. AND IS NOT TO BE REPRODUCED OR USED TO FURNISH ANY INFORMATION FOR MAKING OF DRAWINGS OF APPARATUS EXCEPT WHERE PROVIDED FOR AGREEMENT WITH SAID COMPANY.

CUSTOMER: NTPC LIMITED.
PROJECT: NSPCL BHILAI (2X250MW)
FGD SYSTEM PACKAGE

CUSTOMER NOS: G211,G212

DEPT	NAME (BHEL)	DATE
CODE/DEN	VIDYA	09.10.20
M	KABIRASH	09.10.20
APPD	P.NAVEEN	09.10.20

MITSUBISHI HITACHI POWER SYSTEMS, LTD.
AIR QUALITY CONTROL SYSTEMS TECHNOLOGY DIVISION

P & ID - PRIMARY HYDROCYCLONE FEED TANK

SCALE : NTS

NTPC DRG NO.9993-109-PVM-F-044 SH 01 of 10

BHEL DRG NO 3-FW-000-02069 FILE NO B240-00401 REV NO 03

- NOTE A004
TO PREVENT NONFUNCTIONING OF SLURRY TANK PUMP SUCTION VALVE DUE TO SOLID SEDIMENTATION, AND UPPER HALF OF THE DISC SHOULD BE TURN INTO TANK INSIDE. AS LONG AS ACTUATOR DOES NOT COLLIDE WITH TANK CASING.
- NOTE A006
DISCHARGE OF DRAIN AND OVERFLOW LINE SHALL HAVE 45 DEG INCLINATION TOWARD FLOW DIRECTION OF TRENCH FOR SMOOTH FLOW.
- NOTE A008
TEMPORARY STRAINER SHALL BE INSTALLED AT THE PUMP SUCTION FOR THE TERMS OF PRE-COMMISSIONING.
- NOTE A009
THERE SHOULD BE CERTAIN DISTANCE BETWEEN NOZZLES FOR TRENCH LINE AND PUMP SUCTION NOZZLE AS LONG AS THERE IS NO INSERT PIPE.
- NOTE A011
RO SHALL BE INSTALLED IN VERTICAL LINE.
- NOTE A014
THE DRAIN NOZZLE SHALL BE EMBEDDED IN THE TANK BASE. AND IT SHALL BE DIRECTED TO TRENCH

THIRD ANGLE PROJECTION

No. REQ'D

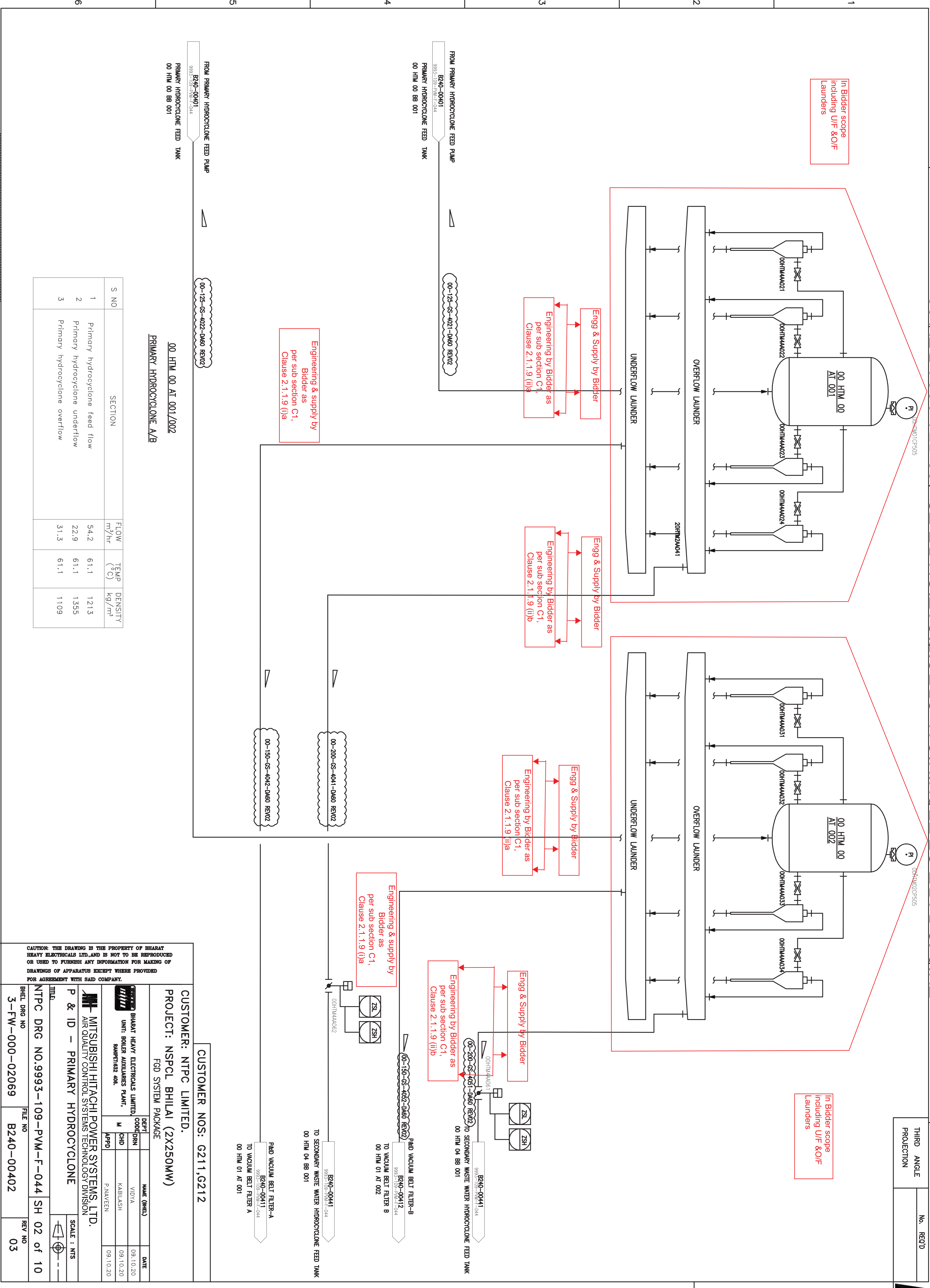
DRAWING No. **A3**

THIS IS PART OF TECHNICAL SPECIFICATION PE-TS-468-571-A-109A-REV 00.

THIRD ANGLE PROJECTION	No. REQ'D
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A3

DRAWING No.



Engg & supply by Bidder as per sub section C1, Clause 2.1.1.9 (I)a

Engg & Supply by Bidder
Engg & Supply by Bidder as per sub section C1, Clause 2.1.1.9 (II)a

Engg & Supply by Bidder
Engg & Supply by Bidder as per sub section C1, Clause 2.1.1.9 (II)b

Engg & Supply by Bidder
Engg & Supply by Bidder as per sub section C1, Clause 2.1.1.9 (II)a

Engg & Supply by Bidder
Engg & Supply by Bidder as per sub section C1, Clause 2.1.1.9 (II)b

Engg & supply by Bidder as per sub section C1, Clause 2.1.1.9 (I)a

In Bidder scope including U/F & O/F Launders

FROM PRIMARY HYDROCYCLONE FEED PUMP
B240-00401
9993-109-PVM-F-044
PRIMARY HYDROCYCLONE FEED TANK
00 HTM 00 BB 001

FROM PRIMARY HYDROCYCLONE FEED PUMP
B240-00401
9993-109-PVM-F-044
PRIMARY HYDROCYCLONE FEED TANK
00 HTM 00 BB 001

00-125-GS-402-D460 REV02

00-125-GS-402-D460 REV02

00-130-GS-402-D460 REV02

00-200-GS-404-D460 REV02

00-130-GS-402-D460 REV02

00-200-GS-404-D460 REV02

P400 VACUUM BELT FILTER-A
B240-00411
9993-109-PVM-F-044
TO VACUUM BELT FILTER A
00 HTM 01 AT 001

P400 VACUUM BELT FILTER-B
B240-00412
9993-109-PVM-F-044
TO VACUUM BELT FILTER B
00 HTM 01 AT 002

B240-00441
9993-109-PVM-F-044
TO SECONDARY WASTE WATER HYDROCYCLONE FEED TANK
00 HTM 04 BB 001

B240-00441
9993-109-PVM-F-044
TO SECONDARY WASTE WATER HYDROCYCLONE FEED TANK
00 HTM 04 BB 001

00 HTM 00 AT 001/002
PRIMARY HYDROCYCLONE A/B

S NO	SECTION	FLOW m ³ /hr	TEMP (°C)	DENSITY kg/m ³
1	Primary hydrocyclone feed flow	54.2	61.1	1213
2	Primary hydrocyclone underflow	22.9	61.1	1355
3	Primary hydrocyclone overflow	31.3	61.1	1109

CAUTION: THE DRAWING IS THE PROPERTY OF BHARAT HEAVY ELECTRICALS LTD. AND IS NOT TO BE REPRODUCED OR USED TO FURNISH ANY INFORMATION FOR MAKING OF DRAWINGS OF APPARATUS EXCEPT WHERE PROVIDED FOR AGREEMENT WITH SAID COMPANY.

CUSTOMER: NTPC LIMITED.
PROJECT: NSPCL BHILAI (2X250MW)
 FGD SYSTEM PACKAGE

CUSTOMER NOS: G211,G212

DEPT	NAME (GHEB)	DATE
CODE/DIR	VIDYA	09.10.20
CHD	KABILASH	09.10.20
APPD	P.NAVEEN	09.10.20

MITSUBISHI HITACHI POWER SYSTEMS, LTD.
 AIR QUALITY CONTROL SYSTEMS TECHNOLOGY DIVISION

P & ID - PRIMARY HYDROCYCLONE

SCALE : NTS

NTPC DRG NO.9993-109-PVM-F-044 SH 02 of 10

BHEL DRG NO 3-FW-000-02069 FILE NO B240-00402 REV NO 03



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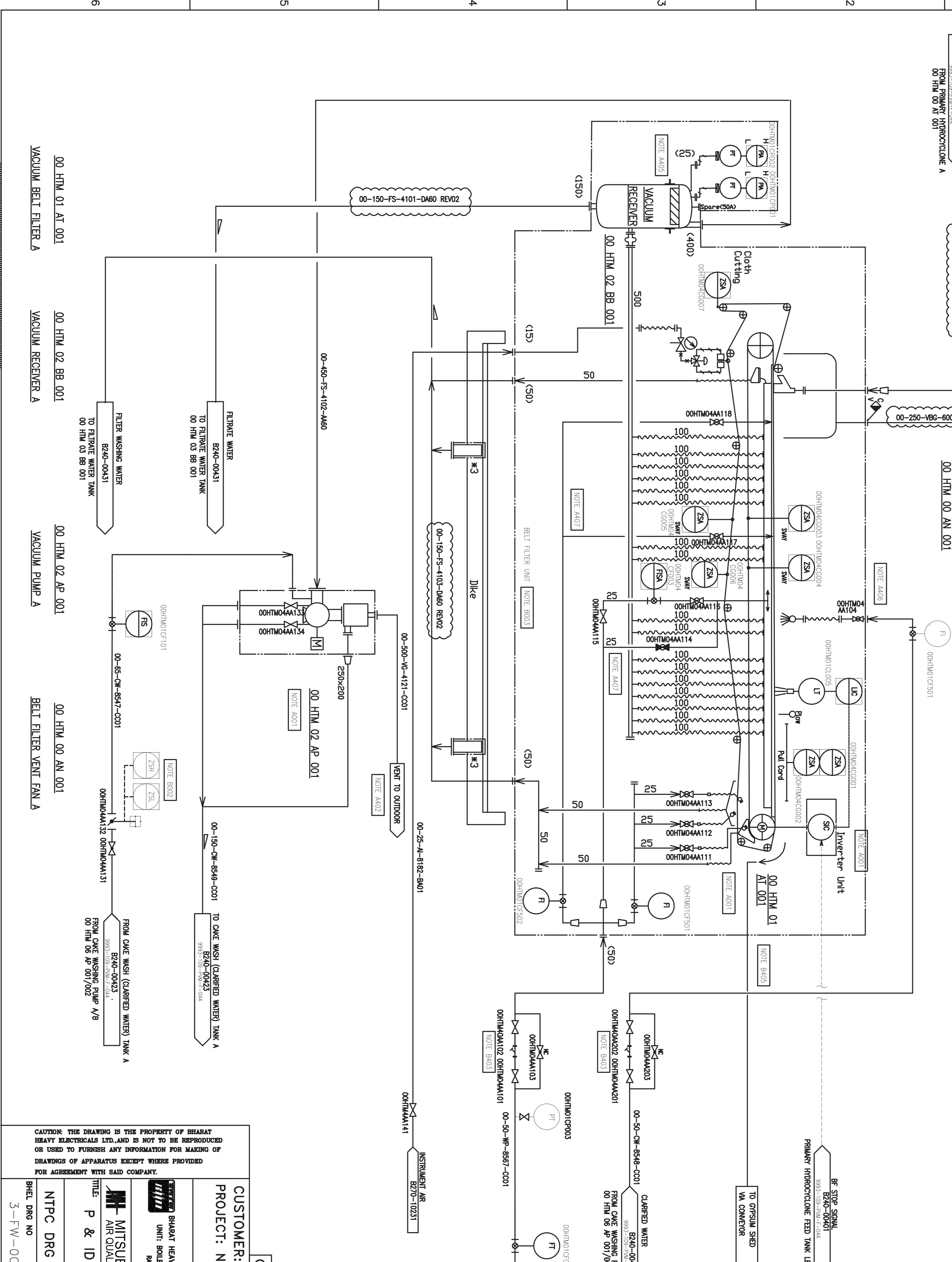
A

B

C

H

S NO	SECTION	FLOW m ³ /hr	TEMP(C)	DENSITY kg/m ³
1	Gypsum slurry line to belt filler	22.9	61.1	1355
2	Gypsum outlet from belt filler to gypsum handling system	15.4	55.6	900
3	Filtrate water from vacuum receiver to filtrate water tank	10.6	54.3	998
4	Vacuum pump flow	LATER	LATER	LATER
5	Seal water to vacuum pump	11.4	45.0	990
6	Seal water return	11.4	45.0	990



NOTE B003
SYSTEM COMPONENTS WRITTEN IN THE DRAWING ARE JUST DEFAULT TYPE WILL BE SUBJECT TO CHANGE DUE TO VENDOR SELECTION.

NOTE A02
BRD SCREEN SHALL BE INSTALLED.

NOTE A05
NOZZLE OF PRESSURE INDICATOR SHALL NOT HAVE A POCKET. IT MAY CAUSE REMAIN OF DRAIN.

NOTE A06
CAKE WASH PIPING SHALL BE MOVABLE SO THAT ITS POSITION CAN BE ADJUSTED WELL DURING COMMISSIONING.

NOTE A07
WASH, SEAL AND LUBRICATION WATER PIPING SHALL BE DESIGNED TO DISTRIBUTE WATER EQUALLY (EX. TO CONNECT SUPPLY LINE TO MIDDLE OF HEADERS).

NOTE B403
STRAINER CAN BE OMITTED IF ANOTHER ONE IS APPLIED UPSTREAM. NOTE B405
GYPSUM CHUTE SHALL BE DESIGNED VERTICALLY, NOT OBLOUQUELY.

NOTE :
PIPE SIZE ARE TENATIVE.
PIPE SIZE WILL BE CONFIRMED AFTER VENDOR FINALISATION.

Complete system in Bidder Scope EXCEPT:

1. Piping with accessories from filtrate extraction pump to filtrate water tank. Refer scheme No. PE-FEP-00.
2. Associated drain of Vacuum Belt Filter (drip tray) to filtrate tanks.

Refer sub section C1, clause 2.1.1.9 (ii) f of the specification.

CUSTOMER NOS: G211,G212

CUSTOMER: NTPC LIMITED.
PROJECT: NSPCL BHILAI (2X250MW)
FGD SYSTEM PACKAGE

DEPT	NAME (GHEB)	DATE
CODE/DEN	VIDYA	09.10.20
CHD	KABULASH	09.10.20
APPD	P.MANVEN	09.10.20

UNIT: BOILER AUXILIARIES PLANT, RANIPET-532 405.

MITSUBISHI HITACHI POWER SYSTEMS, LTD.
AIR QUALITY CONTROL SYSTEMS TECHNOLOGY DIVISION

P & ID - VACUUM BELT FILTER - A

SCALE : NTS

FILE NO	REV NO
BHEL DRG NO 3-FW-000-02069	B240-00411
NTPC DRG NO.9993-109-PVM-F-044	SH 05 of 10

CAUTION: THE DRAWING IS THE PROPERTY OF BHARAT HEAVY ELECTRICALS LTD. AND IS NOT TO BE REPRODUCED OR USED TO FURNISH ANY INFORMATION FOR MAKING OF DRAWINGS OF APPARATUS EXCEPT WHERE PROVIDED FOR AGREEMENT WITH SAID COMPANY.



Same as that of Belt Filter - A

S NO	SECTION	FLOW m ³ /hr	TEMP(C)	DENSITY kg/m ³
1	Gypsum slurry line to belt filter	22.9	61.1	1355
2	Gypsum outlet from belt filter to gypsum handling system	15.4	55.6	900
3	Filtrate water from vacuum filter to filtrate water tank	10.6	54.3	998
4	Vacuum pump flow	LATER	LATER	LATER
5	Seal water to vacuum pump	11.4	45.0	990
6	Seal water return	11.4	45.0	990

NOTE B003
SYSTEM COMPONENTS WRITTEN IN THE DRAWING ARE JUST DEFAULT. THE WILL BE SUBJECT TO CHANGE DUE TO VENDOR SELECTION.

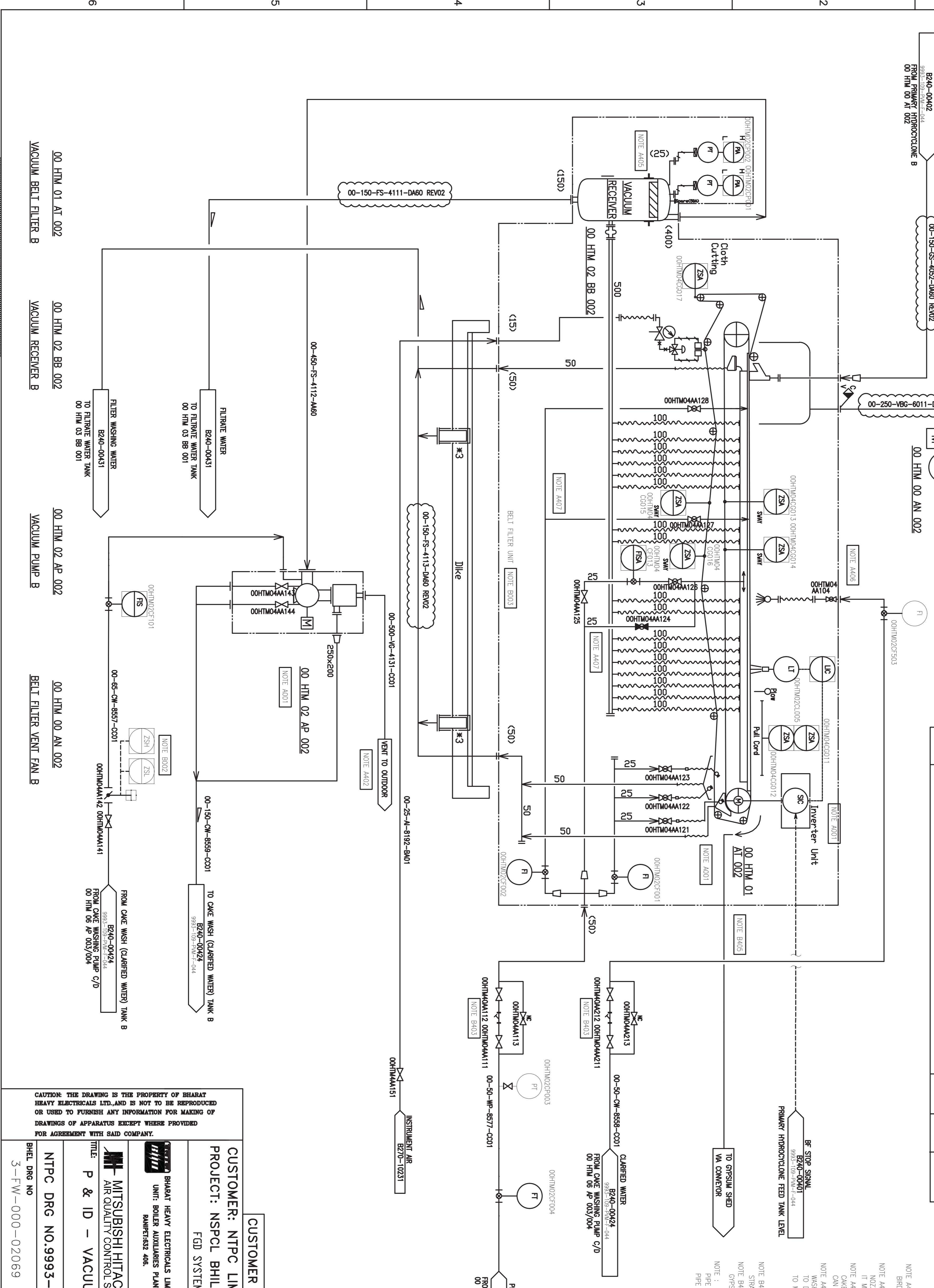
NOTE A402
BFO SCREEN SHALL BE INSTALLED.

NOTE A405
NOZZLE OF PRESSURE INDICATOR SHALL NOT HAVE A ROCKET. IF MAY CAUSE REMAIN OF DRAIN.

NOTE A406
CAKE WASH PIPING SHALL BE MOVABLE SO THAT ITS POSITION CAN BE ADJUSTED WELL DURING COMMISSIONING.

NOTE A407
WASH SEAL AND LUBRICATION WATER PIPING SHALL BE DESIGNED TO DISTRIBUTE WATER EQUALLY EX. TO CONNECT SUPPLY LINE TO MIDDLE OF HEADERS.

NOTE B403
STRAINER CAN BE OMITTED IF ANOTHER ONE IS APPLIED UPSTREAM.
NOTE B405
GYPSUM CHUTE SHALL BE DESIGNED VERTICALLY, NOT OBLIQUELY.
NOTE :
PIPE SIZE ARE TENTATIVE.
PIPE SIZE WILL BE CONFIRMED AFTER VENDOR FINALISATION.



CAUTION: THE DRAWING IS THE PROPERTY OF BHARAT HEAVY ELECTRICALS LTD., AND IS NOT TO BE REPRODUCED OR USED TO FURNISH ANY INFORMATION FOR MAKING OF DRAWINGS OF APPARATUS EXCEPT WHERE PROVIDED FOR AGREEMENT WITH SAID COMPANY.

CUSTOMER: NTPC LIMITED.
PROJECT: NSPCL BHILAI (2X250MW)
FGD SYSTEM PACKAGE

CUSTOMER NOS: G211,G212

DEPT	NAME (CHIEF)	DATE
CODE/DRN	VIDYA	09.10.20
CHD	KABULASH	09.10.20
APPD	PANWARI	09.10.20

MITSUBISHI HITACHI POWER SYSTEMS, LTD.
AIR QUALITY CONTROL SYSTEMS TECHNOLOGY DIVISION

TITLE: P & ID - VACUUM BELT FILTER - B
SCALE : NTS

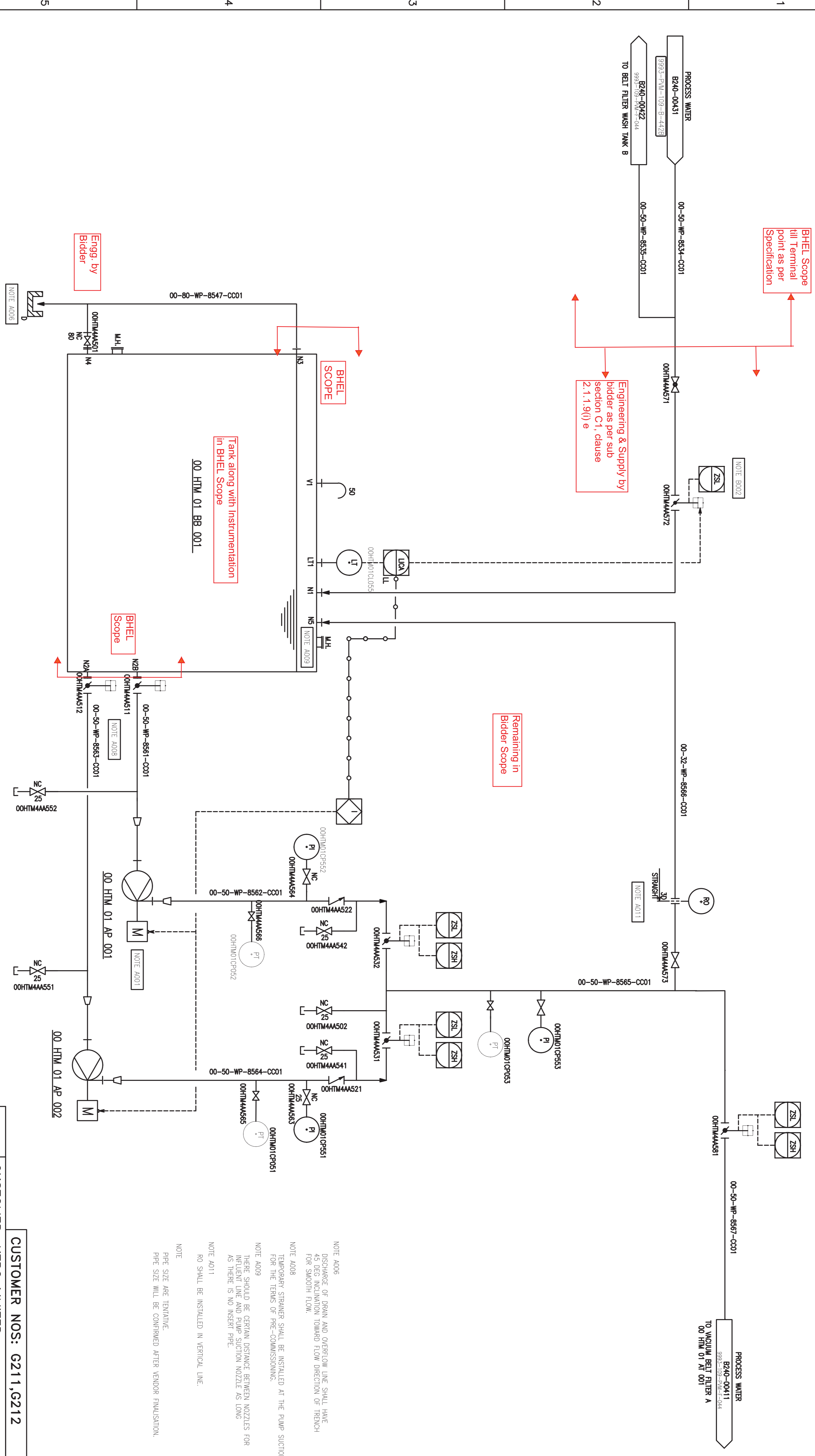
NTPC DRG NO. 9993-109-PVM-F-044
SH 06 of 10

BHEL DRG NO. 3-FW-000-02069
FILE NO. B240-00412
REV NO. 03

THIRD ANGLE PROJECTION	No. REQ'D
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A3

DRAWING No.



S NO	SECTION	FLOW m ³ /hr	TEMP(C)	DENSITY Kg/m ³
1	Process water to belt filter wash tank	5.72	45.0	990
2	At the suction of belt filter wash pump	8.0	45.0	990
3	At the discharge of belt filter wash pump	8.0	45.0	990
4	Wash water to belt filter	5.72	45.0	990

00 HTM 01 BB 001
BELT FILTER WASH TANK A

00 HTM 01 AP 001/002
BELT FILTER WASHING PUMP A/B

CUSTOMER NOS: G211,G212

CUSTOMER: NTPC LIMITED.
PROJECT: NSPCL BHILAI (2X250MW)
FCD SYSTEM PACKAGE

DEPT	NAME (CHIEF)	DATE
CHD	VINDYA	09.10.20
APPD	KABIRLASH	09.10.20
	P.NAVEEN	09.10.20

SCALE : NTS

NTPC DRG NO.9993-109-PVM-F-044 SH 07 of 10

BHEL DRG NO 3-FW-000-02069 FILE NO B240-00421 REV NO 03

CAUTION: THE DRAWING IS THE PROPERTY OF BHARAT HEAVY ELECTRICALS LTD. AND IS NOT TO BE REPRODUCED OR USED TO FURNISH ANY INFORMATION FOR MAKING OF DRAWINGS OF APPARATUS EXCEPT WHERE PROVIDED FOR AGREEMENT WITH SAID COMPANY.

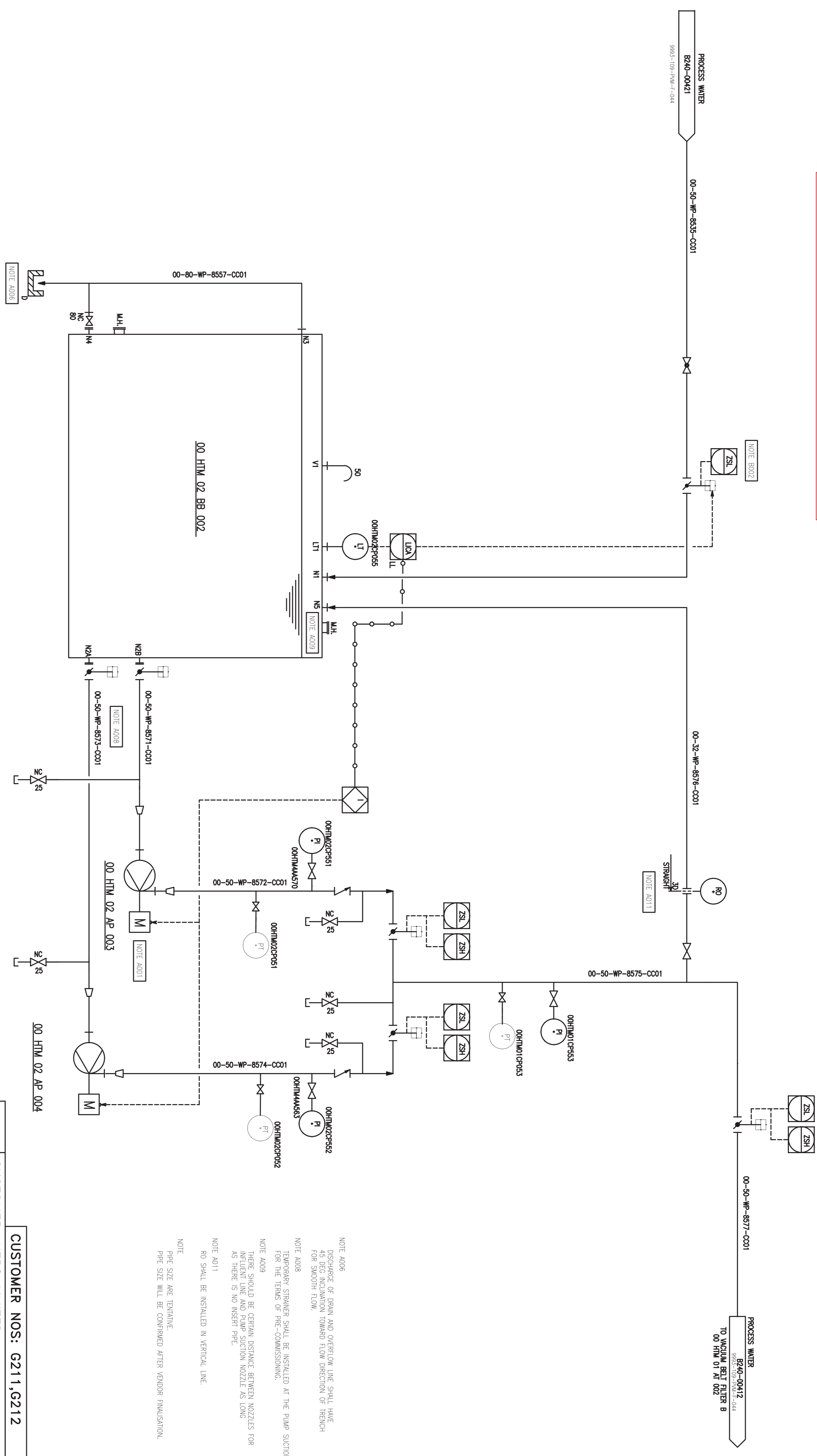


THIRD ANGLE PROJECTION	No. REQ'D
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A3

DRAWING No.

Same Scope as that of Belt Filter Wash Tank- A



S NO	SECTION	FLOW m ³ /hr	TEMP(°C)	DENSITY kg/m ³
1	Process water to belt filter wash tank	5.72	45.0	990
2	At the suction of belt filter wash pump	8.0	45.0	990
3	At the discharge of belt filter wash pump	8.0	45.0	990
4	Wash water to belt filter	5.72	45.0	990

00 HTM 02 BB 002
BELT FILTER WASH TANK B

00 HTM 02 AP 003/004
BELT FILTER WASHING PUMP C/D

- NOTE A006
DISCHARGE OF DRAIN AND OVERFLOW LINE SHALL HAVE 45 DEG INCLINATION TOWARD FLOW DIRECTION OF RENCH FOR SMOOTH FLOW.
- NOTE A008
TEMPORARY STRAINER SHALL BE INSTALLED AT THE PUMP SUCTION FOR THE TERMS OF PRE-COMMISSIONING.
- NOTE A009
THERE SHOULD BE CERTAIN DISTANCE BETWEEN NOZZLES FOR INFLUENT LINE AND PUMP SUCTION NOZZLE AS LONG AS THERE IS NO INSERT PIPE.
- NOTE A011
RO SHALL BE INSTALLED IN VERTICAL LINE.
- NOTE
PIPE SIZE ARE TENTATIVE.
PIPE SIZE WILL BE CONFIRMED AFTER FINALISATION.

CUSTOMER NOS: G211,G212

CUSTOMER: NTPC LIMITED.
PROJECT: NSPL BHILAI (2X250MW)
FGD SYSTEM PACKAGE

DEPT	NAME (HRSD)	DATE
ENGR	VIDYA	09.10.20
CHD	KABILASH	09.10.20
APPD	P.NAVEEN	09.10.20

MITSUBISHI HITACHI POWER SYSTEMS LTD.
AIR QUALITY CONTROL SYSTEMS TECHNOLOGY DIVISION

P & ID - VACUUM BELT FILTER (BELT FILTER WASH TANK B)
SCALE : NTS

NTPC DRG NO.9993-109-PVM-F-044 SH 08 of 10

BHEL DRG NO 3-FW-000-02069 FILE NO B240-00422 REV NO 03



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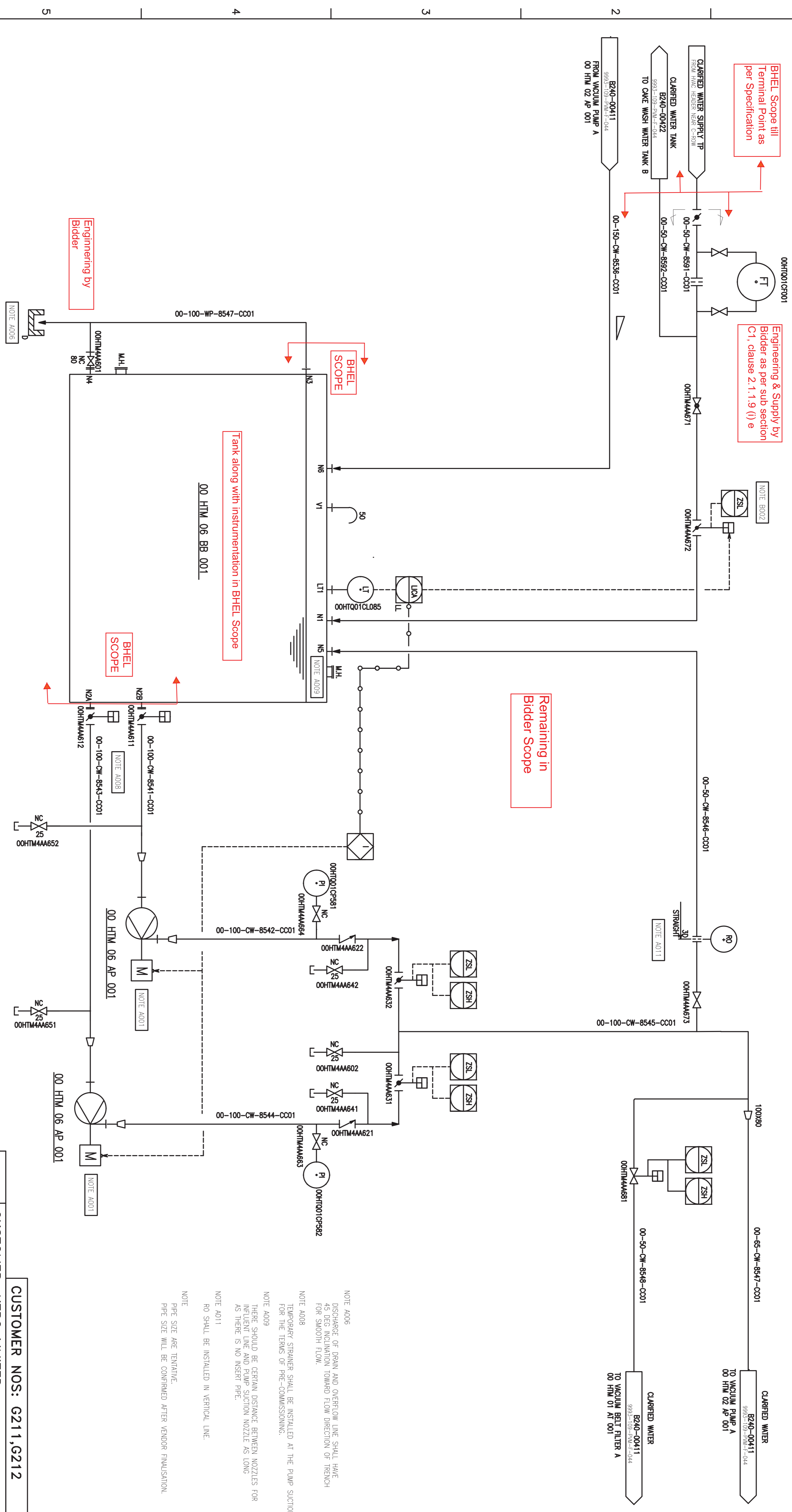
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THIS IS PART OF TECHNICAL SPECIFICATION PE-TS-468-571-A-1091 REV 00.

THIRD ANGLE PROJECTION	No. REQ'D
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A3

DRAWING No.



S NO	SECTION	FLOW m ³ /hr	TEMP(C)	DENSITY kg/m ³
1	Clarified water to clarified wash tank	5.72	45.0	990
2	At the suction of clarified wash pump	25	45.0	990
3	At the discharge of clarified wash pump	25	45.0	990
4	Clarified Wash water to belt filter	5.72	45.0	990
5	Vacuum pump seal water	11.4	45.0	990

00 HTM 06 BB 001
CAKE WASH (CLARIFIED WATER) TANK A

00 HTM 06 AP 001/002
CAKE WASHING PUMP A/B

CUSTOMER NOS: G211,G212

CUSTOMER: NTPC LIMITED.
PROJECT: NSPCL BHILAI (2X250MW)

FCD SYSTEM PACKAGE

DEPT	NAME (BHEL)	DATE
CODE/DRN	VIDYA	09.10.20
CHD	KABILASH	09.10.20
APPD	P.NAVEEN	09.10.20

MITSUBISHI HITACHI POWER SYSTEMS LTD.
AIR QUALITY CONTROL SYSTEMS TECHNOLOGY DIVISION

P & ID - VACUUM BELT FILTER
CAKE WASH (CLARIFIED WATER) TANK A

SCALE : NTS

NTPC DRG NO.9993-109-PVM-F-044
SH 09 of 10

BHEL DRG NO 3-FW-000-02069
FILE NO B240-00423
REV NO 03

CAUTION: THE DRAWING IS THE PROPERTY OF BHARAT HEAVY ELECTRICALS LTD. AND IS NOT TO BE REPRODUCED OR USED TO FURNISH ANY INFORMATION FOR MAKING OF DRAWINGS OF APPARATUS EXCEPT WHERE PROVIDED FOR AGREEMENT WITH SAID COMPANY.

- NOTE A006
DISCHARGE OF DRAIN AND OVERFLOW LINE SHALL HAVE 45 DEG INCLINATION TOWARD FLOW DIRECTION OF RENCH FOR SMOOTH FLOW.
- NOTE A008
TEMPORARY STRAINER SHALL BE INSTALLED AT THE PUMP SUCTON FOR THE TERMS OF PRE-COMMISSIONING.
- NOTE A009
THERE SHOULD BE CERTAIN DISTANCE BETWEEN NOZZLES FOR INFLUENT LINE AND PUMP SUCTON NOZZLE AS LONG AS THERE IS NO INSERN PIPE.
- NOTE A011
RO SHALL BE INSTALLED IN VERTICAL LINE.
- NOTE
PIPE SIZE ARE TENTATIVE
PIPE SIZE WILL BE CONFIRMED AFTER FINALISATION.

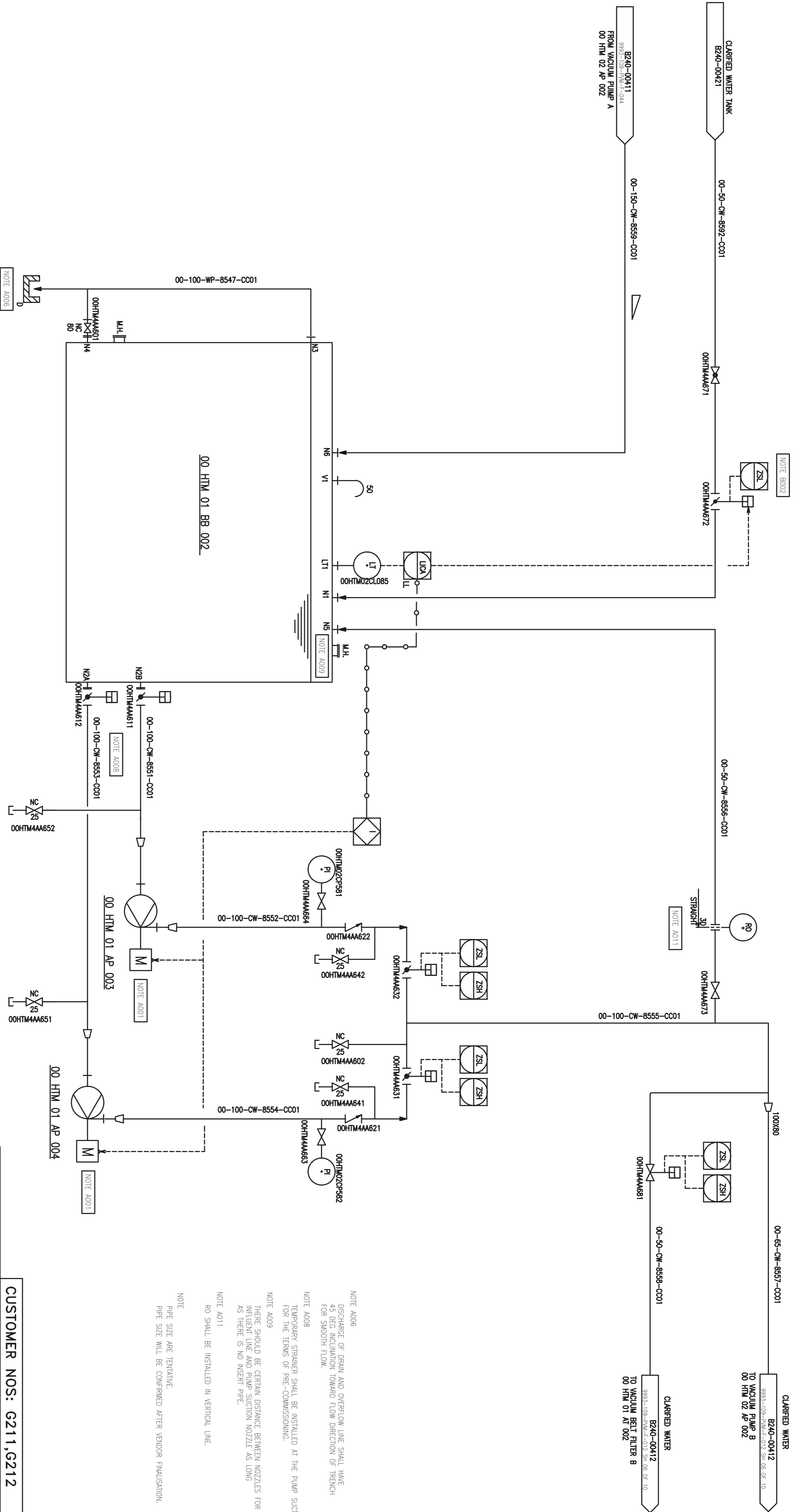
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THIRD ANGLE PROJECTION	No. REQ'D
------------------------	-----------

A3

DRAWING No.

Same Scope as that of Cake Wash Tank-A



S NO	SECTION	FLOW m ³ /hr	TEMP(°C)	DENSITY Kg/m ³
1	Clarified water to clarified wash tank	5.72	45.0	990
2	At the suction of clarified wash pump	25	45.0	990
3	At the discharge of clarified wash pump	25	45.0	990
4	Clarified Wash water to belt filter	5.72	45.0	990
5	Vacuum pump seal water	11.4	45.0	990

00 HTM 01 BB 002
CAKE WASH (CLARIFIED WATER) TANK B

00 HTM 01 AP 003/004
CAKE WASHING PUMP C/D

- NOTE A006
DISCHARGE OF DRAIN AND OVERFLOW LINE SHALL HAVE 45 DEG INCLINATION TOWARD FLOW DIRECTION OF RENCH FOR SMOOTH FLOW.
- NOTE A008
TEMPORARY STRAINER SHALL BE INSTALLED AT THE PUMP SUCTION FOR THE TERMS OF PRE-COMMISSIONING.
- NOTE A009
THERE SHOULD BE CERTAIN DISTANCE BETWEEN NOZZLES FOR INFLUENT LINE AND PUMP SUCTION NOZZLE AS LONG AS THERE IS NO INSER PIPE.
- NOTE A011
RO SHALL BE INSTALLED IN VERTICAL LINE.
- NOTE
PIPE SIZE ARE TENTATIVE.
PIPE SIZE WILL BE CONFIRMED AFTER FINALISUON.

CUSTOMER NOS: G211,G212

CUSTOMER: NTPC LIMITED.
PROJECT: NSPCL BHILAI (2X250MW)

FCD SYSTEM PACKAGE

DEPT	NAME (BHEL)	DATE
CODE/DRN	VIDYA	09.10.20
CHD	KABILASH	09.10.20
APPD	P.NAVEEN	09.10.20

MITSUBISHI HITACHI POWER SYSTEMS LTD.
AIR QUALITY CONTROL SYSTEMS TECHNOLOGY DIVISION

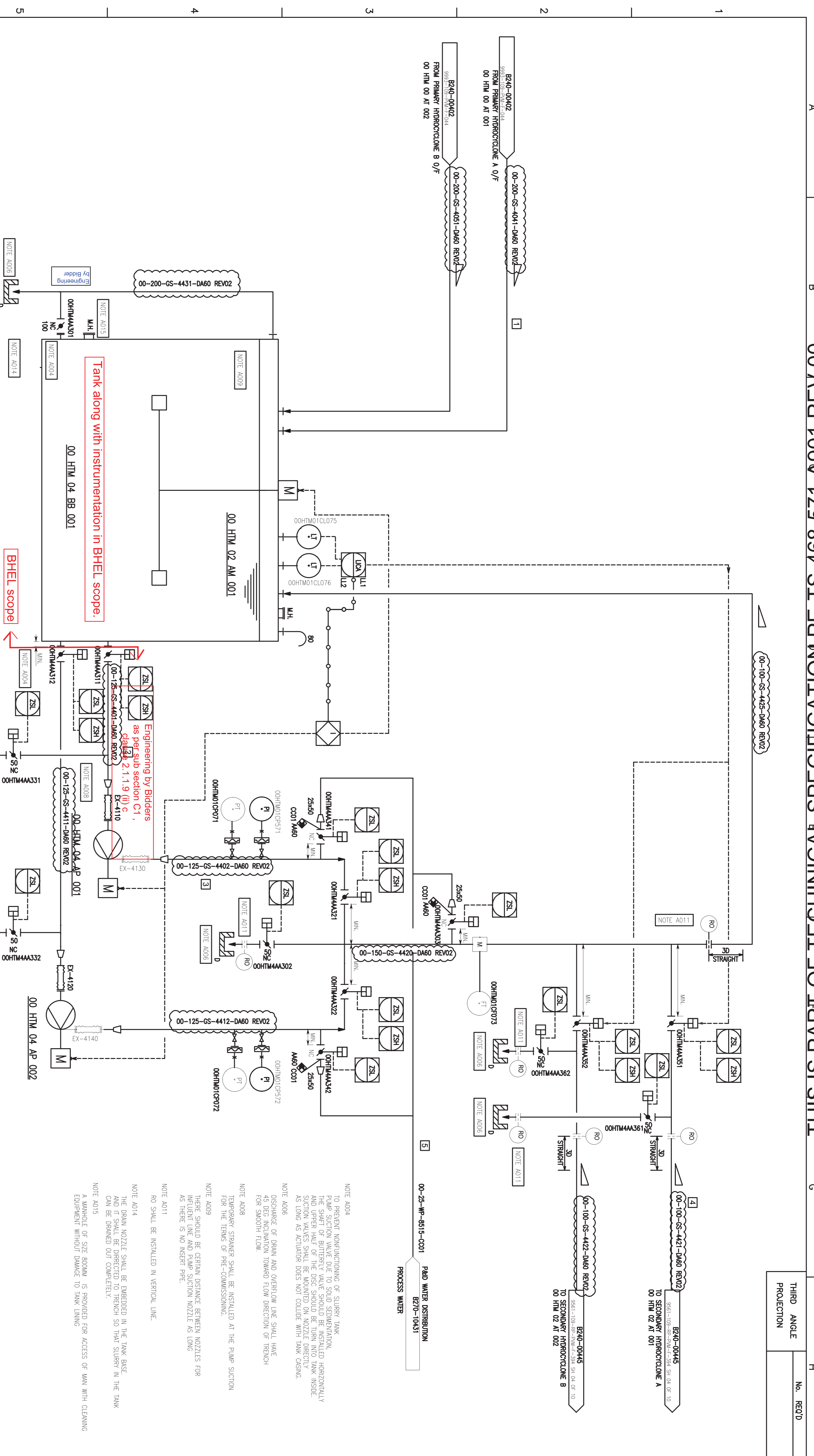
P & ID - VACUUM BELT FILTER
SCALE : NTS

NTPC DRG NO.9993-109-PVM-F-044 SH 10 of 10

BHEL DRG NO 3-FW-000-02069 FILE NO B240-00423 REV NO 03



THIS IS PART OF TECHNICAL SPECIFICATION PE-TS-468-571-A-901 REV 00.



SECTION	SECONDARY WASTE WATER HYDROCYCLONE FEED TANK	SECONDARY WASTE WATER HYDROCYCLONE FEED TANK AGITATOR	SECONDARY WASTE WATER HYDROCYCLONE FEED TANK PUMP A/B
00 HTM 04 BB 001	00 HTM 02 AM 001	00 HTM 04 AP 001/002	00 HTM 04 AP 001/002

S NO	SECTION	FLOW m ³ /hr	TEMP (°C)	DENSITY kg/m ³
1	Primary hydrocyclone overflow	31.32	61.1	1109
2	Secondary hydrocyclone feed pump suction	63	61.1	1109
3	Secondary hydrocyclone feed pump discharge	63	61.1	1109
4	Secondary hydrocyclone flow	31.32	61.1	1109
5	Process water flow for flushing	3	45.0	990

CUSTOMER NOS: G211, G212

CUSTOMER: NTPC LIMITED.
PROJECT: NSPCL BHILAI (2X250MW)

FGD SYSTEM PACKAGE

MITSUBISHI HITACHI POWER SYSTEMS, LTD.
AIR QUALITY CONTROL SYSTEMS TECHNOLOGY DIVISION

DEPT	NAME (BHEL)	DATE
COOR/DEN	VIDYA	09.10.20
CHD	KABULASH	09.10.20
APPD	PAKMEEN	09.10.20

SCALE: NTS

SH 03 of 10

REV NO 03

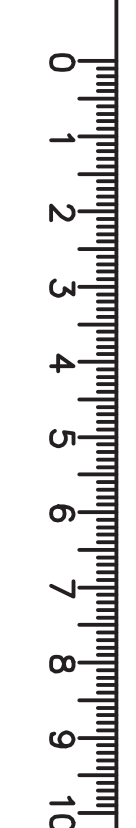
FILE NO B240-00441

3-FW-000-02069

NTPC DRG NO.9993-109-PVM-F-044

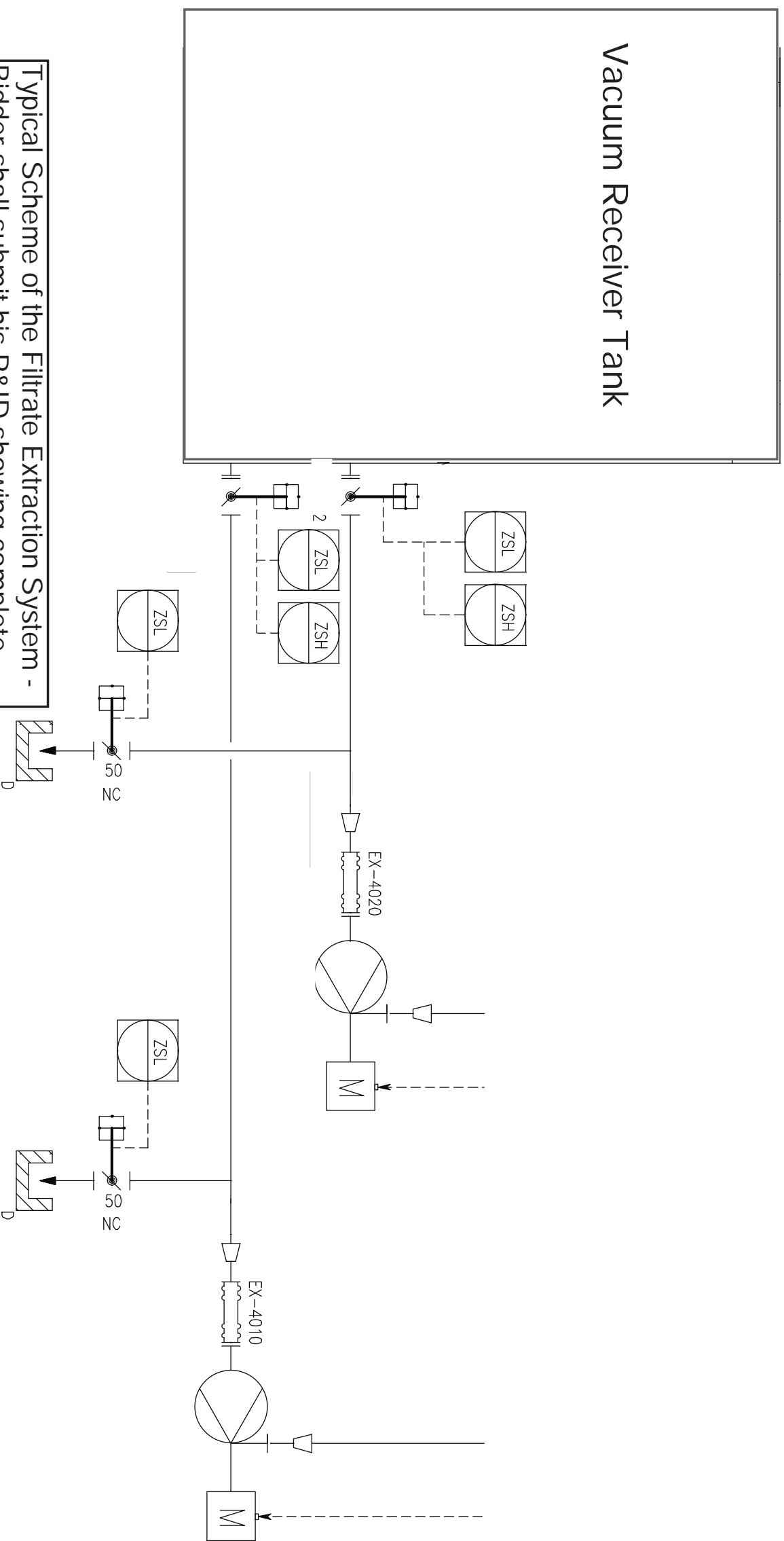
BHEL DRG NO. B240-00441

CAUTION: THE DRAWING IS THE PROPERTY OF BHARAT HEAVY ELECTRICALS LTD. AND IS NOT TO BE REPRODUCED OR USED TO FURNISH ANY INFORMATION FOR MAKING DRAWINGS OF APPARATUS EXCEPT WHERE PROVIDED FOR AGREEMENT WITH SAID COMPANY.



A3
DRAWING No.

Bidder scope after the Pump Discharge is limited to the Engineering of the Piping up to the Filtrate Water Tank as per Clause 2.1.1.9 (ii) f of Sub-section C1, Section-1 of this specification.



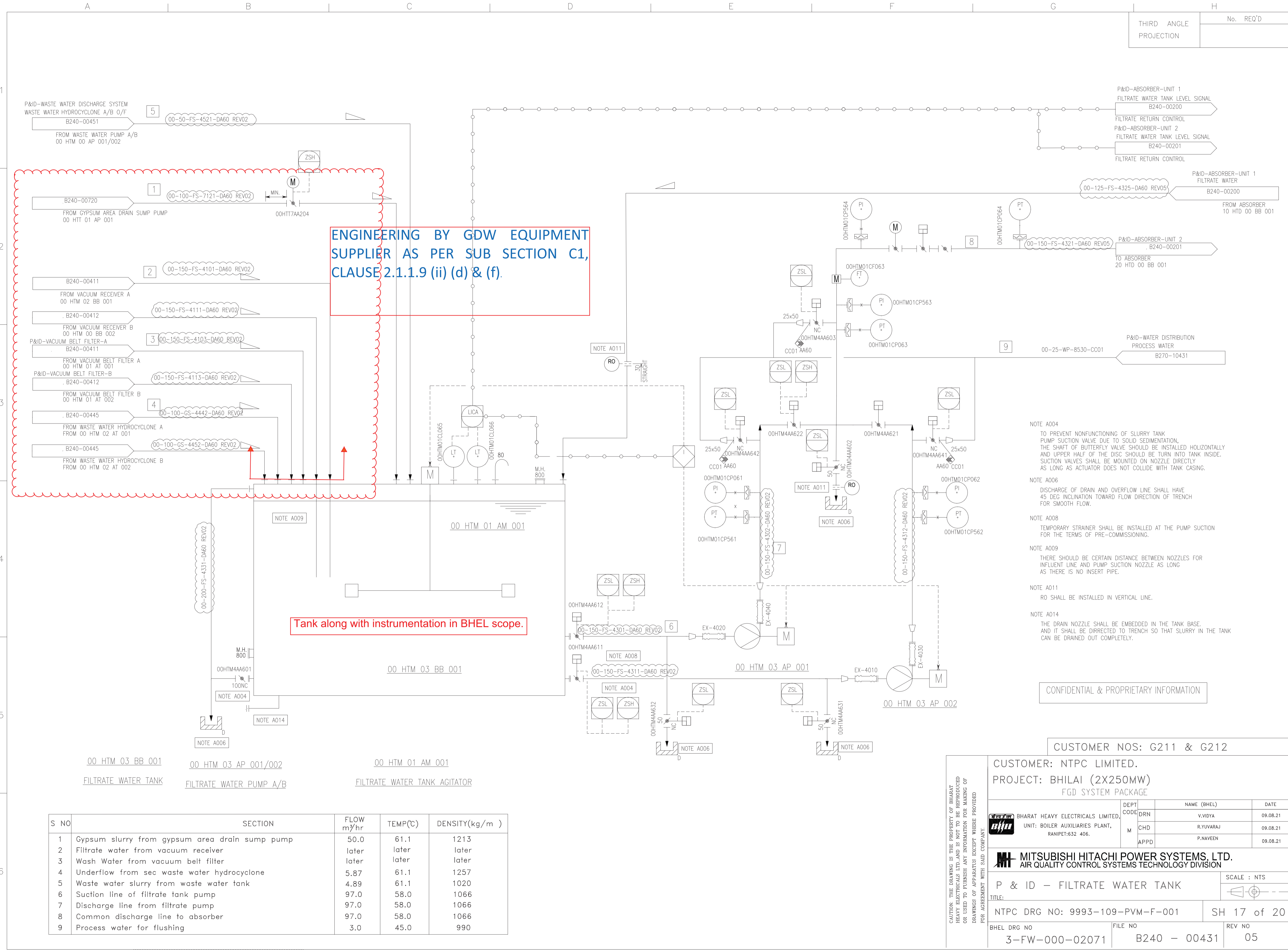
Typical Scheme of the Filtrate Extraction System - Bidder shall submit his P&ID showing complete arrangement for BHEL/Customer approval. Piping and Valves shall be rubber lined as per the details provided elsewhere in the specification.

Scheme No.: PE-FEP-00

A3

DRAWING No.

THIS IS PART OF TECHNICAL SPECIFICATION PE-TS-468-571-A901 REV 00.



ENGINEERING BY GDW EQUIPMENT SUPPLIER AS PER SUB SECTION C1, CLAUSE 2.1.1.9 (ii) (d) & (f).

Tank along with instrumentation in BHEL scope.

- NOTE A004 TO PREVENT NONFUNCTIONING OF SLURRY TANK PUMP SUCTION VALVE DUE TO SOLID SEDIMENTATION, THE SHAFT OF BUTTERFLY VALVE SHOULD BE INSTALLED HORIZONTALLY AND UPPER HALF OF THE DISC SHOULD BE TURN INTO TANK INSIDE. SUCTION VALVES SHALL BE MOUNTED ON NOZZLE DIRECTLY AS LONG AS ACTUATOR DOES NOT COLLIDE WITH TANK CASING.
- NOTE A006 DISCHARGE OF DRAIN AND OVERFLOW LINE SHALL HAVE 45 DEG INCLINATION TOWARD FLOW DIRECTION OF TRENCH FOR SMOOTH FLOW.
- NOTE A008 TEMPORARY STRAINER SHALL BE INSTALLED AT THE PUMP SUCTION FOR THE TERMS OF PRE-COMMISSIONING.
- NOTE A009 THERE SHOULD BE CERTAIN DISTANCE BETWEEN NOZZLES FOR INFLUENT LINE AND PUMP SUCTION NOZZLE AS LONG AS THERE IS NO INSERT PIPE.
- NOTE A011 RO SHALL BE INSTALLED IN VERTICAL LINE.
- NOTE A014 THE DRAIN NOZZLE SHALL BE EMBEDDED IN THE TANK BASE. AND IT SHALL BE DIRECTED TO TRENCH SO THAT SLURRY IN THE TANK CAN BE DRAINED OUT COMPLETELY.

CONFIDENTIAL & PROPRIETARY INFORMATION

CUSTOMER NOS: G211 & G212

CUSTOMER: NTPC LIMITED.
PROJECT: BHILAI (2X250MW)
FGD SYSTEM PACKAGE

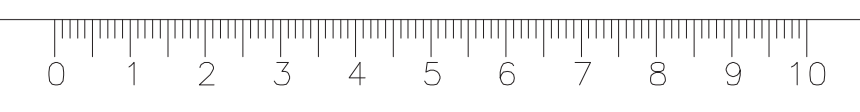
BHARAT HEAVY ELECTRICALS LIMITED, UNIT: BOILER AUXILIARIES PLANT, RANIPET-632 406.	DEPT	NAME (BHEL)	DATE
	DRN	V.VIDYA	09.08.21
	CHD	R.YUVARAJ	09.08.21
	APPD	P.NAVEEN	09.08.21

MITSUBISHI HITACHI POWER SYSTEMS, LTD.
AIR QUALITY CONTROL SYSTEMS TECHNOLOGY DIVISION

P & ID - FILTRATE WATER TANK
SCALE: NTS

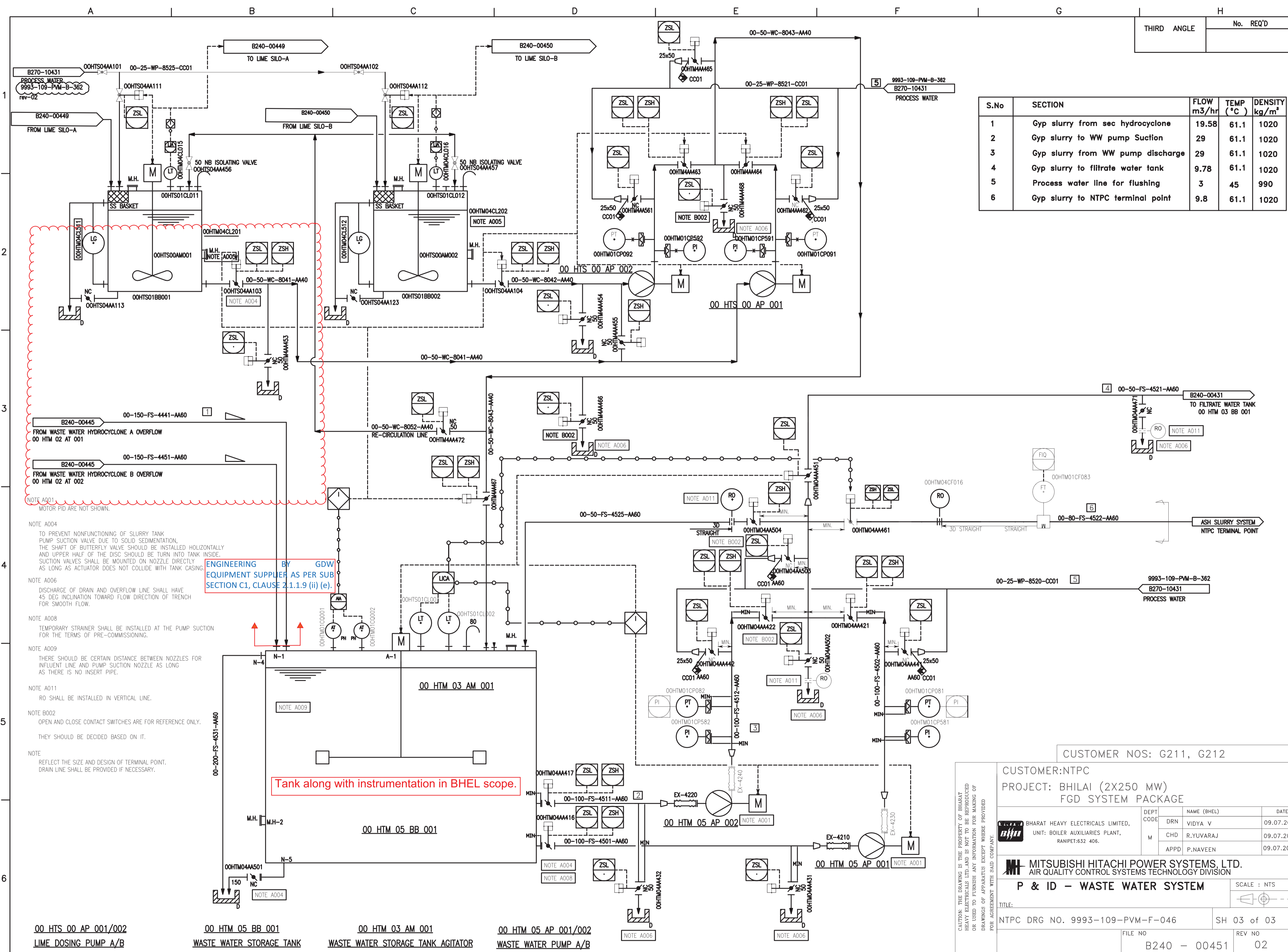
NTPC DRG NO: 9993-109-PVM-F-001		SH 17 of 20	
BHEL DRG NO	FILE NO	REV NO	
3-FW-000-02071	B240 - 00431	05	

S NO	SECTION	FLOW m ³ /hr	TEMP(C)	DENSITY(kg/m ³)
1	Gypsum slurry from gypsum area drain sump pump	50.0	61.1	1213
2	Filtrate water from vacuum receiver	later	later	later
3	Wash water from vacuum belt filter	later	later	later
4	Underflow from sec waste water hydrocyclone	5.87	61.1	1257
5	Waste water slurry from waste water tank	4.89	61.1	1020
6	Suction line of filtrate tank pump	97.0	58.0	1066
7	Discharge line from filtrate pump	97.0	58.0	1066
8	Common discharge line to absorber	97.0	58.0	1066
9	Process water for flushing	3.0	45.0	990




A3

DRAWING No.



THIS IS PART OF TECHNICAL SPECIFICATION PE-TS-468-571-A901 REV 00.


	NSPCL BHILAI (2X250 MW)	SPECIFICATION No: PE-TS-468-571-A901	
	GYPSUM DEWATERING EQUIPMENT technical SPECIFICATION MASTER DRAWING LIST WITH SCHEDULE OF SUBMISSION	SECTION : I	
		SUB-SECTION : D	
		REV. 00	
		SHEET 1 OF 6	

SECTION-I
SUB-SECTION-D

ANNEXURE-V


**MASTER DRAWING LIST WITH SCHEDULE OF
SUBMISSION**


THIS IS PART OF TECHNICAL SPECIFICATION PE-TS-468-571-A901 REV 00.

	NSPCL BHILAI (2X250 MW)	SPECIFICATION No: PE-TS-468-571-A901	
	GYP SUM DEWATERING EQUIPMENT	SECTION : I	
	technical SPECIFICATION	SUB-SECTION : D	
	MASTER DRAWING LIST WITH SCHEDULE OF SUBMISSION	REV. 00	
		SHEET 2 OF 6	

Drawings/Drawings to be submitted by the bidder

SN	Doc / Drawing No.	Drawing Title	Remarks		No. of weeks from LOB
			Type*		
1	PE-V0-468-571-A901	Sub-Vendor List of Components for GDE.	Primary	Basic Engineering drawings/ Documents (Primary drawings/ documents)	THIS IS PART OF TECHNICAL SPECIFICATION PE-TS-468-571-A901
2	PE-V0-468-571-A902	Manufacturing Quality plan of GDE	Primary		
3	PE-V0-468-571-A903	P & I Diagram with Bill of quantity (BOQ) of GDE.	Primary		
4	PE-V0-468-571-A904	Control Philosophy of GDE.	Primary		
5	PE-V0-468-571-A905	Design Philosophy of complete GDE.	Primary		
6	PE-V0-468-571-A906	General Arrangement Drawing of Gypsum Dewatering Equipment (Showing layout of all the equipments of GDE in the building)	Primary		
7	PE-V0-468-571-A907	Sizing calculations of (a) VBF, (b) Vacuum Receiver, (c) Vacuum Pump, (d) Belt Wash Pump, (e) Cake wash Pumps, (f) Drives and (g) other Accessories for GDE.	Primary		
8	PE-V0-468-571-A908	General Arrangement Drawings of VBF including cross-sectional details, foundation plan and load details.	Primary		
9	PE-V0-468-571-A909	Datasheet of Vacuum Belt Filter & all accessories of GDE.	Primary		
10	PE-V0-468-571-A910	Piping Layout (Integral-Vendor Scope) with supports & fixing arrangement with BOQ for GDE.	Primary		
11	PE-V0-468-571-A911	Piping Layout (Non Integral - BHEL Scope) with supports & fixing arrangement with BOQ for GDE.	Primary		
12	PE-V0-468-571-A912	Instrument schedule along with GA & Data sheet for GDE.	Secondary		
13	PE-V0-468-571-A913	Data Sheet of Instruments of GDE	Secondary		
14	PE-V0-468-571-A914	Valve schedule for GDE.	Secondary		
15	PE-V0-468-571-A915	GA & Data sheet of Valves for GDE.	Secondary		

		NSPCL BHILAI (2X250 MW) GYP SUM DEWATERING EQUIPMENT technical SPECIFICATION MASTER DRAWING LIST WITH SCHEDULE OF SUBMISSION		SPECIFICATION No: PE-TS-468-571-A901	
				SECTION : I	
				SUB-SECTION : D	
				REV. 00	
		SHEET 3 OF 6			
16	PE-V0-468-571-A916	Piping Isometric (Integral-Vendor Scope) with supports & fixing arrangement with BOQ for GDE.	Secondary		
17	PE-V0-468-571-A917	Piping Isometric (Non Integral - BHEL Scope) with supports & fixing arrangement with BOQ for GDE.	Secondary		THIS IS PART OF TECHNICAL SPECIFICATION PE-TS-468-571-A901 REV 00.
18	PE-V0-468-571-A918	Block logic diagram & Inter-Connection drawing of GDE.	Secondary		
19	PE-V0-468-571-A919	General Arrangement Drawings of (a) Vacuum Pump, (b) Vacuum Receiver, (c) Hydrocyclones (Primary & Secondary), (d) Belt Wash Pump, (e) Cake Wash Pump & (f) Vent Fan, along with cross sectional details, foundation plan and loading details.	Secondary		
20	PE-V0-468-571-A920	Cable Schedule of GDE.	Secondary		
21	PE-V0-468-571-A921	Electrical load List for GDE.	Secondary		
22	PE-V0-468-571-A922	Local Panel Control Circuit Diagram of GDE.	Secondary		
23	PE-V0-468-571-A923	General Arrangement Drawing & Data sheet of Motors for GDE.	Secondary		
24	PE-V0-468-571-A924	T-S & Performance curves of Vacuum Pump for GDE.	Secondary		
25	PE-V0-468-571-A925	I/O List (Drives & Instruments) of GDE.	Secondary		
26	PE-V0-468-571-A926	Utility Consumption of GDE.	Secondary		
27	PE-V0-468-571-A927	Schedule for Lubrication and other Consumables.	Secondary		
28	PE-V0-468-571-A928	Painting Schedule of GDE	Secondary		
29	PE-V0-468-571-A929	Bill of Material (BOM) of complete GDE for Main Supply	Secondary		
30	PE-V0-468-571-A930	Mandatory Spare List & BBU of GDE	Secondary		
31	PE-V0-468-571-A931	Platform Drawing of GDE with detailed BOQ	Secondary		
32	PE-V0-468-571-A932	Overall space and headroom requirement with details of handling during Erection, operation & maintenance of the equipments of GDE	Secondary		

	NSPCL BHILAI (2X250 MW)	SPECIFICATION No: PE-TS-468-571-A901		
	GYP SUM DEWATERING EQUIPMENT	SECTION : I		
	technical SPECIFICATION	SUB-SECTION : D		
	MASTER DRAWING LIST WITH SCHEDULE OF SUBMISSION	REV. 00		
		SHEET 4 OF 6		

33	PE-V0-468-571-A933	Erection & Commissioning Manual of GDE including- i. Installation and assembly procedure of complete GDE ii. Pre-Commissioning Check List of GDE	Secondary		
34	PE-V0-468-571-A934	Operation & Maintenance (O&M) Manual of GDE including Transportation and Storage Specification for GDE Components	Secondary		
35	PE-V0-468-571-A935	Schedule of Start-up & Commissioning Spares for GDE	Secondary		
36	PE-V0-468-571-A936	List of Special tools & Tackles for GDE	Secondary		
37	PE-V0-468-571-A937	Monthly Progress Report for GDE	Secondary		
38	PE-V0-468-571-A938	Packing List for complete GDE	Secondary		
39	PE-V0-468-571-A939	Performance Test Procedure of GDE	Secondary		


*Manufacturing Clearance to be given to the Vendor based on approval of 'Primary' Drawings.

*Secondary drawings are to be submitted within 2-3 weeks after approval of relevant primary drawings.

Notes:


1. The above drawing list is tentative and shall be finalized with the successful bidder after placement of order. While some of the drawings indicated above may not be applicable, some additional drawings may also be required based on scope of work.
2. Drawings shall be prepared in Auto-Cad/3D Modelling software latest edition, as applicable. Required no. of hard and soft copies (editable) of the drawings shall be furnished as per requirement specified elsewhere in the specification.
3. Only manual calculation with authentic supporting literature (e.g. extracts of hand Book/ standard/codes) shall be acceptable. All design calculations and drawings shall be in SI system only.
4. All the drawings and documents including general arrangement drawing, data sheet, calculation etc. to be furnished to the customer during detailed engineering stage shall include / indicate the following details for clarity w.r.t. Inspection, construction, erection and maintenance etc.:

THIS IS PART OF TECHNICAL SPECIFICATION PE-TS-468-571-A901 REV 00.

	NSPCL BHILAI (2X250 MW)	SPECIFICATION No: PE-TS-468-571-A901	
	GYP SUM DEWATERING EQUIPMENT technical SPECIFICATION MASTER DRAWING LIST WITH SCHEDULE OF SUBMISSION	SECTION : I	
		SUB-SECTION : D	
		REV. 00	
		SHEET 5 OF 6	

- a) All drawings and documents shall indicate the list of all reference drawings including General Arrangement.
- b) All drawings shall include / show plan, elevation, side view, cross-section, skin section, blow-up view; all major self-manufactured and bought out items shall be labeled and included in BOQ / BOM in tabular form.
- c) Painting schedule shall also be made as a part of general arrangement drawing of each equipment / items indicating at least 3 trade names.
- d) All the drawings required to be furnished to customer during detailed engineering stage shall include technical parameters, details of paints and lubrication, hardness and BOQ / BOM in tabular form indicating all major components including bought out items and their quantity, material of construction indicating its applicable code / standard, weight, make etc.
- e) Drawings/ documents to be submitted for purchaser's review/ approval shall be under Revision A, B, C... etc. while drawings /documents to be submitted thereafter for customer's approval after purchaser's approval shall be under R-0, 1, 2, 3 etc.
- f) Drawings and documents not covered above but required to check safety of machines/ equipment/ system, shall be submitted during detailed engineering stage without any commercial implication.
- g) All drawings shall include "B.O.M" and indicate quantity, material of construction, make along with IS/BS No., Technical parameters, dimensions, hardness, machining symbol and tolerance, requirement of radiography and hydraulic tests, painting details, elevation, side view, plan, skin section and blow-up view for clarity.
- h) All drawings shall be prepared as per BHEL's title block and shall bear BHEL's drawing No. Documents marked for submission to BHEL's Customer shall also bear BHEL's Customer's drawing No.
- i) Schedule of drawings submissions, comment incorporations & approval shall be as stipulated in the specifications. The successful bidder shall depute his design personnel to BHEL's/ Customer's/ Consultant's office for across the table resolution of issues and to get documents approved in the stipulated time.

THIS IS PART OF TECHNICAL SPECIFICATION PE-TS-468-571-A901 REV 00.

	NSPCL BHILAI (2X250 MW)	SPECIFICATION No: PE-TS-468-571-A901	
	GYPSUM DEWATERING EQUIPMENT technical SPECIFICATION MASTER DRAWING LIST WITH SCHEDULE OF SUBMISSION	SECTION : I	
		SUB-SECTION : D	
		REV. 00	
		SHEET 6 OF 6	

- j) Bidder to follow the following the drawing submission schedule:
- k) 1st submission of drawings from date of LOI as per the submission schedule.
- l) Every revised submission incorporating comments – within 7 days.
- m) Bidder to submit revised drawings complete in all respects incorporating all comments. Any incomplete drawing submitted shall be treated as non-submission with delays attributable to bidder's account. For any clarification/ discussion required to complete the drawings, the bidder shall depute his personal to BHEL for across the table discussions/ finalizations/ submissions of drawings.

THIS IS PART OF TECHNICAL SPECIFICATION PE-TS-468-571-A901 REV 00.