

3 X 800MW PATRATU STPS

SECTION-IC

SPECIFIC TECHNICAL REQUIREMENT – C & I



BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA-INDIA

C & I SPECIFICATIONS FOR DCS BASED COMPRESSED AIR SYSTEM

	NTPC			
	3 X 800 MW PATRATU STPP(UNIT NO. 1, 2 & 3)		DESG	MG
	JOB NO: 434		CHKD	MK
	REV. NO. 00	DATE: 07.06.2018	APPD	BS

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3X800 MW PATRATU STPP (UNIT NO. 1, 2 & 3)

SCOPE OF C & I FOR COMPRESSED AIR SYSTEM

1. COMPRESSED AIR SYSTEM is Microprocessor based system and is common for three units.
2. Operation and control of compressed air system shall be as per design philosophy/customer specification given elsewhere in the specification. Integrated microprocessor based control system shall be provided for each Instrument Air compressor & Service air compressor. All transmitter such as PT, DPT, TE (including winding and bearing temperature of compressor motor) etc. outside the compressor skid shall also be hooked up to this system. Compressors connectivity to DCS shall be provided for information and overall control.

MODBUS (on RS-485) link on Fibre Optic cable shall be provided between plant DCS & this microprocessor system for monitoring of all the parameters and status feedback of drives of compressed air system.

In addition to the MODBUS link, provision for hardwired START, STOP commands with overall control from main plant DCS to all the compressors shall also be provided. All necessary hardware and software at bidder's end shall be under the bidder's scope.

Bidder to confirm all the above requirements stated above in their scope of supply. Bidder to furnish the configuration diagram of Microprocessor Based Control System showing communication with the DCS along with the bid. Bidder to furnish write-up & recommended logics for overall control of Air compressors. Fibre optic cable is not in bidder's scope of supply.

Bidder to furnish signal exchange list between compressed air system and DCS in BHEL format attached further.

3. The requirements given below are to be read in conjunction with detailed Technical specification Enclosed in the specification. Further in case of any discrepancy in the requirement within the same Section noted by the bidder in the specification, the same will be brought to the notice of BHEL in the Form of pre bid clarification. In absence of any pre bid clarification, the more stringent requirement as per interpretation of customer/BHEL shall prevail without any commercial implication.
4. The Contractor shall provide complete Instrumentation for control, monitoring and operation of entire CAS.
5. The make/model of various instruments/items/systems shall be as per NTPC approved vendor list. No commercial and delivery implication in this regard shall be acceptable. In case of any conflict and repetition of clauses in the specification, the more stringent requirements among them are to be complied with, the more stringent requirement as per interpretation of customer/BHEL shall prevail without any commercial implication.
6. All instruments shall be terminated on JB/LCP in field and both instrument and JB/LCP are in bidder scope.
7. For cable scope refer to electrical scope between BHEL and vendor defined in electrical specification.

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8. Bidder to provide mandatory spares as per mandatory spares list mentioned elsewhere in the specification.
9. Electrical Actuators with integral starter shall be provided for all on/off and inching type valves along with necessary interface units for linking to corresponding Control System as applicable, typical Hook-up diagram of drives is included for reference
10. The specifications for instruments mentioned in the specification are minimum requirements. The detail specifications shall be finalized during detail engineering.
11. The bidders shall specifically mention any deviation they would like to take on the C&I specification. In absence of any deviation a No deviation certificate is to be furnished.
12. The quantity of instruments for the system shall be as per tender P & ID wherever provided of the respective system as a minimum, for bidding purpose. However, Bidder shall also include in his proposal all the instruments and devices that are needed for the completeness of the plant auxiliary system/ equipment supplied by the bidder, even if the same is not specifically appearing in the P & ID. During detail engineering if any additional instruments are required for safe & reliable operation of plant, bidder shall supply the same without any price implication.
13. Bidder to terminate all instrumentation and control elements in junction boxes. bidder to provide input/output list, drives list, junction box schedule and termination details, recommended control logics / write-up etc. the list of documents to be submitted after award of contract is to be referred by bidder.
14. All the transmitters supplied by Bidder shall be rack mounted. The transmitter racks shall be in Bidder's scope of supply. All transmitters shall be HART compatible.
15. Bidder to perform tests of C&I items/instruments/systems as per Quality plans/type test attached in the specification. However, if any test not specified in the quality plan but specified in specification Tests for I&C equipment included elsewhere in specification will have to perform by Bidder without any cost implication.
16. Instrument installation and accessories required for the same shall be in Bidder's scope and shall be submitted after award of contract. However any instrument/ analyzer installation not covered in the same shall be subject to customer and BHEL approval during detailed engineering.
17. All Temperature sensors shall be Duplex type and temperature transmitter shall be provided for all temperature measurement applications.
18. Bidder to furnish electrical load/UPS load data during detailed engineering

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19. Bidder to provide temperature transmitter along with compensating cable, JB/Rack & other erection hardware
20. 230 V AC UPS supply shall be provided by BHEL at a single point, further distribution to various instruments/Equipment's of the system shall be in bidder scope. Bidder to include necessary power distribution board in his scope. Any power supply other than the above, if required by any instrument/equipment has to be derived by the bidder from the above supply & all necessary hardware for the same shall be in bidder scope. Bidder to submit the UPS power requirement along with the bid. Static Switch based Changeover scheme for redundant UPS Feeders shall be used. It shall be ensured that changeover time between feeders shall be such that that compressor Controller Failure shall not take place during changeover.
21. Bidder's presence is required for 3 Man days (in one visit) at site during commissioning of DDCMIS for assistance related to process correctness. All the expenses like boarding, lodging and travel, Air fare etc. shall be in bidder's scope.
22. Contractor shall furnish Instrument Schedule, I/O list, Drive list, Cable Schedule, Cable interconnection, JB grouping, Annunciation list, SOE list, List of Instruments/devices for HART in BHEL approved format. The reusable database format like MS Excel, MS Access etc. of these documents shall also be provided by Contractor in BHEL approved format. Soft copy of the formats shall be provided to the successful bidder.
23. Interface of MCC, HT SWGR, field instruments, Actuators etc. with DDCMIS based control system shall be as per Drive Control Philosophy/wiring diagram enclosed in specification.
24. Local control panel if any required for operation shall be in bidder scope.
25. Plant schematic for monitoring and operation shall be available on all the OWES.
26. Time synchronization of compressor microprocessor system with the DCS has to be done. Bidder to provide necessary hardware/software at their end.
27. The solenoid operated valves/Dampers/Gate shall have a limit switch for open/close feedback. Solenoid valve shall be rated for 24 V Dc only.
28. Diaphragm seal shall be provided with instruments having contact with corrosive media.
29. Redundancy of sensors shall be provided (except skid mounted as per OEM practice)
 - A) Triple redundancy for all analog and binary inputs required for protection of systems/drives.
 - B) For all control functions dual redundancy of the sensors shall be provided by the bidder.

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30. Double root valves shall be provided for all pressure tapings where the pressure exceeds 40 kg/cm²
31. Use of process actuated switches shall be avoided unless it is proprietary requirement.
32. Number of pair to be selected for screen control cable(size : 0.5 mm²)
F-type: 2P/4P/8P/12P
G-type: 2P/4P/8P/12P
Core Cable: 3CX2.5sqmm²/ 5CX2.5sqmm²/ 12CX1.5sqmm²
33. Vibration Monitoring System is envisaged for HT motors for Compressed Air System which is in BHEL scope. However, for mounting of vibration sensors/probe, vendor to provide vibration pad (of dimension of 80 mm*80mm*10mm each) for mounting of sensors and a notch/slot for mounting of key phasor. The mounting arrangement/pad shall be made at each DE-X, DE-Y and NDE-X, NDE-Y end both for Compressor and motors.
34. Measuring instruments (primary & secondary), SWAS equipment/analyzers offered for this package shall have at least one year's satisfactory operation in one power station having unit rating of 200 MW or above. Provenness certificate shall be provided as per the attached format.

	SPECIFICATION FOR CONTROL & INSTRUMENTATION FOR AUX PACKAGES	SPECIFICATION NO.:	
		VOLUME	
		SUB SECTION	
		REV. NO.	DATE :
		SHEET	OF

GENERAL REQUIREMENT

1.0 Bidder shall provide complete and independent control & instrumentation system with all accessories, auxiliaries and associated equipments for the safe, efficient and reliable operation of auxiliary systems.

2.0 The quantity of instruments for auxiliary system shall be as per tender P & ID wherever provided of the respective system as a minimum, for bidding purpose. However, Bidder shall also include in his proposal all the instruments and devices that are needed for the completeness of the plant auxiliary system/ equipment supplied by the bidder, even if the same is not specifically appearing in the P & ID. During detail engineering if any additional instruments are required for safe & reliable operation of plant, bidder shall supply the same without any price implication.

3.0 Measuring instruments/equipment and subsystems offered by the bidder shall be from reputed experienced manufacturers of specified type and range of equipment, whose guaranteed and trouble free operation has been proven. Further all the instruments shall be of proven reliability, accuracy, and acceptable international standards and shall be subject to employer's approval. All instrumentation equipment and accessories under this specification shall be furnished as per technical specification, ranges, makes/ numbers as approved by the employer' during detail engineering.

4.0 The necessary root valves, impulse piping, drain cocks, gauge-zeroing cocks, valve manifold and all the other accessories required for mounting/ erection of these local instruments shall be furnished, even if not specifically asked for, on as required basis. The contacts of equipment mounted instruments; sensors, switches etc for external connection including spare contacts shall be wired out to suitably located junction boxes.

5.0 The customer specification attached as Specific Technical Requirement will supercede the Data sheets, if there is any mismatch.

LIST OF DELIVERABLES OF PEM - C&I DEPARTMENT FOR CAS 2X800 MW karimnagar Telangana STPP(Unit-1,2,)			
DOCUMENT NUMBER PE-GL-405-145-I100		SHEET 1 of 1	
Sl.No.	DRAWING NO.	DRAWING/DOCUMENT TITLE	CATEGORY
1	PE-V0-424-145-I901	CONTROL & OPERATIONAL WRITE-UP FOR THE SYSTEM	A
2	PE-V0-424-145-I902	CONTROL SCHEME/LOGIC DIAGRAM(TO BE IMPLEMENTED IN DDCMIS)	A
3	PE-V0-424-145-I903	HMI PICTURES/PLANT SCHEMATICS	A
4	PE-V0-424-145-I904	INSTRUMENT SCHEDULE with set points	A
5	PE-V0-424-145-I905	I/O LIST (ANALOG & BINARY)	A
6	PE-V0-424-145-I906	DRIVE LIST/SOLENOID/ACTUATOR VALVE LIST WITH LOCATION DATA	A
7	PE-V0-424-145-I907	FIELD JB/LIE/LIR TERMINATIONS	A
8	PE-V0-424-145-I908	DATASHEETS FOR INSTRUMENTS, JB's, etc.	A
9	PE-V0-424-145-I909	QUALITY PLANS (INSTRUMENTS,VMS, etc.)	A
10	PE-V0-424-145-I910	DRIVE LIST/SOLENOID/ACTUATOR VALVE LIST WITH LOCATION DATA	A
11	PE-V0-424-145-I911	THERMOWELL SIZING CALCULATION	A
13	PE-V0-424-145-I913	CABLE SCHEDULE & INTERCONNECTION	A
14	PE-V0-424-145-I914	ANNUNCIATION & SOE LIST	A
15: PE-V0-424-145-I915 EXCHANGE LIST BETWEEN CAS/COMPRESSORS IN BHEL FORMAT			A
NOTES: 1. ANY OTHER DOCUMENT DECIDED DURING DETAILED ENGINEERING SHALL BE PROVIDED BY BIDDER WITHOUT ANY COMMERCIAL/TECHNICAL IMPLICATION. 2. CONTRACTOR TO SUBMIT REUSABLE DATABASE FORMATS IN BHEL/NTPC APPROVED FORMATS LIKE MS EXCEL,MS ACCESS OF DOCUMENTS LIKE INSTRUMENT SCHEDULE, I/O LIST, DRIVE LIST,FIELD JB TERMINATIONS, CABLE SCHEDULE & INTERCONNECTION, etc. SOFT COPY OF FORMATS SHALL BE PROVIDED TO SUCCESSFUL BIDDERS.			

Checklist for Serial Communication between maxDNA Systems and Foreign Device :BHEL

A Device Specific :

SN	Parameters	Options available	Remarks if any
1	Modle No.& Make of Device		
2	Communications Link Options	☐ Multidrop ☐ Peer to Peer ☐ N/w topology attached	
3	Protocol Mode (Device is a)	☐ Master ☐ Slave ☐ Master/Slave	
4	Protocol	☐ RTU ☐ ASCII ☐ Other -----	
5	Master	☐ System maxDNA ☐ Other -----	
6	Redundancy Requirements	Yes / No	
7	Dist.bet.maxDNA System & Device*	☐ ----- Feet ☐ ----- Meters	

B Electrical Specific :

1	Interface Type	☐ RS232 ☐ RS422 ☐ RS485	
2	Wiring at Device end	☐ 2 Wire ☐ 4 Wire	
3	Transmission Channel	☐ Half Duplex ☐ Full Duplex	
4	Baud Rates (bps)	☐ 1200 ☐ 2400 ☐ 4800 ☐ 9600 ☐ 19200	
5	Databits	☐ 8 ☐ 7	
6	Stopbits	☐ 1 ☐ 2	
7	Parity	☐ None ☐ Odd ☐ Even	
8	H/w & Software Handshake	☐ Yes ☐ No	
9	Response Timeout time (Sec)	☐ ----- ☐ Configurable timeout	
10	Data Formats Supported	☐ Boolean ☐ Real ☐ Char ☐ Sn.Int ☐ UnSn.Int	
11	Transmission mode	☐ Asynchronous ☐ Synchronous	

C Application Specific : *

1	Primary Function*	☐ Data Acquisition ☐ Data Acquisition & Control	
		☐ Download parameter sets	
2	Analog Points to read	-----Nos. ☐ Details attached ☐ Details not attached	
3	Analog Points to write	-----Nos. ☐ Details attached ☐ Details not attached	
4	Digital Points to read	-----Nos. ☐ Details attached ☐ Details not attached	
5	Digital Points to write	-----Nos. ☐ Details attached ☐ Details not attached	
6	Memory / Flag Points to read	-----Nos. ☐ Details attached ☐ Details not attached	
7	Memory / Flag Points to write	-----Nos. ☐ Details attached ☐ Details not attached	

D Hardware Specific :

1	Cable type	☐ Boolean cable ☐ Twisted pair cable	
2	Cable Details Enclosed	☐ Yes ☐ No	
3	Any specific Converter required	☐ Yes ☐ No ☐ Details enclosed	

E Device Documents :

1	Manufacturer's Documents*	☐ Tech., Spec. ☐ Operating Manual	

***Notes:**

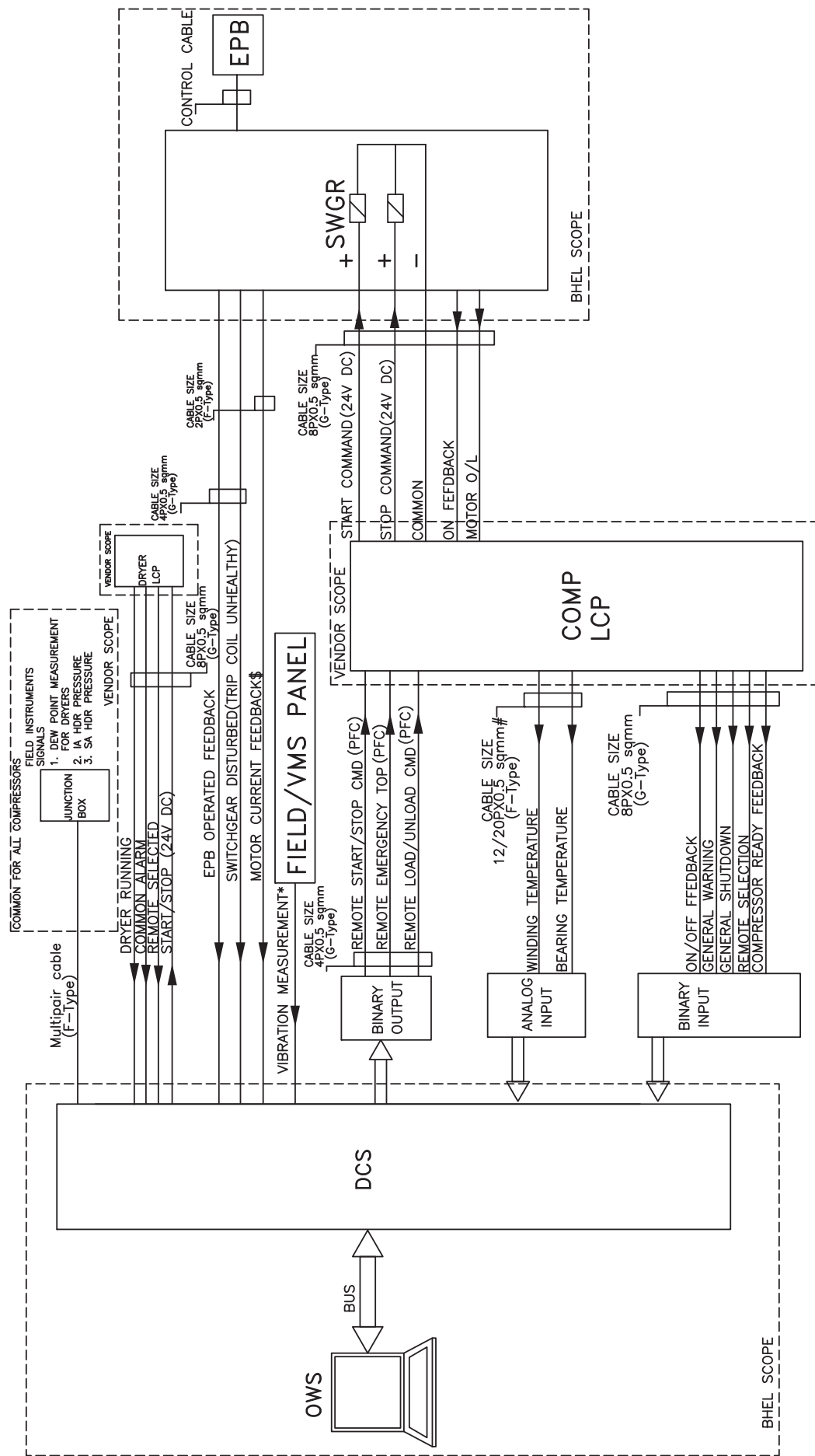
A6 To identify converter requirement and cable length.

C The sr.no.1 to 7 are reqd.to be furnished for interface impl. :such as Tagname,Description,point type, modbus(Register) address,EU,range & device (dlave) address

C1 What is the primary purpose of the communications link?

E1 Reqd. Contents : This document must provide an overview of the device including its intended use(a general technical,communication & electrical details)

STANDARD HARDWIRED INTERFACE BETWEEN COMPRESSOR CONTROL SYSTEM, DCS AND SWGR



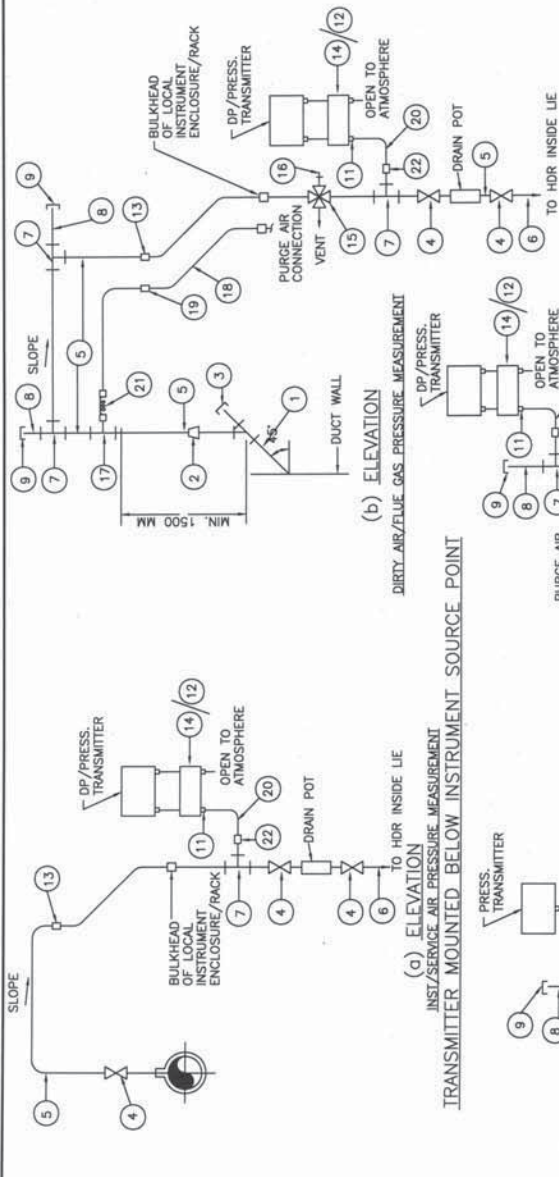
TITLE DDCMIS/LCP/SWGR INTERFACE FOR INDIVIDUAL COMPRESSOR/DRYER

NOTE:

- *APPLICABLE FOR HT MOTORS (PROJECT SPECIFIC)
- #12P APPLICABLE IF 'TT' IS ENVISAGED, 20P APPLICABLE IF 'RTD' IS ENVISAGED.
- \$FOR NTPC PROJECTS MIN 4P(F-TYPE) TO BE USED.
- CABLE SCOPE SHALL BE AS PER ELECTRICAL SCOPE MATRIX OF PARTICULAR PROJECT

C&I TECHNICAL SPECIFICATION FOR COMPRESSED AIR SYSTEM										
HARDWIRED SIGNALS BETWEEN COMPRESSOR CONTROL SYSTEM, DCS AND SWGR										
S. NO.	KKS TAG NO.	SOURCE	DESTINATION	DESCRIPTION	STATUS	I/O TYPE	SIGNAL TYPE	REMARKS		
1	QEB10AN001	COMPRESSOR-1 LCP	DCS PANEL	COMPRESSOR-1 REMOTE SELECTION FEEDBACK	TRUE	DI	NO			
2	QEB10AN001			COMPRESSOR-1 GENERAL WARNING FEDABCK	TRUE	DI	NO			
3	QEB10AN001			COMPRESSOR-1 GENERAL SHUTDOWN FEDABCK	TRUE	DI	NO			
4	QEB10AN001			COMPRESSOR-1 ON/OFF (RUN) FEDABCK	TRUE	DI	NO			
5	QEB10AN001			COMPRESSOR-1 READY FEEDBACK	TRUE	DI	NO			
6	QEB10CT001-6*			FIELD/VMS PANEL	DCS PANEL	COMPRESSOR-1 MOTOR WINDING TEMPERATURE (3/6nos.)*	--	AI	RTD/4-20mA***	
7	QEB10CT007-10					COMPRESSOR-1 MOTOR BEARING TEMPERATURE(4nos.)	--	AI	RTD/4-20mA***	
8	QEB10VT001-8**			COMPRESSOR-1 MOTOR VIBRATIONS(8nos.)**	--	AI	4-20mA	As applicable		
9	QEB10AN001	DCS PANEL	COMPRESSOR-1 LCP	COMPRESSOR-1 REMOTE LOAD/UNLOAD COMMAND	CMD	DO	NO	Maintained Type PFC		
10	QEB10AN001			COMPRESSOR-1 REMOTE START/STOP COMMAND	START/STOP	DO	NO	Maintained Type PFC		
11	QEB10AN001			COMPRESSOR-1 REMOTE EMERGENCY STOP	EMERG STOP	DO	NO			
12	QEB10AN001			COMPRESSOR-1 START COMMAND	START	DO	NO			
13	QEB10AN001			COMPRESSOR-1 STOP COMMAND	STOP	DO	NO			
14	QEB10AN001	COMPRESSOR-1 SWGR	COMPRESSOR-1 LCP	COMPRESSOR-1 ON FEEDBACK	ON FB	DI	NO			
15	QEB10AN001			COMPRESSOR-1 MOTOR O/L	MTR O/L	DI	NO			
16	QEB10AN001	COMPRESSOR-1 SWGR	DCS PANEL	COMPRESSOR-1 EPB OPERATED	EPB OPTD	DI	NO			
17	QEB10AN001	COMPRESSOR-1 SWGR	DCS PANEL	COMPRESSOR-1 SWGR DISTURBED FEEDBACK	SWGR DIST	DI	NO			
18	QEB10CE001	COMPRESSOR-1 SWGR	DCS PANEL	COMPRESSOR-1 MOTOR CURRENT	--	AI	4-20mA			
19	QEB20AT001	DRYER-1 LCP	DCS PANEL	DRYER-1 REMOTE SELECTED	REMOTE	DI	NO			
20	QEB20AT001			DRYER-1 RUNNING	ON	DI	NO			
21	QEB20AT001			DRYER-1 COMMON ALARM	ALARM	DI	NO			
22	QEB20AT001	DCS PANEL	DRYER-1 LCP	DRYER-1 START/STOP COMMAND	START/STOP	DO	24V DC			
23	QED20DM001	JB	DCS PANEL	DEW POINT MEASUREMENTS FOR DRYERS	--	AI	4-20mA			
24	QED25CP001			IA HEADER PRESSURE	--	AI	4-20mA			
25	QED35CP001			SA HEADER PRESSURE	--	AI	4-20mA			
NOTE:				LEGENDS:						
1. *3nos. Of winding temperature applicable for NTPC projects.				DI-DIGITAL INPUT						
2. **Vibration signals are project specific & quantity/type depends upon VMS panel/Field outputs.				DO-DIGITAL OUTPUT						
3. ***If temp transmitter envisaged then 4-20mA applicable for winding/bearing temperature.				NO-NORMALLY OPEN						
4. This signal list is for one compressor & one dryer. Similar signal list shall be applicable for other compressors/dryers also.				NC-NORMALLY CLOSED						

ITEM NO.	DESCRIPTION
1.	4.2 X 405 MM M.S. BLACK PIPE
2.	M42x2 TO 3/4" REDUCING INSERT
3.	M42x2(F) M.S.CAP
4.	3/4" SW GLOBE VALVE/GATE VALVE
5.	3/4" NPS PIPE
6.	3/4" NPS SW 3/4" NPT(M) CS/AS NIPPLE
7.	3/4" SW EQUAL TEE
8.	3/4" NPS SCH 80 CARBON/ALLOY STEEL NIPPLE
9.	3/4" NPT(F) CS/AS CAP
10.	3/4" SW CS/AS EQUAL CROSS
11.	1/2" TUBE ADAPTER
12.	3 VALVE MANIFOLD
13.	3/4" PIPE UNION
14.	2 VALVE MANIFOLD
15.	3/4" SW 4 WAY VALVE
16.	QUICK DISCONNECT FITTING
17.	3/4"SWx1/2"SW BRANCH TEE
18.	1/2" NB SEAMLESS GI PIPE
19.	1/2" NPT (F) GI FITTING
20.	SS TUBE
21.	FLEXIBLE HOSE WITH ONE END SOCKET WELDED (PIPE SIDE) & OTHER END WITH SUITABLE FITTINGS.
22.	3/4" x 1/2" S.S. TUBE UNION



1. SEE NOTES UNDER DRG. NO.0000-999-Pol-A-022.
2. IMPULSE LINE DRAIN CONNECTIONS SHALL BE DONE AS PER TECHNICAL SPECIFICATIONS.
3. THE SLOPE IN THE HORIZONTAL OF THE IMPULSE PIPE SHALL BE APPROX. 50 mm/mtr.
4. THE EXACT ORIENTATION OF THE TRANSMITTERS WITH RESPECT TO VALVE MANIFOLDS ETC. WILL BE FINALISED DURING DETAILED ENGINEERING KEEPING IN VIEW THE MANUFACTURER'S RECOMMENDATIONS.
5. COMMON INSTRUMENT AIR HEADER (1"NB) USING REDUNDANT AIR FILTER REGULATORS FOR EACH INSTRUMENT LINE SHALL BE TAPPED FROM THIS HEADER USING INDIVIDUAL PURGE ROTAMETERS AS SHOWN IN DRG. NO. 0000-999-Pol-A-034 TYPICALLY.

FOR TENDER PURPOSE ONLY

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NTPC LIMITED
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ENGINEERING DIVISION

TYPICAL THERMAL POWER PROJECT

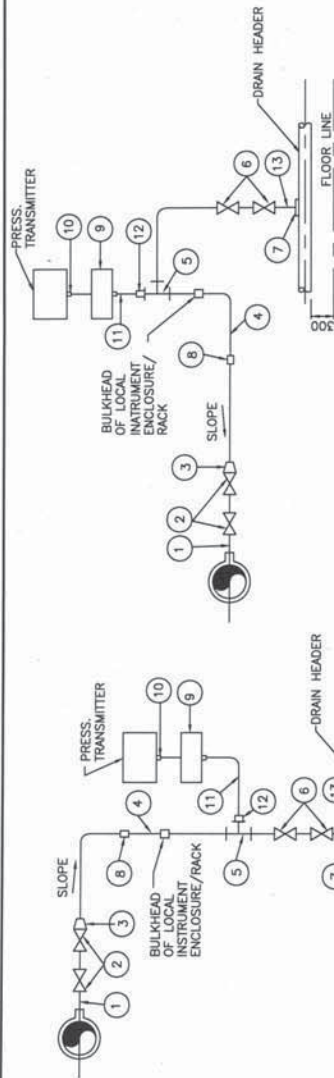
INSTRUMENT INSTALLATION DIAGRAM
(PRESSURE MEASUREMENT USING PRESS / DP TRANSMITTERS
(INST./SERVICE, DIRTY AIR/FLUE GAS))

SIZE A3	SCALE 1:100	DRG. NO. 0000-999-POI-A-023	REV. NO. A
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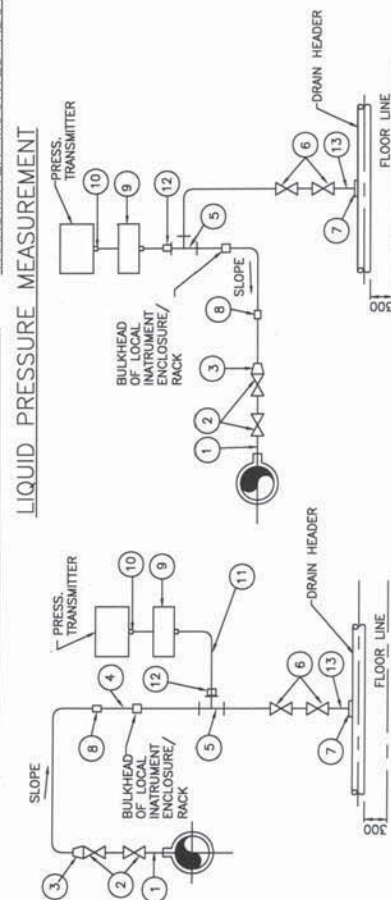
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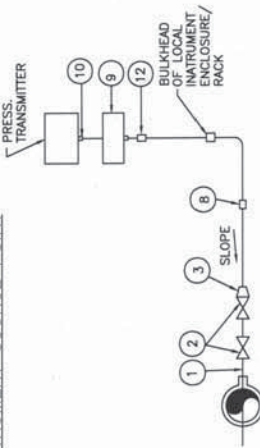
ITEM NO.	DESCRIPTION
1.	1/2" x 3/4" NPS SCH. 80/160 XS/P91 NIPPLE OF MATERIAL SAME AS THAT OF MAIN PIPE.
2.	3/4" / 1" SW GLOBE VALVE.
3.	3/4" / 1" TO 1/2" REDUCING INSERT
4.	1/2" NPS PIPE
5.	1/2" SW EQUAL TEE
6.	1/2" SW GLOBE VALVE
7.	1/2" NPS SCH. 80/160 SW 1/2" CS/AS COUPLER
8.	1/2" PIPE UNION
9.	2/3 VALVE MANIFOLD (FOR DETAIL SEE DRAWING RG.0060-102-F01-A-025).
10.	SUITABLE ADAPTER
11.	SS TUBE
12.	1/2" PIPE x 1/2" TUBE UNION
13.	1/2" NPS SCH. 80/160 SW 1/2" NPT(M) CS/AS NIPPLE



PAGE	ELEVATION	ELEVATION
712	TRANSMITTER MOUNTED BELOW INSTRUMENT SOURCE POINT	TRANSMITTER MOUNTED ABOVE INSTRUMENT SOURCE POINT
		13.



ELEVATION	TRANSMITTER MOUNTED ABOVE INSTRUMENT SOURCE POINT	ELEVATION	TRANSMITTER MOUNTED BELOW INSTRUMENT SOURCE POINT	STEAM PRESSURE MEASUREMENT



ELEVATION
VACCUUM PRESSURE MEASUREMENT

NOTES:-

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

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ENGINEERING DIVISION

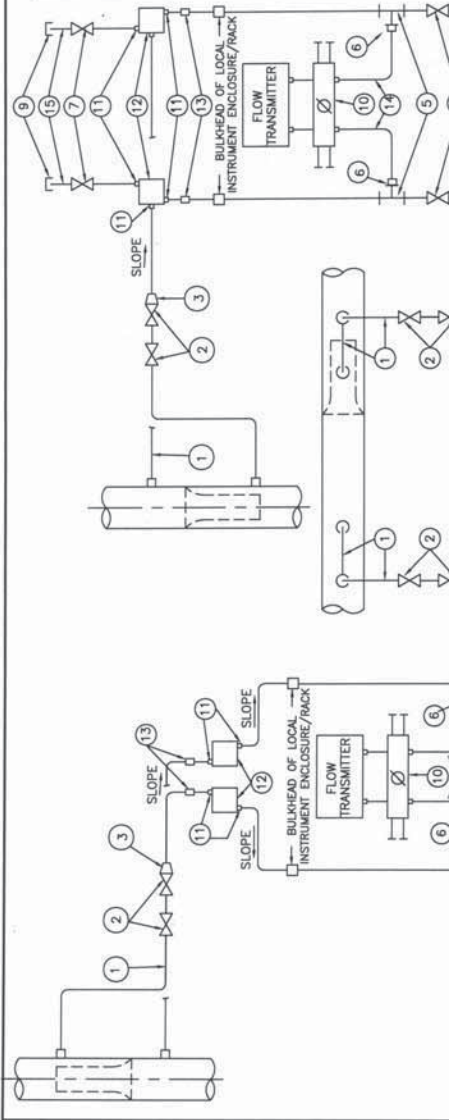
TYPICAL THERMAL POWER PROJECT

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

A	FIRST ISSUE								21.08.12	TRANSMITTERS STEAM/LIQUID VACUUM)					REV. NO.	A
D E S C R I P T I O N		DRAWN	DESIGN	CHKD.	M	E	C	C&I	ARCH.	APPD	DATE	SIZE A3	SCALE N.T.S.	DRG. NO. 0000-999-POI-A-025		
					CLEARED BY											

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LIST OF MATERIALS	
ITEM NO.	DESCRIPTION
1.	3/4" / 1" NPS SCH. 80/160 XS/P91 (AS PER PROCESS REQUIREMENT, 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 TEE
6.	1/2" PIPE x 1/2" TUBE UNION
7.	1/2" SW GLOBE VALVE.
8.	1/2" NPS SCH. 80/160 SW x 1/2" SW CS/AS COUPLER
9.	1/2" NPT (F) CAP
10.	5 VALVE MANIFOLD
11.	SUITABLE ADAPTER
12.	CONDENSATE POT (RESERVOIR)
13.	1/2" PIPE UNION
14.	SS TUBE
15.	1/2" NPS SCH. 80/160 SW x 1/2" NPT (M) CS/AS NIPPLE



- NOTES:-**
1. SAME NOTES UNDER DRG. NO. 0000-999-POI-A-023.
 2. CONDENSATE POTS SHALL BE PROVIDED FOR ALL STEAM SERVICES.
 3. FOR WATER SERVICES CONDENSATE POTS SHALL BE PROVIDED ONLY IN THOSE CASES WHERE TEMP. > 120°C

FOR TENDER PURPOSE ONLY

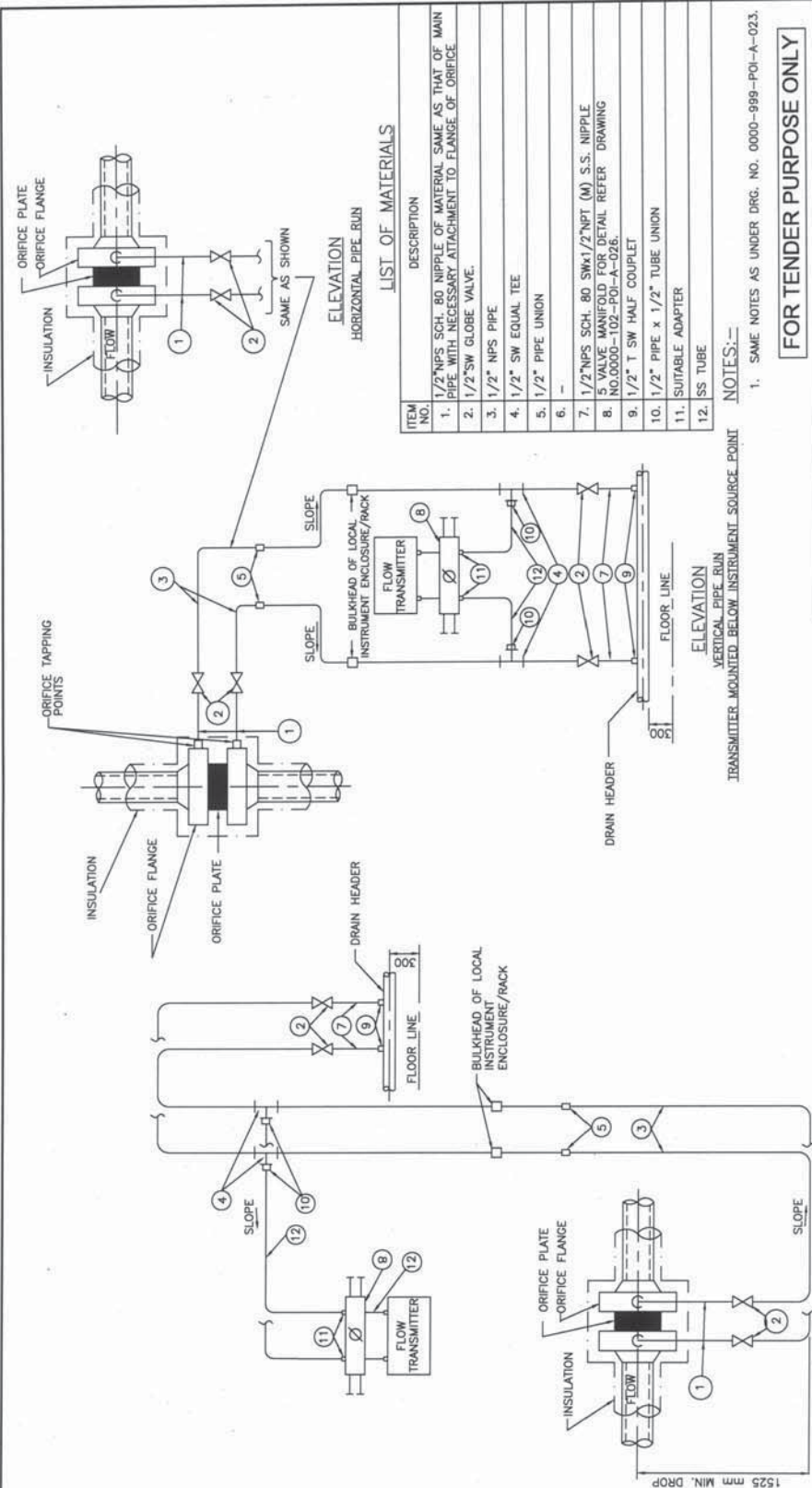
NTPC LIMITED
(A GOVERNMENT OF INDIA ENTERPRISE)
ENGINEERING DIVISION

TYPICAL THERMAL POWER PROJECT

TITLE		INSTRUMENT INSTALLATION DIAGRAM FLOW MEASUREMENT (USING FLOW NOZZLES) STEAM & FEEDWATER		REV. NO. A
SIZE A3	SCALE N.T.S.	DRG. NO. 0000-999-POI-A-026		

REV/NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	E	C	C&I	ARCH.	APPD	DATE
A	FIRST ISSUE										21.08.12

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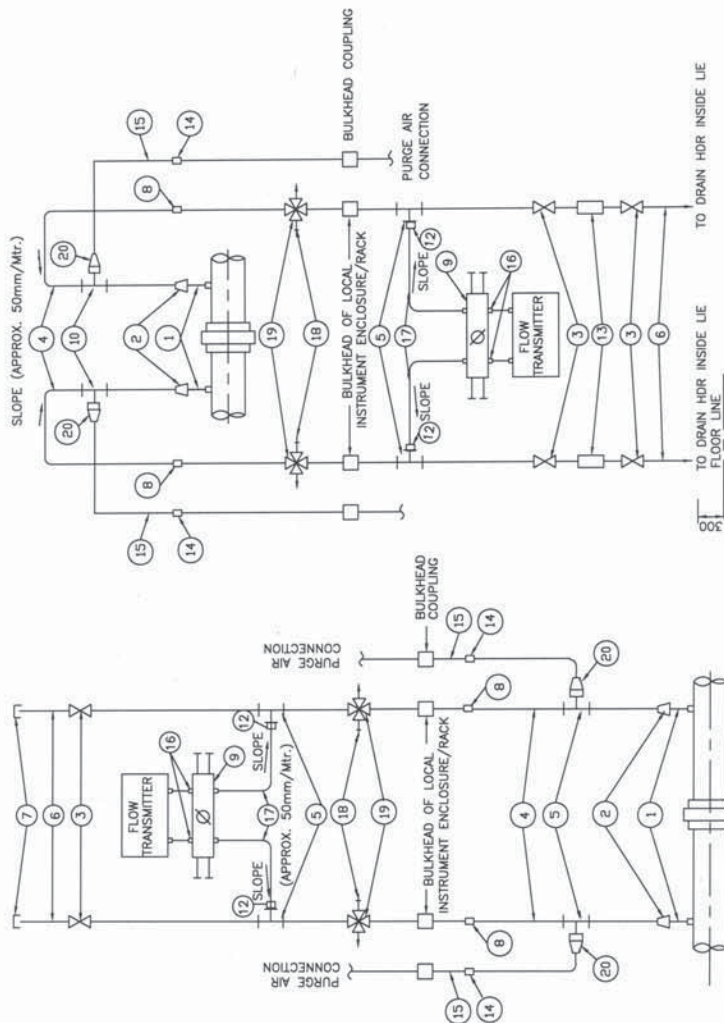
NTPC LIMITED (A GOVERNMENT OF INDIA ENTERPRISE) ENGINEERING DIVISION		PROJECT		TYPICAL THERMAL POWER PROJECT	
TITLE		INSTRUMENT INSTALLATION DIAGRAM		FLOW MEASUREMENT (USING ORIFICE PLATES)	
REV. NO.		SCALE		DRG. NO.	
A		A3		0000-999-POI-A-027	
FIRST ISSUE		DATE		REV. NO.	
A		21.08.12		A	
DRAWN DESIGN CHKD.		APPD		N.T.S.	
DESCRIPTION		T.G.		C&I	
		M		E	
		C		ARCH.	
		CLEARED BY			

LIST OF MATERIALS

ITEM NO.	DESCRIPTION
1.	42x4.05mm M.S. BLACK PIPE.
2.	M 42x2 TO 3/4"SW REDUCING INSERT.
3.	3/4" SW GLOBE VALVE.
4.	3/4" PIPE.
5.	3/4" SW EQUAL TEE.
6.	3/4" SCH. 80 SWx3/4" NPT (M) CS/AS NIPPLE
7.	3/4" NPT (F) CAP.
8.	3/4" PIPE UNION.
9.	5 VALVE MANIFOLD FOR DETAIL REFER DRAWING NO.0000-102-POI-A-028.
10.	3/4" SW EQUAL TEE.
11.	3/4" SW GATE VALVE.
12.	3/4" PIPE x 1/2" TUBE UNION
13.	DRAIN POT.
14.	1/2" GI FITTING
15.	1/2" NB GI PIPE
16.	SUITABLE ADAPTER
17.	SS TUBE
18.	QUICK DISCONNECT FITTINGS.
19.	3/4" SW 4 WAY VALVE.
20.	3/4" x1/2" REDUCER.

NOTES:-

1. SAME NOTES AS UNDER DRG. NO. 0000-999-POI-A-023.



ELEVATION
 TRANSMITTER MOUNTED ABOVE INSTRUMENT SOURCE POINT
 ELEVATION
 TRANSMITTER MOUNTED BELOW INSTRUMENT SOURCE POINT

FOR TENDER PURPOSE ONLY

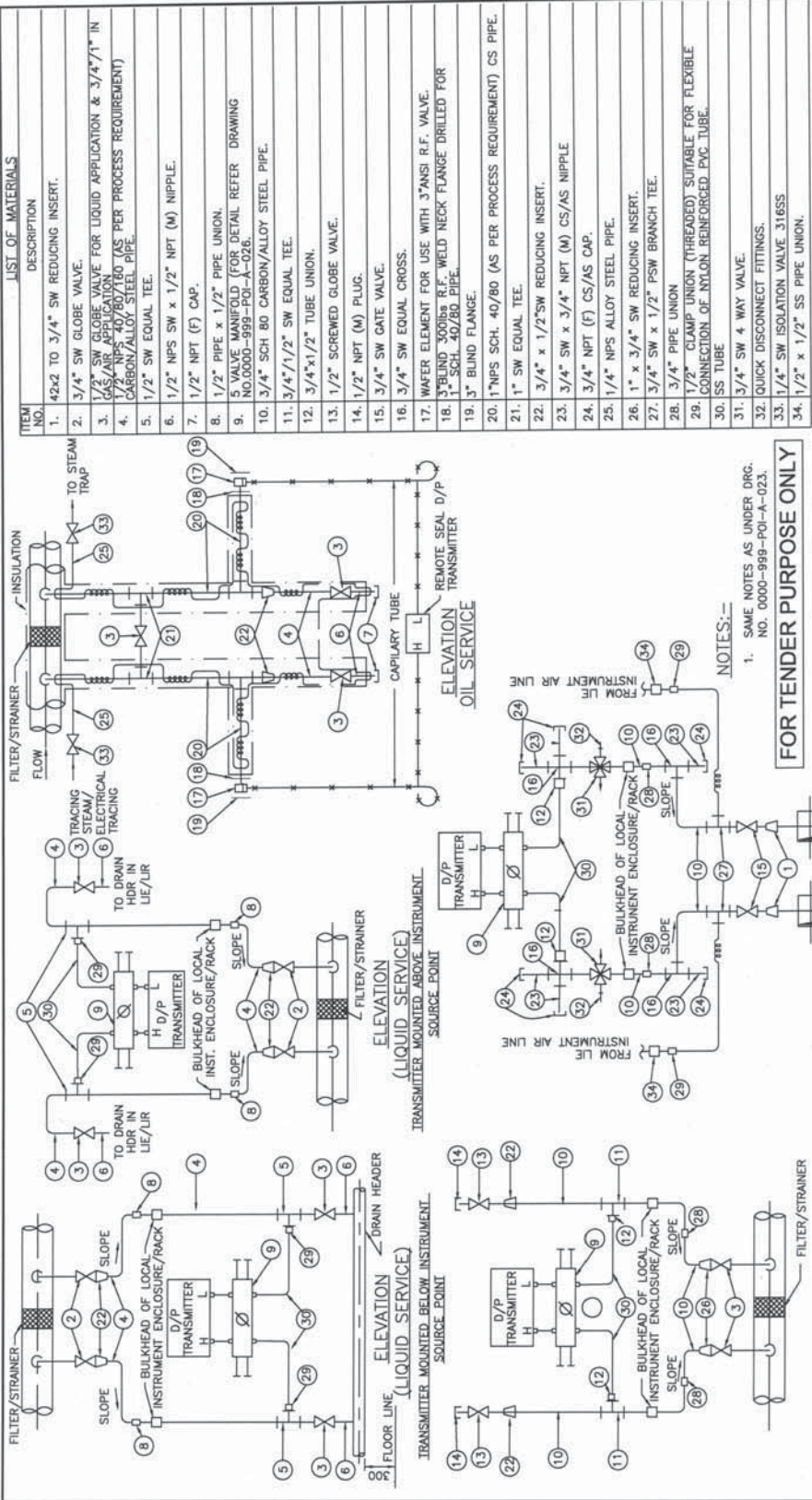


NTPC LIMITED
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 ENGINEERING DIVISION

TYPICAL THERMAL POWER PROJECT

INSTRUMENT INSTALLATION DIAGRAM
 (FLOW MEASUREMENT AIR/GAS)

PROJECT		TITLE	
SIZE	A3	SCALE	N.T.S.
DRG. NO.	0000-999-POI-A-028	REV. NO.	B
Cleared by			
DESIGN	CHKD.	DATE	21.08.12
APPD.	ARCH.		
M	E	C	CAI
DESCRIPTION			
REV. NO.	A	FIRST ISSUE	



ITEM NO.	DESCRIPTION
1.	42x2 TO 3/4" SW REDUCING INSERT.
2.	3/4" SW GLOBE VALVE.
3.	1/2" SW GLOBE VALVE FOR LIQUID APPLICATION & 3/4"/1" IN
4.	1/2" NPS SCH 40/80/100 (AS PER PROCESS REQUIREMENT)
5.	1/2" NPS SCH 80 CARBON/ALLOY STEEL PIPE.
6.	1/2" SW EQUAL TEE.
7.	1/2" NPS SW x 1/2" NPT (M) NIPPLE.
8.	1/2" NPT (F) CAP.
9.	5 VALVE MANIFOLD (FOR DETAIL REFER DRAWING NO.0000-999-POI-A-026).
10.	3/4" SCH 80 CARBON/ALLOY STEEL PIPE.
11.	3/4"/1/2" SW EQUAL TEE.
12.	3/4"x1/2" TUBE UNION.
13.	1/2" SCREWED GLOBE VALVE.
14.	1/2" NPT (M) PLUG.
15.	3/4" SW GATE VALVE.
16.	3/4" SW EQUAL CROSS.
17.	WATER ELEMENT FOR USE WITH 3"ANSI R.F. VALVE.
18.	3"BLIND 300lbs R.F. WELD NECK FLANGE DRILLED FOR 1" SCH. 40/80 PIPE.
19.	3" BLIND FLANGE.
20.	1"NPS SCH. 40/80 (AS PER PROCESS REQUIREMENT) CS PIPE.
21.	1" SW EQUAL TEE.
22.	3/4" x 1/2"SW REDUCING INSERT.
23.	3/4" SW x 3/4" NPT (M) CS/AS NIPPLE
24.	3/4" NPT (F) CS/AS CAP.
25.	1/4" NPS ALLOY STEEL PIPE.
26.	1" x 3/4" SW REDUCING INSERT.
27.	3/4" SW x 1/2" PSW BRANCH TEE.
28.	3/4" PIPE UNION
29.	1/2" CLAMP UNION (THREADED) SUITABLE FOR FLEXIBLE CONNECTION OF NYLON REINFORCED PVC TUBE.
30.	SS TUBE
31.	3/4" SW 4 WAY VALVE.
32.	QUICK DISCONNECT FITTINGS.
33.	1/4" SW ISOLATION VALVE 316SS
34.	1/2" x 1/2" SS PIPE UNION.

NTPC LIMITED (A GOVERNMENT OF INDIA ENTERPRISE) ENGINEERING DIVISION		PROJECT		TYPICAL THERMAL POWER PROJECT	
TITLE		INSTRUMENT INSTALLATION DIAGRAM		REV. NO.	
DIFF. PRESS.MEASUREMENT (LIQUID, OIL, AIR/GAS SERVICE)		SCALE		A	
SIZE		A3		DRG. NO.	
DATE		21.08.12		0000-999-POI-A-030	
APPD		T.G.		N.T.S.	
ARCH.		C&I		A	
E		M		A	
C		C		A	
M		M		A	
DESIGN CHKD.		DESIGN CHKD.		A	
DRAWN		DRAWN		A	
DESCRIPTION		DESCRIPTION		A	
FIRST ISSUE		FIRST ISSUE		A	
REV.NO.		REV.NO.		A	

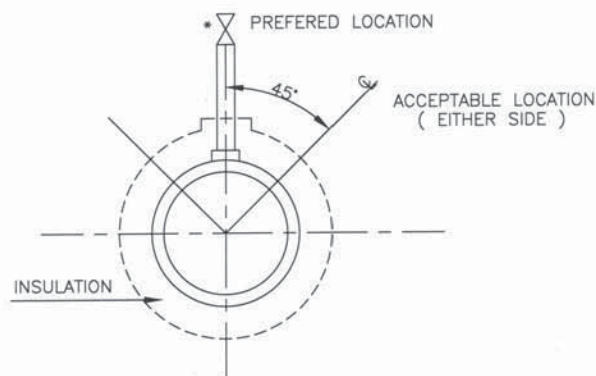
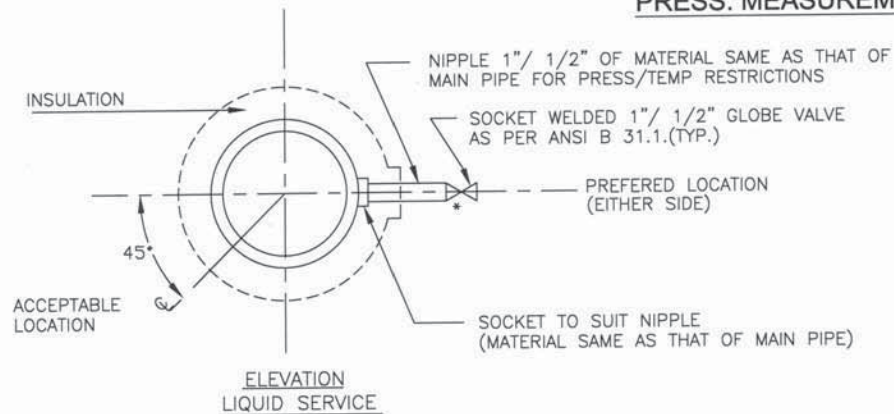
FOR TENDER PURPOSE ONLY

NOTES:-
1. SAME NOTES AS UNDER DRG. NO. 0000-999-POI-A-023.

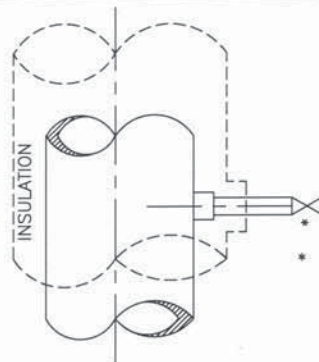
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PRESS. MEASUREMENT



PRESSURE CONNECTION ON HORIZONTAL PIPE



* USE DOUBLE ISOLATION VALVES FOR PRESSURE EQUAL TO OR EXCEEDING 40 Kg/Cm2.

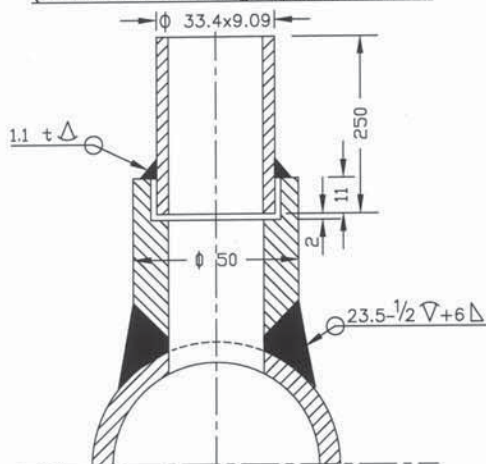
PRESSURE CONNECTIONS ON VERTICAL PIPES

FOR TENDER PURPOSE ONLY

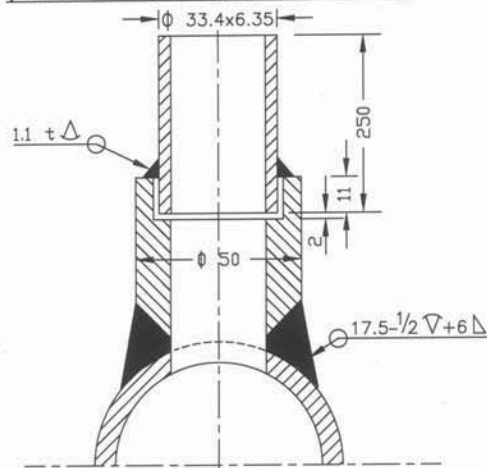
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PROJECT TYPICAL THERMAL POWER PROJECT											
TITLE INSTRUMENT SOURCE CONNECTION DETAILS											
A	FIRST ISSUE	DR	DESIGN	CHKD.	M	E	C	CL	ARCH.	APPD.	DATE
REV. NO.	DESCRIPTION	DR	DESIGN	CHKD.	M	E	C	CL	ARCH.	APPD.	DATE
Cleared by										SIZE A4	SCALE N.T.S.
										DRG. NO. 0000-999-POI-A-035	REV. NO. A

PRESSURE MEASUREMENT

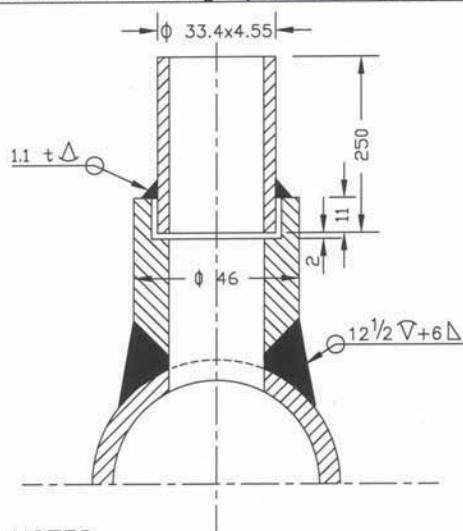
(SYSTEM PR. >40Kg/Sq Cm CL 9000)



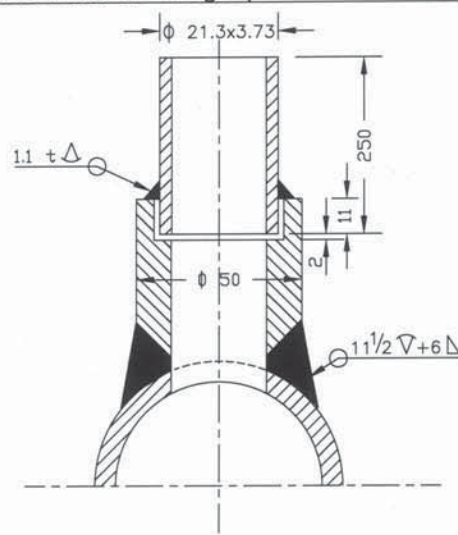
(SYSTEM PR. >40Kg/Sq Cm CL 6000)



(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 ALIGNMENT WITH HOLE IN THE COUPLING.
8. ALL DIMENSIONS ARE IN mm UNLESS OTHERWISE STATED.

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PROJECT TYPICAL THERMAL POWER PROJECT

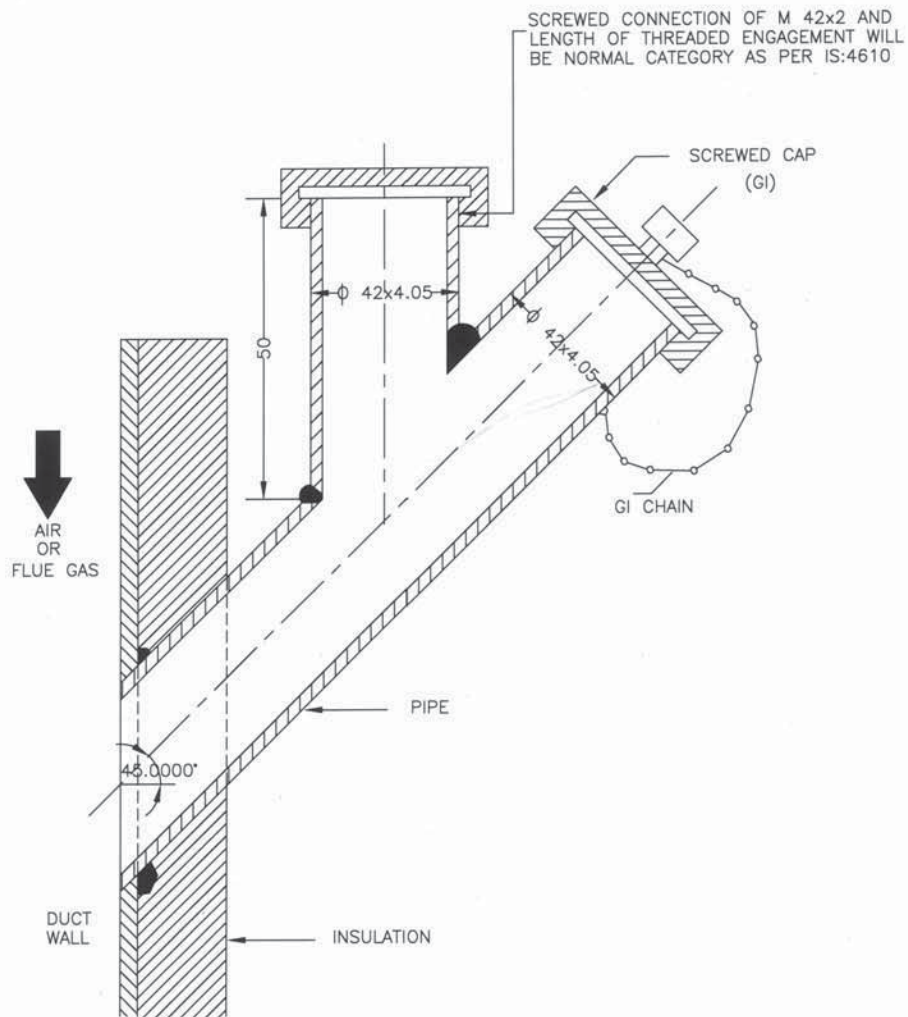
TITLE INSTRUMENT SOURCE CONNECTION DETAILS

REV. NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	W	E	C	DAI	ARCH.	APPRO.	DATE
A	FIRST ISSUE										

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

Sh-2 of 14

PRESS. MEASUREMENT



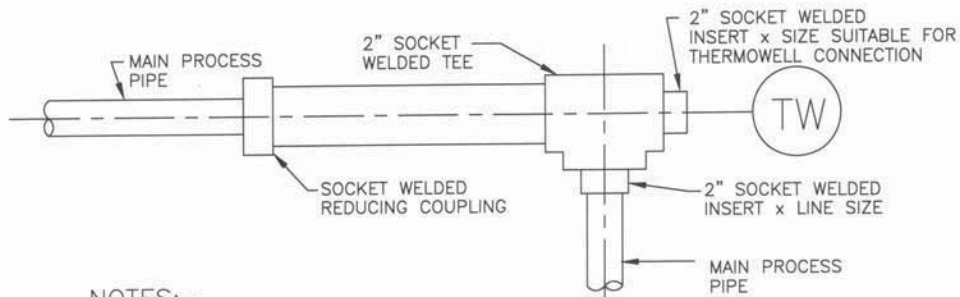
NOTES:-

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

FOR TENDER PURPOSE ONLY

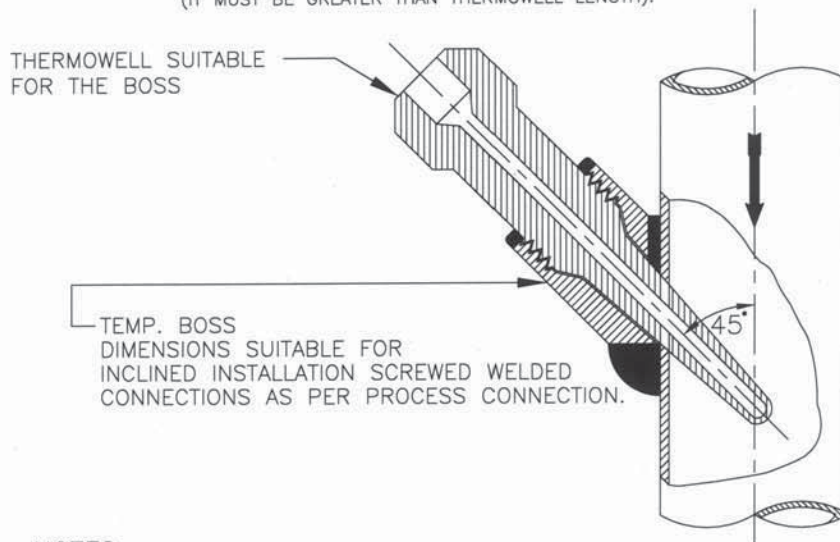
		NTPC LIMITED (A GOVERNMENT OF INDIA ENTERPRISE) ENGINEERING DIVISION	
PROJECT		TYPICAL THERMAL POWER PROJECT	
TITLE		INSTRUMENT SOURCE CONNECTION DETAILS	
REV. NO.	DESCRIPTION	DRWN/DESIGN CHKD.	M E C DLT ARCH. APPD. DATE 31.08.12 CLEARED BY
A	FIRST ISSUE		SIZE A4 SCALE N.T.S. DRG. NO. 0000-999-POI-A-035 Sh-3 Of 14 REV. NO. A

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).



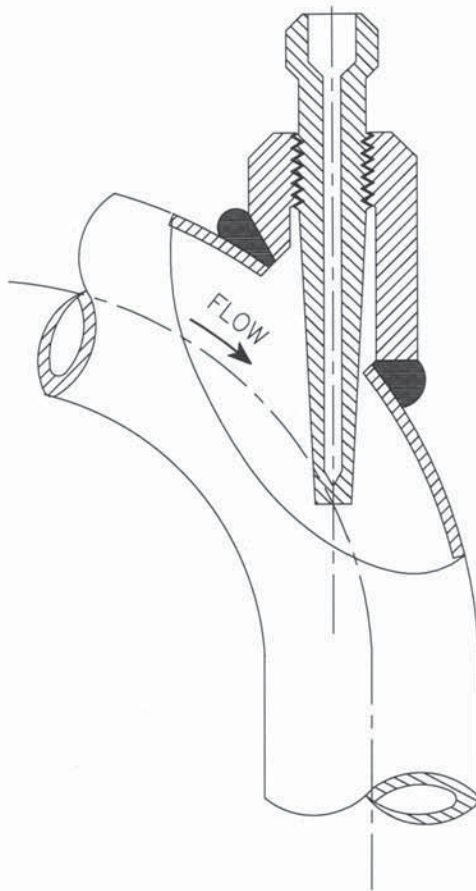
NOTES:-

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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NTPC LIMITED (A GOVERNMENT OF INDIA ENTERPRISE) ENGINEERING DIVISION PROJECT: TYPICAL THERMAL POWER PROJECT (SG PACKAGE) TITLE: INSTRUMENT SOURCE CONNECTION DETAILS												
REV. NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	W	E	C	DATE	SIZE	SCALE	DRG. NO.	REV. NO.
A	FIRST ISSUE							31.08.18	A4	N.T.S.	0000-999/102-POI-A-035	A
Cleared By										Sh-4 of 14		

TEMP. MEASUREMENT



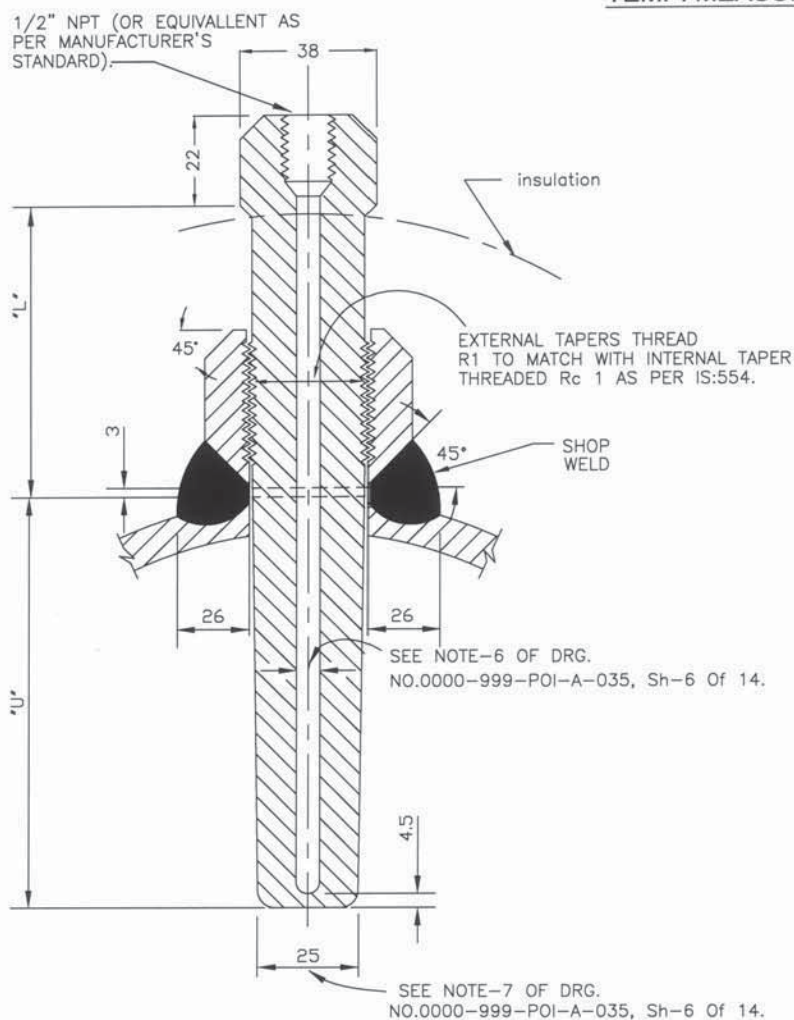
NOTES:-

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.

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<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 5%;">REV. NO.</td> <td style="width: 25%;">DESCRIPTION</td> <td style="width: 10%;">DRAWN</td> <td style="width: 10%;">DESIGN</td> <td style="width: 10%;">CHKD.</td> <td style="width: 10%;">M</td> <td style="width: 10%;">E</td> <td style="width: 10%;">C</td> <td style="width: 10%;">CAL</td> <td style="width: 10%;">ARCH.</td> <td style="width: 10%;">APPD.</td> <td style="width: 10%;">DATE</td> </tr> <tr> <td colspan="12" style="text-align: center;">Cleared By</td> </tr> </table> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 15%;">PROJECT</td> <td colspan="5">TYPICAL THERMAL POWER PROJECT</td> </tr> <tr> <td style="width: 15%;">TITLE</td> <td colspan="5">INSTRUMENT SOURCE CONNECTION DETAILS</td> </tr> <tr> <td style="width: 15%;">SIZE</td> <td style="width: 15%;">SCALE</td> <td style="width: 15%;">DRG. NO.</td> <td style="width: 25%;">0000-999-POI-A-035</td> <td style="width: 15%;">REV. NO.</td> <td style="width: 10%;">A</td> </tr> <tr> <td>A4</td> <td>N.T.S.</td> <td colspan="2"></td> <td colspan="2" style="text-align: right; font-size: small;">Sh-5 of 14</td> </tr> </table>										REV. NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	E	C	CAL	ARCH.	APPD.	DATE	Cleared By												PROJECT	TYPICAL THERMAL POWER PROJECT					TITLE	INSTRUMENT SOURCE CONNECTION DETAILS					SIZE	SCALE	DRG. NO.	0000-999-POI-A-035	REV. NO.	A	A4	N.T.S.			Sh-5 of 14	
REV. NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	E	C	CAL	ARCH.	APPD.	DATE																																														
Cleared By																																																									
PROJECT	TYPICAL THERMAL POWER PROJECT																																																								
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SIZE	SCALE	DRG. NO.	0000-999-POI-A-035	REV. NO.	A																																																				
A4	N.T.S.			Sh-5 of 14																																																					

TEMP. MEASUREMENT

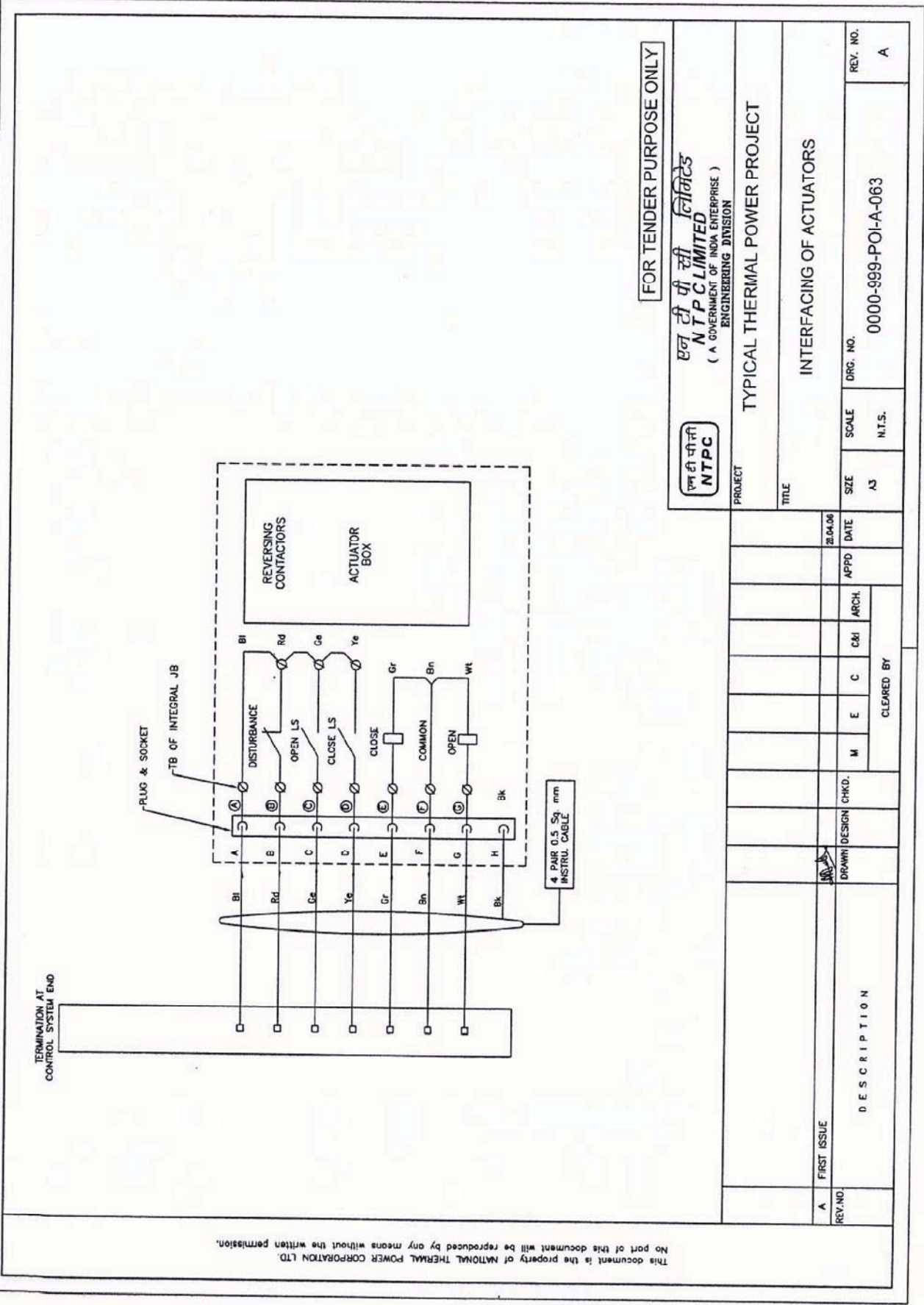


NOTES:-

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.

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PROJECT		TYPICAL THERMAL POWER PROJECT													
TITLE		INSTRUMENT SOURCE CONNECTION DETAILS													
REV. NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	W	E	C	CLT	ARCH.	APPD.	DATE	SIZE	SCALE	DRG. NO.	REV. NO.
A	FIRST ISSUE											A4	N.T.S.	0000-999-POI-A-035	A
Cleared by												Sh-7 Of 14			



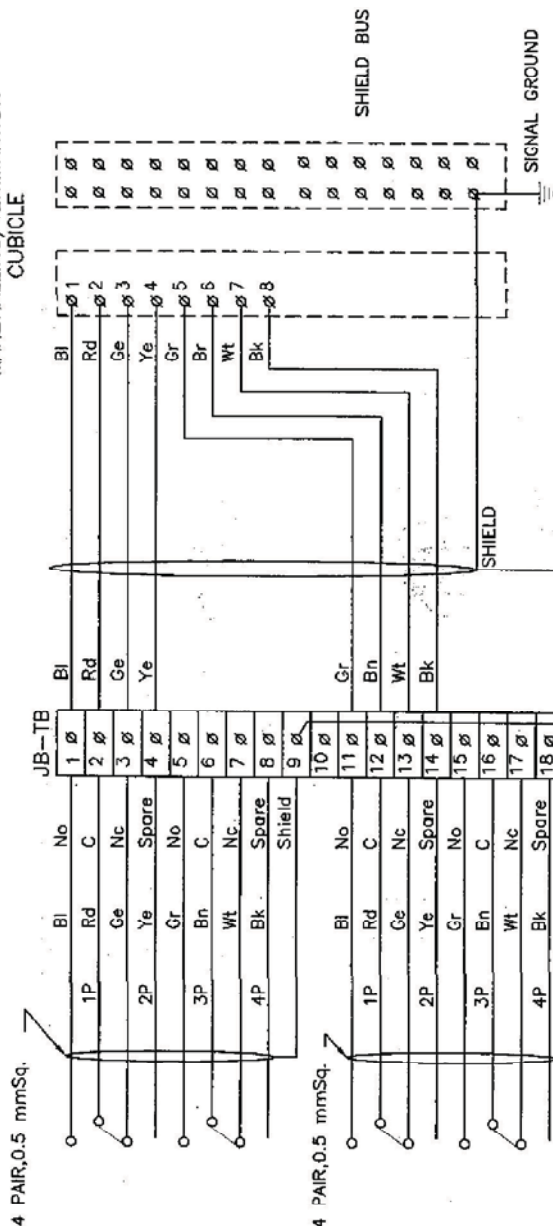
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PROJECT			
TYPICAL THERMAL POWER PROJECT			
TITLE			
INTERFACING OF ACTUATORS			
REV. NO.	SIZE	SCALE	DRG. NO.
A	A3	N.T.S.	0000-999-POI-A-063
			REV. NO.
			A

REV. NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	CLEARED BY						APPD	DATE
					M	E	C	C&I	ARCH.			
A	FIRST ISSUE											28.04.06

MARSHALLING/TERMINATION CUBICLE



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ENGINEERING DIVISION

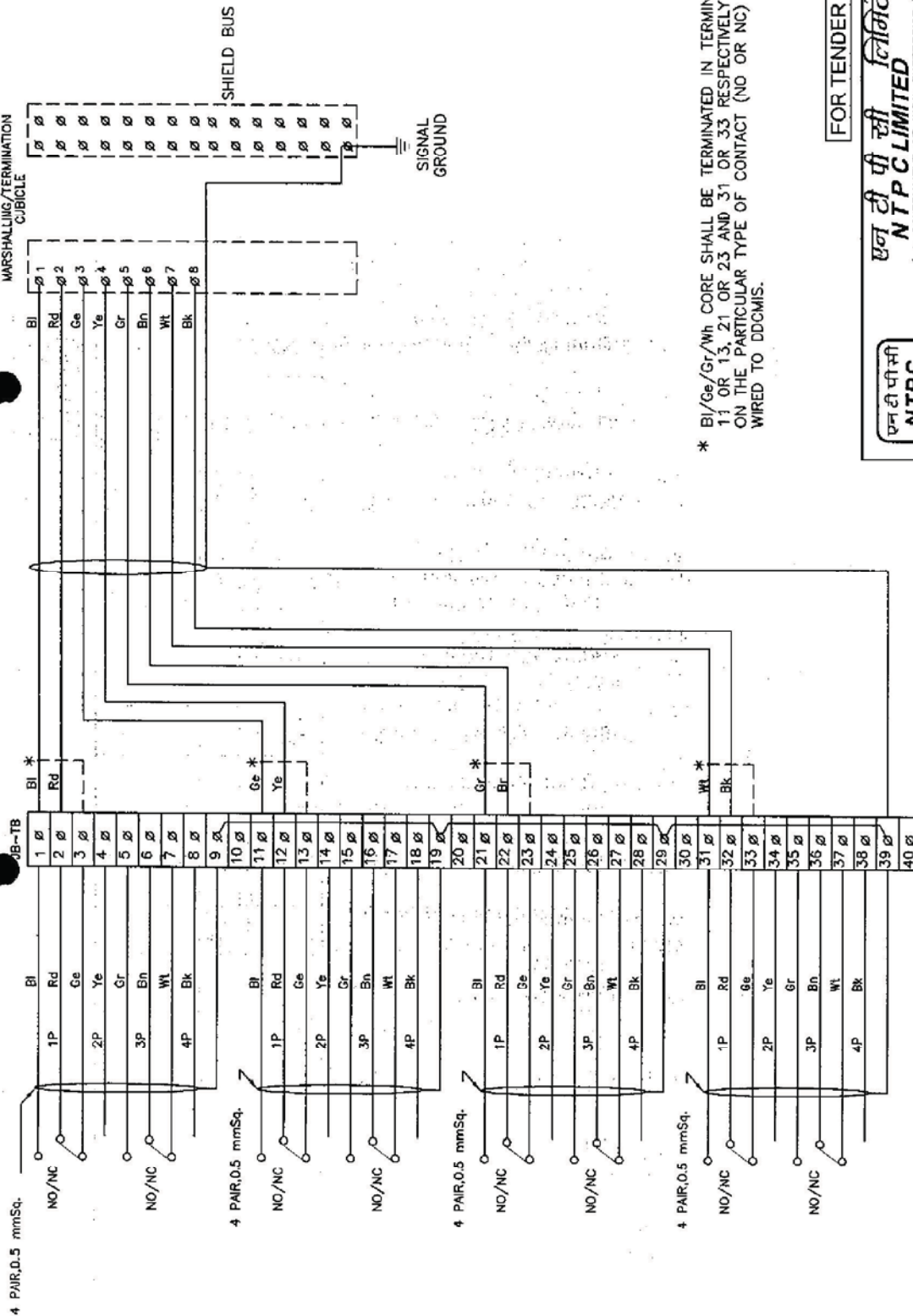
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NTPC

PROJECT TYPICAL THERMAL POWER PROJECT

TITLE INTERFACING OF FIELD INSTRUMENTS/
SWGR SWITCH (COC) TERMINATION DETAILS

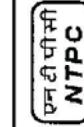
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A	FIRST ISSUE										19.04.08	A3	0000-999-POI-A-065	A
												NTS	SH 01 OF 14	

28/06/2018



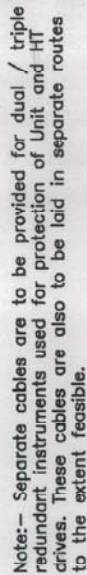
* BI/Ge/Gr/Wl core shall be terminated in terminal 1 or 3, 11 or 13, 21 or 23 and 31 or 33 respectively depending on the particular type of contact (NO or NC) is to be wired to DDCMIS.

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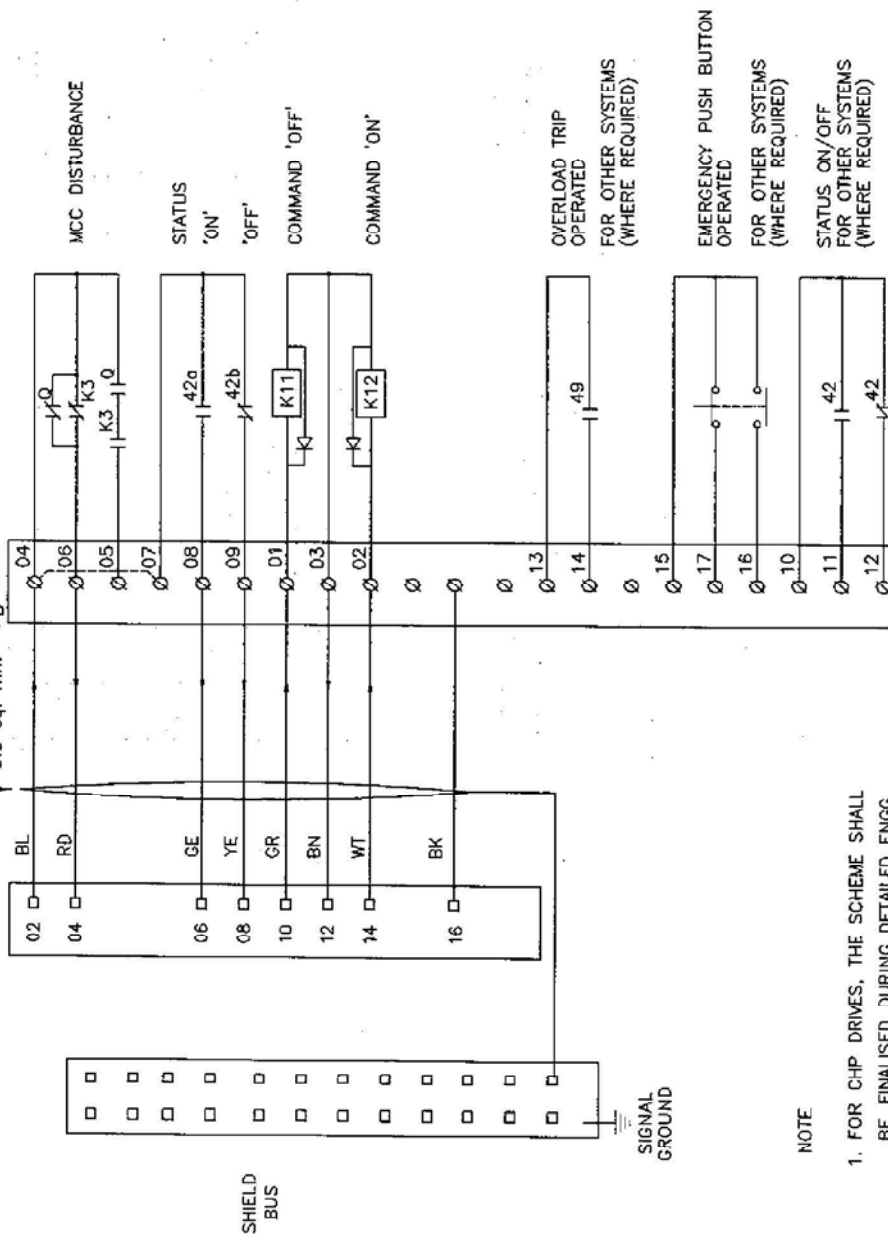
PROJECT										TYPICAL THERMAL POWER PROJECT																																																																																																																																																																																																																	
TITLE										INTERFACING OF FIELD INSTRUMENTS SWITCH TERMINATION DETAILS NO/NC																																																																																																																																																																																																																	
A										FIRST ISSUE										28.04.08										DATE										APPD.										ARCH.										C&I										C										E										M										CHKD.										DRAWN DESIGN										DESCRIPTION										REV. NO.										A										SH 02 OF 14										0000-999-POI-A-065										DRG. NO.										SCALE										NTS										SIZE										A3									
A										FIRST ISSUE										28.04.08										DATE										APPD.										ARCH.										C&I										C										E										M										CHKD.										DRAWN DESIGN										DESCRIPTION										REV. NO.										A										SH 02 OF 14										0000-999-POI-A-065										DRG. NO.										SCALE										NTS										SIZE										A3									



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(A GOVERNMENT OF INDIA ENTERPRISE)
ENGINEERING DIVISION

ENGINEERING DIVISION															
PROJECT		TYPICAL THERMAL POWER PROJECT													
TITLE		INTERFACING OF FIELD INSTRUMENTS 4-20mA													
REV.NO.	SCALE	DWG. NO.	REV. NO.												
	A3	NTS		0000-999-POI-A-065 SH 04 OF 14 C											
C	NOTE REGARDING CABLE IS ADDED.														10.12.13
B	INTERNAL WIRING FOR LIE/LUR MOUNTED SHOWN WIRING OF STAND ALONE TXTR SHOWN														10.12.08
A	FIRST ISSUE														12.1.05
REV.NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	E	C	C&I	ARCH.	APPD	DATE	SIZE	SCALE	DWG. NO.	REV. NO.
					CLEARED BY							A3	NTS		

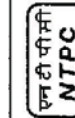
MARSHALLING/ TERMINATION CUBICLES 4 PAIR, 0.5 Sq. mm D MCC/SWGR



NOTE

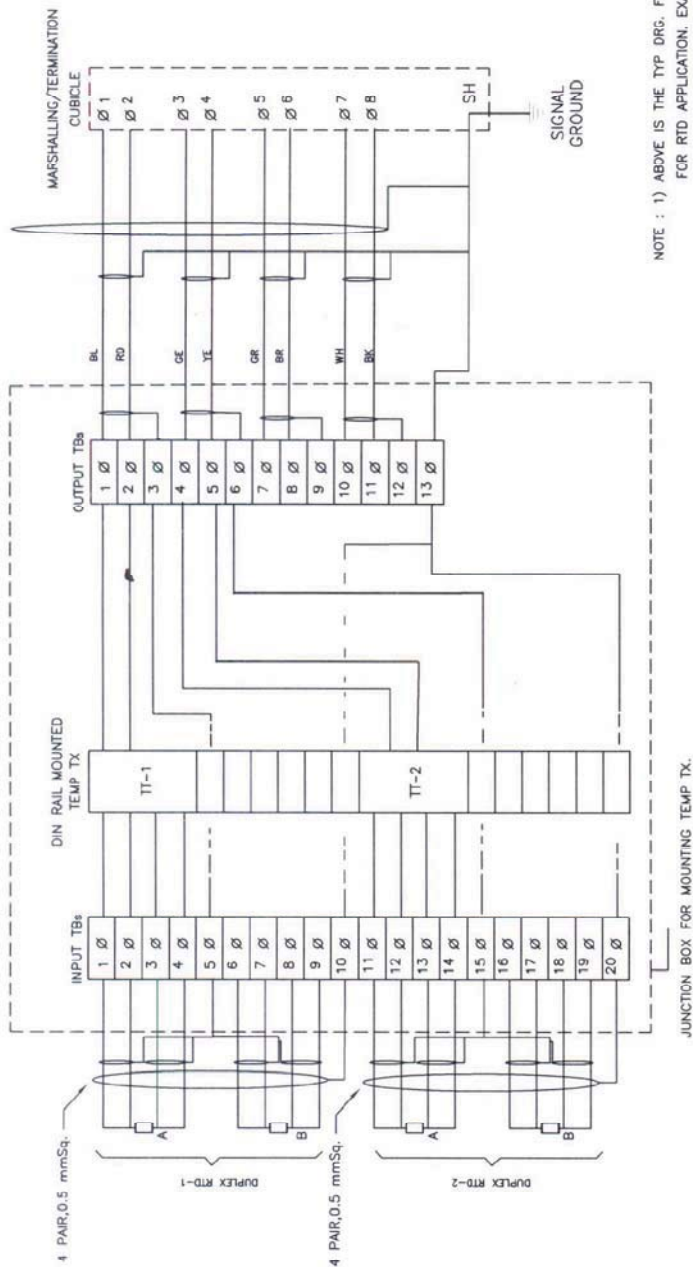
1. FOR CHP DRIVES, THE SCHEME SHALL BE FINALISED DURING DETAILED ENGG.

FOR TENDER PURPOSE ONLY



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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 (LT MOTORS)									
REV.NO.	DESCRIPTION	SIZE	SCALE	DRG. NO.	REV. NO.						
		A3	NTS		0000-999-POI-A-065 SH 05 OF 14 A						
A	FIRST ISSUE	DATE	APPD	ARCH.	C					10.04.08	
					M	E	C	CAD			



NOTE : 1) ABOVE IS THE TYP DRG. FOR DIN RAIL MOUNTED TEMP TRANSMITTERS FOR RTD APPLICATION. EXACT TYPE OF TEMP TRANSMITTER SHALL BE AS PER PART-A OF SPECIFICATION.
2) THE EXACT GROUPING OF TEMP TXs SHALL BE FINALISED DURING DETAILED ENGG. STAGE.

FOR TENDER PURPOSE ONLY

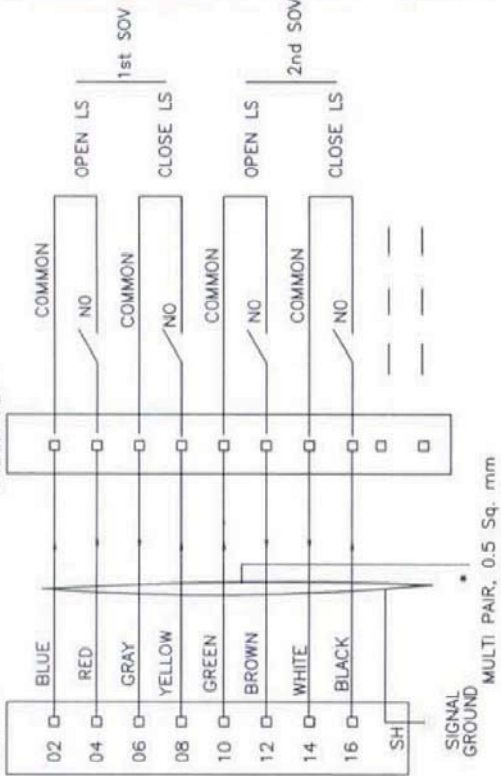


NTPC LIMITED
(A GOVERNMENT OF INDIA ENTERPRISE)
ENGINEERING DIVISION

PROJECT										TYPICAL THERMAL POWER PROJECT									
TITLE										INTERFACING OF FIELD INSTRUMENTS TYPICAL RTD CONNECTION WITH TEMP TRANSMITTERS INJBS									
REV. NO.	A	FIRST ISSUE	DRAWN	DESIGN	CHKD	M	E	C	C&I	ARCH.	APPD	DATE	SCALE	DRG. NO.	0000-999-POI-A-065	REV. NO.	C	SH 06 OF 14	

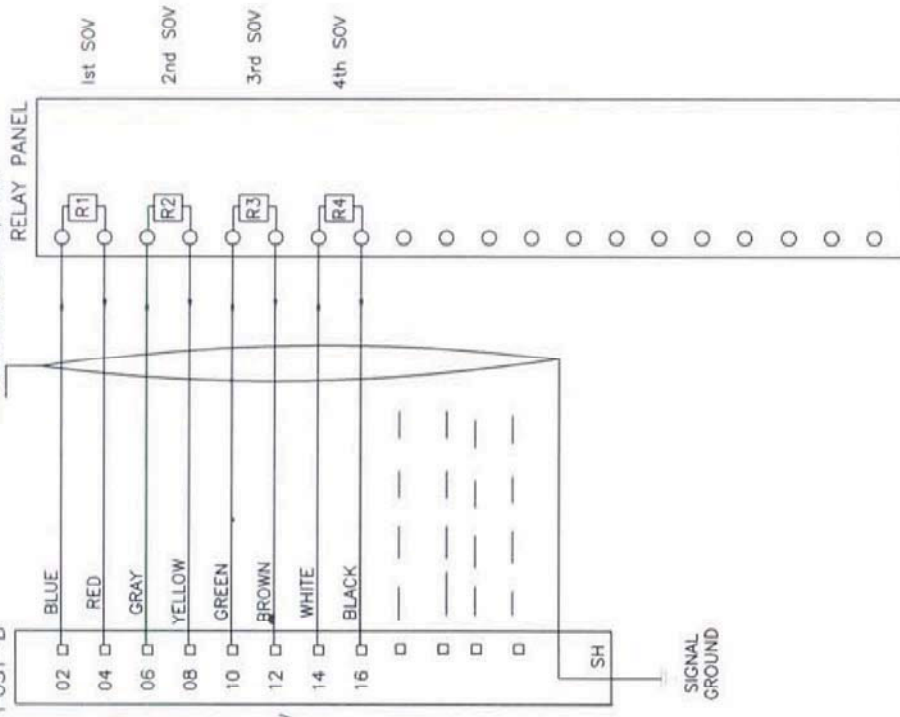
Marshalling/ Termination Cubicle
POST-A

FIELD JB *



Marshalling/
Termination Cubicle
POST-B

** MULTI PAIR, 0.5 Sq. mm



- 1) * FEEDBACKS OF SOVs CAN BE GROUPED IN FIELD JB AND MULTI PAIR CABLE IS TO BE USED FROM FIELD JB TO MARSHALLING/TERMINATION CUBICLE FOR FEEDBACKS OF GROUP OF SOVs. TYP ARRANGEMENT IS SHOWN FOR A GROUP OF TWO SOVs WITH OPEN AND CLOSE LIMIT SWITCHES.
- 2) NO. OF LIMIT SWITCHES/NO. OF CONTACT IN LIMIT SWITCHES SHALL BE PROVIDED FOR EACH VALVE AS PER SPEC. REQUIREMENT/ PHILOSOPHY FOR RESPECTIVE SYSTEM.
- 3) ** MULTIPAIR CABLE IS TO BE USED FOR CONNECTION OF COMMAND OUTPUTS FROM MARSHALLING/TERMINATION CUBICLE TO RELAY PANEL FOR A GROUP OF SOVs.

एन टी पी सी
NTPC

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

PROJECT

TYPICAL THERMAL POWER PROJECT

TITLE

INTERFACING OF FIELD INSTRUMENTS
INTERFACE OF DDCMIS WITH MCC/SWGR/ACTUATOR
(SINGLE COIL SOLENOID)

SIZE

A3

SCALE

NTS

DRG. NO.

0000-999-POI-A-065

REV. NO.

C

SH 08 OF 14

CLEARED BY

M E C

ARCH.

APPD

DATE

30.10.02

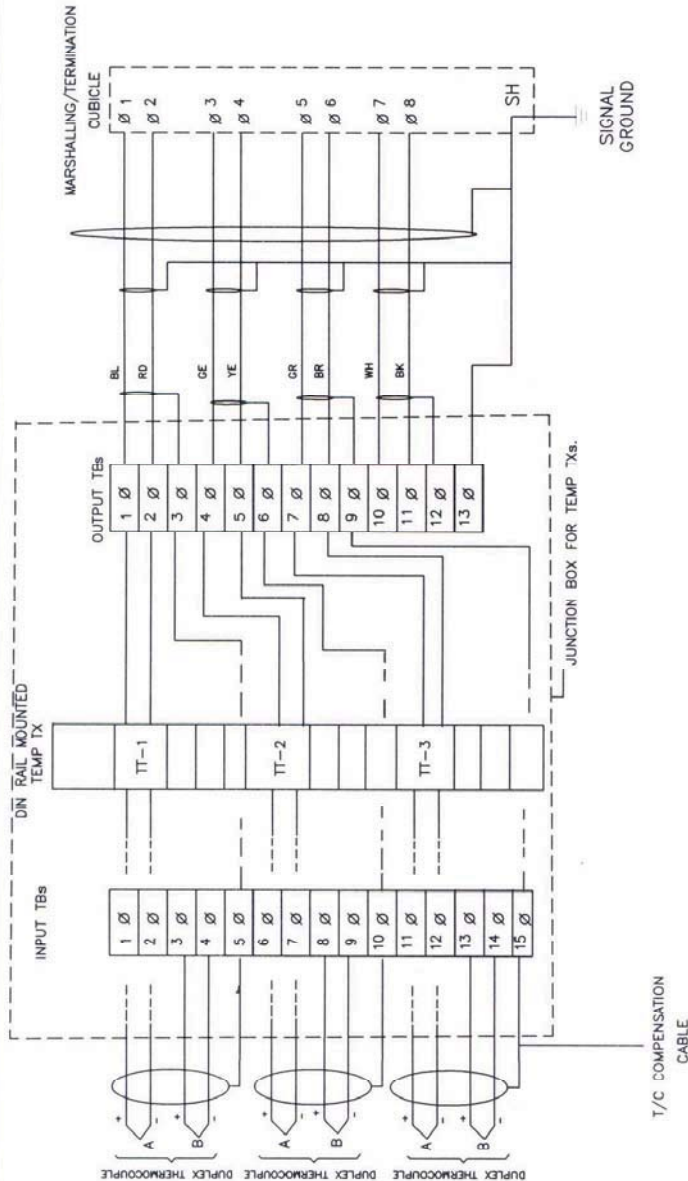
DESCRIPTION

DRAWN DESIGN CHKD.

REV. NO.

B

FIRST ISSUE



- NOTE: 1) ABOVE IS THE TYP DRG. FOR DIN RAIL MOUNTED TEMP TRANSMITTER FOR 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 FINALISED DURING DETAILED ENGG. STAGE.
- 3) AFTER GLANDING OF T/C CABLES ON JB, THE CABLE PAIR OF FIRST ELEMENT WILL BE DIRECTLY CONNECTED TO TT AND FOR CABLE PAIR OF SECOND ELEMENT LOOP SHALL BE KEPT, BEFORE TERMINATION AT INPUT TBs 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.	A	FIRST ISSUE	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	E	C	C&I	ARCH.
DATE	29.04.06										
APPD											
SCALE	A3	NTS									
DRG. NO.	0000-999-POI-A-065										
REV. NO.	C										
SH	11	OF	14								



SPECIFICATION FOR MOTORISED VALVE ACTUATOR

REV. NO.	01	DATE: 11.05.2018
SHEET	1 OF	4

Data Sheet A & B

DATA SHEET-A
(TO BE FILLED BY PURCHASER)

DATA SHEET-B
(TO BE FILLED-UP BY BIDDER)

GENERAL*	* PROJECT	3 x 800 MW PATRATU TPP	
	OFFER REFERENCE		
	* TAG NO. SERVICE		
	* DUTY	☐ ON / OFF	☐ INCHING
	* LINE SIZE (inlet/outlet): MATERIAL		
	* VALVE TYPE	☐ GLOBE ☐ GATE ☐ REG. GLOBE ☐ BUTTERFLY	
	* OPENING / CLOSING TIME		
	* WORKING PRESSURE		
	AMBIENT CONDITION	SHALL BE SUITABLE FOR CONTINUOUS OPERATION UNDER AN AMBIENT TEMP. OF 0-55 DEG C AND RELATIVE HUMIDITY OF 0-95%	
	VALVE SEAT TEST PRESS	BIDDER TO SPECIFY	
	REQUIRED VALVE TORQUE	BIDDER TO SPECIFY	
	ACTUATOR RATED TORQUE	BIDDER TO SPECIFY	
CONSTRUCTION AND SIZING	CONSTRUCTION	TOTALLY ENCLOSED, WEATHER PROOF, IP:55	
	MECHANICAL POSITION INDICATOR	TO BE PROVIDED FOR 0-100% TRAVEL	
	BEARINGS	DOUBLE SHIELDED, GREASE LUBRICATED ANTI-FRICTION.	
	GEAR TRAIN FOR LIMIT SWITCH/TORQUE SWITCH OPERATION	METAL (NOT FIBRE GEARS). SELF-LOCKING TO PREVENT DRIFT UNDER TORQUE SWITCH SPRING PRESSURE WHEN MOTOR IS DE-ENERGIZED.	
	SIZING	OPEN/CLOSE AT RATED SPEED AGAINST DESIGNED DIFFERENTIAL PRESSURE AT 90% OF RATED VOLTAGE. FOR ISOLATING SERVICE THREE SUCCESSIVE OPEN-CLOSE OPERATIONS OR 15 MINS. WHICHEVER IS HIGHER. FOR INCHING /REGULATING SERVICE - 150 STARTS/HR MINIMUM.	
HANDWHEEL	* REQUIRED	☒ YES ☐ NO	
	* ORIENTATION	☐ TOP MOUNTED ☐ SIDE MOUNTED	
	*TO DISENGAGE AUTOMATICALLY DURING MOTOR OPERATION.		
ELECTRIC ACTUATOR	ACTUATOR MAKE/MODEL	BIDDER TO SPECIFY	
	MOTOR MAKE / MODEL / TYPE / RATING (KW)	BIDDER TO SPECIFY	
	@ MOTOR TYPE	SQUIRREL CAGE INDUCTION MOTOR, STARTING CURRENT LIMITED TO SIX TIMES THE RATED CURRENT- INCLUSIVE OF I.S. TOLERANCE	
	ACTUATOR APPLICABLE WIRING DIAGRAM	☒ ENCLOSED (BIDDER TO CONFIRM) A: ☐ DRG. NO. 3-V-MISC-24227 R00 B: ☐ DRG. NO. 3-V-MISC-24550 R00 C: ☐ DRG. NO. 3-V-MISC-24283 R00 D: ☐ DRG. NO. 4-V-MISC-90271 R11 E: ☐ For Thyristor based Integral starter, Bidder/Vendor to furnish wiring diagram	
	COLOUR SHADE	☒ BLUE (RAL 5012) ENAMEL ☐	
	PAINT TYPE (## Refer Notes)	☐ ENAMEL ☐ EPOXY ☐	
	SHAFT RPM	BIDDER TO SPECIFY	
	OLR SET VALUE	BIDDER TO SPECIFY	
	@ STARTING / FULL LOAD CURRENT	BIDDER TO SPECIFY	
	NO. OF REV FOR FULL TRAVEL	BIDDER TO SPECIFY	
	@ PWR SUPP TO MTR / STARTER	415V +/- 10 %, 3PH,3 W, AC 50 HZ. +/- 5 %	
	@ CONTROL VOLTAGE REQUIREMENT	TO BE DERIVED FROM THE POWER SUPPLY TO THE STARTER ☐ 230 V ☒ 110 V AC/24V DC	



SPECIFICATION FOR MOTORISED VALVE ACTUATOR

REV. NO. 01

DATE: 11.05.2018

SHEET 2 OF

4

Data Sheet A & B

DATA SHEET-A
(TO BE FILLED BY PURCHASER)

DATA SHEET-B
(TO BE FILLED-UP BY BIDDER)

	MOTOR BEARING WITH 2 EARTH TERMINALS	DOUBLE SHIELDED, GREASE LUBRICATED ANTI FRICTION	
	@ ENCLOSURE CLASS OF MOTOR	IP 67 FOR OUTDOOR & IP 55 FOR INDOOR(TOTALLY ENCLOSED SELF VENTILATED)	
	@ INSULATION CLASS	CLASS-F TEMP. RISE LIMITED TO CLASS-B	
	@ WINDING TEMP PROTECTION	☒ THERMOSTAT (3 Nos., 1 IN EACH PHASE) ☐	
	SINGLE PHASE / WRONG PHASE SEQUENCE PROTECTION	REQUIRED	
INTEGRAL STARTER	INTEGRAL STARTER	☒ REQUIRED ☐ NOT REQUIRED	
	TYPE OF SWITCHING DEVICE	☒ CONTACTORS ☐ THYRISTORS	
	TYPE	☒ CONVENTIONAL ☐ SMART (NON-INTRUSIVE)	
	IF SMART	(NOT APPLICABLE)	
	a) SERIAL LINK INTERFACE	☐ INTEGRAL ☐ FIELD MOUNTED	
	b) SERIAL LINK PROTOCOL	☐ FOUNDATION FIELD-BUS ☐ PROFI-BUS ☐ DEVICE NET ☐	
	c) SERIAL LINK MEDIA	☐ TWISTED PAIR Cu-CBL ☐ CO-AXIAL Cu-CBL ☐ OFC	
	d) HAND HELD PROGRAMMER	☐ REQUIRED ☐ NOT REQUIRED	
	e) TYPE OF HAND HELD PROGRAMMER	☐ BLUETOOTH ☐ INFRARED ☐	
	f) MASTER STATION	☐ REQUIRED ☐ NOT REQUIRED	
	g) MASTER STN INTRFACE WITH DCS	☐ MODBUS ☐ TCP/IP	
	h) DETAILS OF SPECIAL CABLE	☐ ENCLOSED ☐ NOT REQUIRED	
	STEP DOWN CONT. TRANSFORMER	☒ REQUIRED	
	OPEN / CLOSE PB	☒ REQUIRED ☐ NOT REQUIRED	
	STOP PB	☒ REQUIRED ☐ NOT REQUIRED	
	INDICATING LAMPS	☒ REQUIRED ☐ NOT REQUIRED	
	LOCAL REMOTE S/S	☒ REQUIRED ☐ NOT REQUIRED	
	STATUS CONTACTS FOR MONITORING	☒ REQUIRED ☐ NOT REQUIRED	
INTEGRAL STARTER DISTURBED SIGNAL	REQUIRED (O/L RELAY OPERATED, CONT./POWER SUPPLY FAILED, S/S IN LOCAL, TORQUE SWITCH OPTD. MID WAY)		
INTERPOSING RELAY/OPTO COUPLER (Applicable for integral Starter)	TYPE OF ISOLATING DEVICE	☒ INTERPOSING RELAY ☐ OPTO COUPLER ☐ EITHER	
	QUANTITY	☒ 2 NOs. ☐ 3 NOs.	
	DRIVING VOLTAGE	☒ 20.5 – 24V DC ☐ _____ V DC	
	DRIVING CURRENT	☒ 125mA MAX ☐ _____ mA MAX	
	LOAD RESISTANCE	☒ > 192 ohms - <25 k ohms ☐ > _____ ohms - < _____ ohms	
TORQUE SWITCH (Not Applicable for Smart Actuator) (\$\$ Refer Notes)	MFR & MODEL NO.	BIDDER TO SPECIFY	
	OPEN / CLOSE	☒ 1 No. ☐ 2Nos. / ☒ 1 No. ☐ 2Nos	
	CONTACT TYPE	2 NO + 2 NC	
	RATING	5A 240V AC AND 0.5A 220V DC	
	CALIBRATED KNOBS(OPEN&CLOSE TS)	REQUIRED FOR SETTING DESIRED TORQUE	
	ACCURACY	+3% OF SET VALUE	
LIMIT SWITCH (Not Applicable for Smart Actuator) (\$\$)	MFR & MODEL NO.	BIDDER TO SPECIFY	
	OPEN : INT : CLOSE	☐ 1 No. ☒ 2 Nos.	☐ 1 No. ☒ 2Nos.
	CONTACT TYPE	2 NO + 2 NC	

	SPECIFICATION FOR MOTORISED VALVE ACTUATOR			
	REV. NO.	01	DATE:	11.05.2018
SHEET	3 OF		4	
Data Sheet A & B				
DATA SHEET-A (TO BE FILLED BY PURCHASER)			DATA SHEET-B (TO BE FILLED-UP BY BIDDER)	
Refer Notes)	RATING (AC / DC)	5A 240V AC AND 0.5A 220V DC		
Limit switches shall be silver plated with high conductivity and non-corrosive type. Contact rating shall be sufficient to meet the requirement of control system subject to a minimum of 60 V, 6 VA rating. Protection class shall be IP 55.				

POSITION TRANSMITTER	POSITION TRANSMITTER (For inching duty applications)	☒ REQUIRED ☐ NOT REQUIRED	
	MFR & MODEL NO.	BIDDER TO SPECIFY	
	TYPE	☐ ELECTRONIC (2 WIRE) R/I CONVERTER ☒ ELECTRONIC (2 WIRE) CONTACTLESS INDUCTIVE TYPE ,EXTERNAL 24 V DC OPERATED ,SUITABLE FOR STABILISED 4-20 mA SIGNAL	
	SUPPLY	☒ 24V DC ☐	
	OUTPUT	☒ 4-20mA	
	ACCURACY	± 1% FS	
SPACE HEATER	@SPACE HEATER	REQUIRED	
	@ POWER SUPPLY (NON INTEGRAL)	230V AC,1 PH.,50 Hz	
	@ POWER SUPPLY (INTEGRAL)	POWER SUPPLY DERIVED FROM MAIN POWER SUPPLY AVAILABLE AT ACTUATOR END.	
	@ RATING		
TERMINAL BOX	ACTUATOR/MOTOR TERMINAL BOX	REQUIRED	
	ENCL CLASS ACTUATOR/MOTOR T.B.	☒ IP 68 @ ☐	
	@ EARTHING TERMINAL	REQUIRED	
	PLUG & SOCKET(9 PIN) (FOR COMMD, LS/TS FEED BACK, PoT)	☒ REQUIRED ☐ NOT REQUIRED ☒ 2 NOS. PRE WIRED ☐	
CABLE GLANDS	@ POWER CABLE GLAND	SIZE:-----	
	@ SPACE HEATER CABLE GLAND	SIZE:-----	
	OTHER CONTROL CABLE GLANDS-1	2 NOS SUITABLE FOR 4P,0.5SQ MM	
	OTHER CONTROL CABLE GLAND	1 No. for BFV of CW PUMP(Cable size 2Px1.5mm2)	



SPECIFICATION FOR MOTORISED VALVE ACTUATOR

REV. NO. 01	DATE: 11.05.2018
SHEET 4 OF	4

Data Sheet A & B

DATA SHEET-A
(TO BE FILLED BY PURCHASER)

DATA SHEET-B
(TO BE FILLED-UP BY BIDDER)

WEIGHT	TOTAL WEIGHT (ACTUATOR + ACCESSORIES)	BIDDER TO SPECIFY	_____ Kg.
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NOTES:

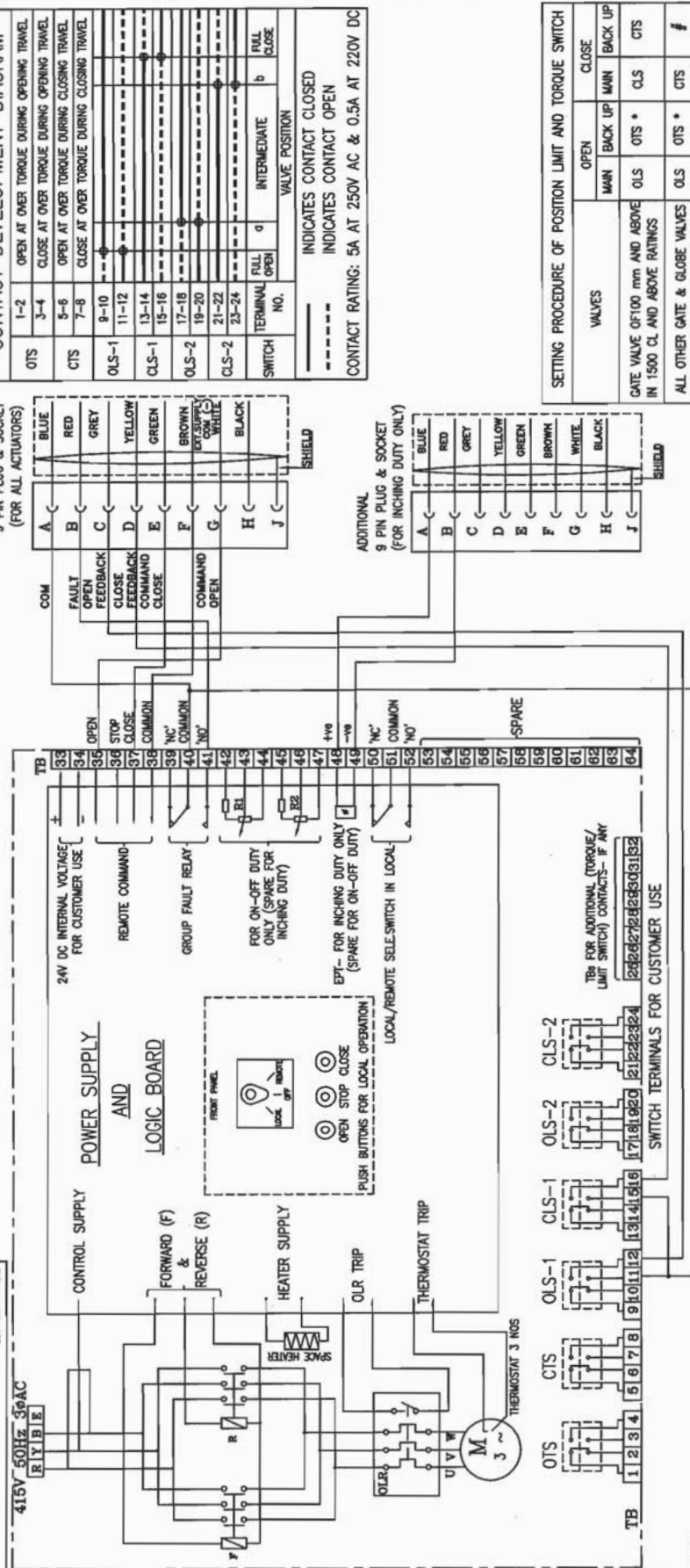
1. **SCOPE:** DESIGN, MANUFACTURE, INSPECTION, TESTING AND DELIVERY TO SITE OF ELECTRIC ACTUATOR FOR INCHING OR OPEN / CLOSE DUTY.
2. **CODES & STANDARDS:** DESIGN AND MATERIALS USED SHALL COMPLY WITH THE RELEVANT LATEST NATIONAL AND INTERNATIONAL STANDARD. AS A MINIMUM, THE FOLLOWING STANDARDS SHALL BE COMPLIED WITH: IS-9334, IS-2147, IS-2148, IS-325, IS-2959, IS-4691 AND IS-4722
3. TEMPERATURE RISE SHALL BE RESTRICTED TO 70 DEG. C FOR AMBIENT TEMPERATURE OF 50 DEG C.
4. CABLE GLANDS OF DOUBLE COMPRESSION TYPE, BRASS MATERIAL SHALL BE PROVIDED.
5. THE TORQUE SWITCHES SHALL BE PROVIDED WITH MECHANICAL LATCHING DEVICE TO PREVENT OPERATION WHEN UNSEATING FROM THE END POSITIONS. THE LATCHING DEVICE SHALL UNLATCH AS SOON AS THE VALVE LEAVES THE END POSITION. IF SUCH PROVISION IS NOT POSSIBLE, THE TORQUE SWITCHES SHALL BE BYPASSED BY END-POSITION LIMIT SWITCHES WHICH OPENS ON VALVE LEAVING END POSITION. THESE LIMIT SWITCHES ARE ADDITIONAL TO THE NUMBER OF LIMIT SWITCHES SPECIFIED ELSEWHERE.
6. THE MOTOR SHALL OPERATE SATISFACTORILY UNDER THE +/- 10% SUPPLY VOLTAGE VARIATION AT RATED FREQUENCY, -5% TO +3% VARIATION IN FREQUENCY AT RATED SUPPLY VOLTAGE, SIMULTANEOUS VARIATION IN VOLTAGE & FREQUENCY THE SUM OF ABSOLUTE PERCENTAGE NOT EXCEEDING 10%.
7. THE MOTOR SHALL BE SUITABLE FOR DIRECT ON LINE STARTING.
- \$\$ TORQUE SWITCH & LIMIT SWITCH SHALL ACT INDEPENDENT OF EACH OTHER. TANDEM OPERATION IS NOT ACCEPTABLE.**
- ## EPOXY PAINT IS RECOMMENDED FOR COASTAL AREAS.**
8. IT SHALL BE POSSIBLE TO OPERATE THE ACTUATOR LOCALLY. LOCKABLE LOCAL/REMOTE SELECTION SHALL BE PROVIDED ON THE ACTUATOR.
9. POSITION INDICATOR SHALL BE PROVIDED FOR 0 TO 100 % TRAVEL
10. WIRING SHALL BE SUITABLE VOLTAGE GRADE COPPER WIRE.

	PREPARED BY	CHECKED BY	APPROVED BY	VENDOR COMPANY SEAL
NAME	Madhav gupta	Mayank kesharwani	Bharat Singh	NAME
SIGNATURE				SIGNATURE
DATE	01.03.2018 01.	03.2018	01.03.2018	DATE

NOTES* = TO BE FILLED BY MPL (LEAD AGENCY). @= TO BE FILLED BY ES

ALL DIMENSIONS ARE IN MILLIMETRES. FOR TOLERANCES OF UNTOUCHED DIMENSIONS DURING MANUFACTURE REFER RELEVANT QCP / QP.

8272-CSIW-A-3



NOTE:-

1. ALL TORQUE AND LIMIT SWITCHES (OTS, CTS, OLS1&2, CLS1&2) ARE WITH 2NO+2NC CONTACTS. '1NO+1NC' IS TERMINATED IN TBS 1-24, REMAINING CONTACTS ARE FOR INTERNAL USE.
2. ANY SPARE CONTACTS WHICH ARE NOT USED INTERNALLY ARE TO BE TERMINATED IN TBS 25-32
3. CTS - TORQUE SWITCHES FOR CW ROTATION (CLOSE)
4. OLS-1, OLS-2 - TORQUE SWITCHES FOR CCW ROTATION (OPEN)
5. CLS-1, CLS-2 - LIMIT SWITCHES FOR POSITION OPEN
6. EPT - ELECTRONIC POSITION TRANSMITTER (CONTACTLESS TYPE, FOR INCHING DUTY)
7. R1-R2-POTENTIOMETER 2 x 100 OHMS (FOR ON-OFF DUTY)
8. FOR COMMANDS & EPT EITHER INTERNALLY GENERATED 24 VDC OR EXTERNAL SUPPLY OF 24VDC CAN BE USED
9. M - MOTOR 3φ 415V 50 Hz AC SUPPLY
10. TORQUE SWITCH BYPASS WITH LIMITSWITCH BOTH ON OPEN & CLOSE DIRECTION TO BE DONE INTERNALLY.

CONTACT DEVELOPMENT DIAGRAM

OTS	1-2	OPEN AT OVER TORQUE DURING OPENING TRAVEL	
	3-4	CLOSE AT OVER TORQUE DURING OPENING TRAVEL	
CTS	5-6	OPEN AT OVER TORQUE DURING CLOSING TRAVEL	
	7-8	CLOSE AT OVER TORQUE DURING CLOSING TRAVEL	
OLS-1	9-10	—	
CLS-1	11-12	—	
	13-14	—	
OLS-2	15-16	—	
	17-18	—	
CLS-2	19-20	—	
	21-22	—	
	23-24	—	
SWITCH NO.	TERMINAL NO.	INTERMEDIATE	VALVE POSITION
		a	b
INDICATES CONTACT CLOSED			
INDICATES CONTACT OPEN			
CONTACT RATING: 5A AT 250V AC & 0.5A AT 220V DC			

--- INDICATES CONTACT CLOSED
- - - - - INDICATES CONTACT OPEN

CONTACT RATING: 5A AT 250V AC & 0.5A AT 220V DC

VALVES	OPEN		CLOSE	
	MAIN	BACK UP	MAIN	BACK UP
GATE VALVE 05'00 mm AND ABOVE	OLS	OTS *	CLS	CTS
ALL OTHER GATE & GLOBE VALVES	OLS	OTS *	CLS	CTS
# - CLS NOT TO BE CONNECTED IN TRIP CIRCUIT				
* - BYPASS OTS FOR INITIAL 5% OF TRAVEL (FOR GATE VALVES ONLY)				

SETTING PROCEDURE OF POSITION LIMIT AND TORQUE SWITCH
IN 1500 CL AND ABOVE RATINGS

TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT		ELECTRICAL VALVE ACTUATORS (AC) WITH INTEGRAL STARTERS FOR NTPC PROJECTS (DRAWN FOR INTERMEDIATE POSITION OF VALVES)	
BHARAT HEAVY ELECTRICALS LTD., UNIT: HIGH PRESSURE BOILER PLANT, TECHERAPALLY-680014.		NAME N.P.ESWAR D.DINAKARAN K.ARUNACHALAM	SIGN N.P D.D K.A
DATE 17.03.05	VAR. 17.03.05	REFERENCE INFORMATION	
DEPT 358-121	VL	SCALE NTS	WEIGHT (KG) -
CODE	ALTERNED CHD & APPD	REV 0	
TITLE WIRING DIAGRAM (TERMINAL PLAN) FOR ACTUATOR WITH INTEGRAL STARTER WITH PLUG & SOCKET		DRAWING NO. 3-V-MISC-24283	
FOR ACTUATOR WITH INTEGRAL STARTER WITH PLUG & SOCKET FOR NTPC PROJECTS		Page 6 of 6	

CAUTION: The information on this document is the property of BHARAT HEAVY ELECTRICALS LTD. It must not be used directly or indirectly in any way detrimental to the interest of the company.

CLAUSE NO.	TECHNICAL REQUIREMENTS			
1.00.00	MEASURING INSTRUMENTS (PRIMARY AND SECONDARY)			
1.01.00	Measuring instruments/equipment and subsystems offered by the Bidder shall be from reputed experienced manufacturers of specified type and range of equipment, whose guaranteed and trouble free operation has been proven. Refer Sub-section Basic Design Criteria. Further, all instruments shall be of proven reliability, accuracy, and repeatability requiring a minimum of maintenance and shall comply with the acceptable international standards and shall be subject to Employer's approval.			
1.02.00	Every panel-mounted instrument requiring power supply shall be provided with easily replaceable glass cartridge fuses of suitable rating. Every instrument shall be provided with a grounding terminal and shall be suitably connected to the panel grounding bus.			
1.03.00	All transmitters, sensors, switches and gauges for parameters like pressure, temperature, level, flow etc. as required for the safe and efficient operation and maintenance as well as for operator and management information (including all computation) of equipment in the system under the scope of specification shall be provided on as required basis with in quoted lump sum price. The Contractor shall furnish all Instrumentation / Control equipment & accessories under this specification as per technical specification, ranges, makes & model as approved by the Employer during detailed engineering.			
1.04.00	The necessary root valves, impulse piping, drain cocks, gauge-zeroing cocks, valve manifolds and all the other accessories required for mounting/erection of these local instruments shall be furnished, even if not specifically asked for, on as required basis. The contacts of equipment mounted instruments, sensors, switches etc. for external connection including spare contacts shall be wired out in flexible/rigid conduits, independently to suitably located common junction boxes. The proposal shall include the necessary cables, flexible conduits, junction boxes and accessories for the above purpose. Double root valves shall be provided for all pressure tapping where the pressure exceeds 40 Kg./sq.cm.			
1.05.00	All instruments envisaged for sea water applications, shall be provided with wetted parts made of Monel/ Hastelloy C or any other material (if provenness experience of the proposed material for such applications is established by contractor). For Chlorine application: Instruments shall be provided with wetted parts (e.g. diaphragm seal, etc.) made of Hastelloy C. Also, filled liquid shall be Fluorolube oil/ Inert Hydrocarbon / CTFE etc., for these applications. For applications of FECL3 solution: Instruments shall be provided with wetted parts (e.g. diaphragm seal, etc.) made of Tantalum.			
1.06.00	For coastal areas, all instruments shall be provided with durable epoxy coating for housings and all exposed surfaces of the instruments.			
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE –I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION – VI, PART-B BID DOC. NO.: CS:9585-001-2	SUB-SECTION-IIIC-04 MEASURING INSTRUMENTS (PRIMARY & SECONDARY)	PAGE 1 OF 46

CLAUSE NO.	TECHNICAL REQUIREMENTS		
2.00.00	SPECIFICATION FOR ELECTRONIC TRANSMITTERS		
2.01.00	SPECIFICATION FOR ELECTRONIC TRANSMITTER FOR PRESSURE, DIFF PRESS AND DP BASED FLOW / LEVEL MEASUREMENTS		
	Sl.No.	Features	Essential/Minimum Requirements
	1.	Type of Transmitter	Microprocessor based 2 wire type (loop powered), Hart protocol compatible.
	2.	Accuracy	± 0.1% of calibrated span (minimum)
	3.	Output signal range	4-20 mA DC (Analog) along with superimposed digital signal (based on HART protocol)
	4.	Turn down ratio (minimum)	10:1 for vacuum/very low pressure applications (i.e. pressure <= 200 mmWC) 5:1 for very high pressure application (i.e. pressure >= 200 Kg/cm2) 30:1 for other applications
	5.	Stability	± 0.1% of calibrated span for six months for Ranges up to and including 70 Kg/cm² ± 0.25% of calibrated span for six months for Ranges more than 70 Kg/cm²
	6.	Zero and span drift	+/- 0.015% per deg.C at max span +/-0.11% per deg.C at min. Span
	7.	Load impedance	500 ohm (minimum)
	8.	Housing	Weather proof as per IP-65, metallic housing with durable corrosion resistant coating
	9.	Over Pressure	150% of max. Operating pressure
	10.	Connection (Electrical)	Plug and socket type
	11.	Process connection	1/2 inch NPT (F)
	12.	Span and Zero	Continuous, tamper proof, Remote as well as manual adjustability from instrument with zero suppression and elevation facility.
	13.	Accessories	-Diaphragm seal, pulsation dampeners, syphon etc. as required by service and operating condition. -2 valve manifold for absolute & Gauge pressure transmitters, 3-valve and 5 valve manifold for DP/Level/Flow applications. The valve manifold shall be non integral type (except Fuel Oil area).
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE –I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION – VI, PART-B BID DOC. NO.: CS:9585-001-2	SUB-SECTION-III-C-04 MEASURING INSTRUMENTS (PRIMARY & SECONDARY)
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CLAUSE NO.	TECHNICAL REQUIREMENTS		एनटीपीसी NTPC	
2.02.00		-For hazardous area, explosions proof enclosure as described in NEC article 500 Mounting: 2 inch pipe mounting. 14. Diagnostics & display Self-Indicating feature and digital display on transmitter 15. Power supply 24V DC ± 10%. 16. Adjustment/calibration/maintenance From hand held HART calibrator/ centralized PC based system (as applicable). Notes - For primary air/ secondary air/flue gas applications, DP type transmitters shall be provided for pressure measurement. - LVDT type is not acceptable. - Where the process fluids are corrosive, viscous, solid bearing or slurry type, diaphragm seals shall be provided. Parts below the diaphragm shall be removable for cleaning. The entire volume above the diaphragm shall be completely filled with an inert liquid suitable for the application.		
	GUIDED WAVE RADAR TYPE LEVEL TRANSMITTER			
	Type	Microprocessor based 2 wire type (loop powered), HART protocol compatible Guided wave radar transmitter.		
	Principle	TDR (Time domain reflectometry)		
	Probe Type & Material	(i) Coaxial probe of SS316/316L. If required, probe shall be suitable for overfill prevention. (ii) Rod probe, cable probe of SS316/SS316L can be used for applications wherever coaxial probe is not suitable.		
	Output signal	4-20 mA DC along with superimposed digital signal (based on HART protocol), suitable for over fill prevention.		
	Accuracy	+/- 0.5% of calibrated span or minimum 5mm.		
	Power supply	24 VDC +/- 10%.		
	Housing	Weather proof as per IP-65, metallic housing with durable corrosion resistance coating.		
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CLAUSE NO.	TECHNICAL REQUIREMENTS			
3.00.00	Temperature Elements and accessories			
3.01.00	Thermocouple			
	Sr. No.	Features	Essential/Minimum Requirements	
	1	Type of Thermocouple.	: 16 AWG wire of Chromel-Alumel (Type K) or 24 AWG wire Pt-Rhodium Pt (Type R) depending on operating temperature Range (ungrounded separate junction type).	
	2	No. of element	: Duplex	
	3	Housing/Head	: IP-65/Diecast Aluminium. Head of TE to be provided with sufficient space and arrangement to mount head mounted temperature transmitter (as applicable). Plug in connectors are to be provided for external signal cable connection. TE terminal head shall be spring loaded for positive contacts with the thermo well.	
	4	Insulation and Sheathing of Thermocouple	: Swaged type mineral (magnesium oxide) insulation and SS316 sheath.	
	5	Calibration and accuracy	: As per IEC-584/ ANSI-MC-96.1 (special limits of errors/ class1) for T/C.	
	6	Accessories	: Thermo well and associated fittings	
	7	Standard	: IEC-584/ ANSI MC 96.1 for Thermocouple and ASME PTC-19.3 for Thermo-well	
3.02.00	Resistance Temperature Detector (RTD)			
	Sr. No.	Features	Essential/Minimum Requirements	
	1	Type of RTD.	: Four wire, Pt-100 (100 Ohms resistance at zero degree Centigrade).	
	2	No. of element	: Duplex	
	3	Housing/Head	: IP-65/Diecast Aluminium. Head of TE to be provided with sufficient space and arrangement to mount head mounted temperature transmitter (as applicable). Plug in connectors are to be	
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE –I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION – VI, PART-B BID DOC. NO.: CS:9585-001-2	SUB-SECTION-III-C-04 MEASURING INSTRUMENTS (PRIMARY & SECONDARY)	PAGE 7 OF 46

CLAUSE NO.	TECHNICAL REQUIREMENTS 		
	provided for external signal cable connection. TE terminal head shall be spring loaded for positive contacts with the thermo well 4 Insulation and sheathing of RTD : Mineral (magnesium oxide) insulation and SS316 sheath, 5 Calibration and accuracy : As per IEC-751/ DIN-43760 Class-A for RTD 6 Accessories : Thermo well and associated fittings 7 Standard : IEC-751/ DIN-43760 for RTD and ASME PTC-19.3 for Thermo-well. NOTES : 1) The specifications for RTDs of winding/ bearings of motor/pump, can be as per their manufacturer standards. The manufacturer shall submit the adequate supporting documents for establishing their standard practice. However the type of RTD shall be Pt100. 2) The specifications of temp elements for air conditioning & ventilation system / process can be as per system manufacturer's standards. The manufacturer shall submit the adequate supporting documents for establishing their standard practice. 3.03.00 Metal Temperature Thermocouples Measuring Medium Metal Temperature Material of Thermocouple. Chromel Alumel Type K Type of Thermocouple Duplex with ungrounded separate hot junctions Insulation Mineral Insulation (Magnesium Oxide). Thermocouple wire gauge 16 AWG Protective sheath SS 321 Protective sheath dia 8 mm OD Calibration & accuracy As per IEC-584/ ANSI-MC-96.1 (special limits of error) for T/C Mounting accessories 1/2" BSP SS sliding end connector, weld pad, clamps of heat resistant steel SS310. Adjustable gland fitting for connection at the junction box end as per manufacturer's standard. Cold end sealing SS pot seal with colour coded PTFE Insulated flexible tails. Sealing compound- Epoxy resin. Length of PTFE insulated flying leads shall be minimum 750 mm.		
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE –I (3X 800MW)	TECHNICAL SPECIFICATIONS SECTION – VI, PART-B BID DOC. NO.: CS:9585-001-2	SUB-SECTION-IIIC-04 MEASURING INSTRUMENTS (PRIMARY & SECONDARY)	PAGE 8 OF 46

CLAUSE NO.	TECHNICAL REQUIREMENTS																																							
	especially designed for DIN-rail mounting with IP 20 protection class. These shall have terminals for input/output provided on front side when mounted on DIN-rail. Head mounted temperature transmitter with clamps to make it suitable for DIN-rail mounting shall not be acceptable under this category. c. Dual-input Temperature Transmitter With integral Indicator: These shall be suitable for mounting on pipes/ support. Both elements of the duplex thermocouple/ RTD shall be wired to a single transmitter. Integral indicator shall be provided with these transmitters. These transmitters shall have bump less change over facility to second sensor in case first sensor fails .This change-over is to be alarmed. Protection class shall be IP65 minimum. d. Common requirements for each of the above type of temperature transmitters. <table><tr><td>Output</td><td>:</td><td colspan="2">2-wire (power supply from input card of Control System) with 4-20mA output with superimposed HART protocol signal.</td></tr><tr><td>Input</td><td>:</td><td colspan="2">Same transmitter shall be capable to handle Pt-100 RTD, Thermocouples –K & R types (input type to be selectable at site through HART terminal).</td></tr><tr><td>Isolation</td><td>:</td><td colspan="2">Min. 500 V AC.</td></tr><tr><td>EMC compatibility</td><td>:</td><td colspan="2">As per EN 61326.</td></tr><tr><td>Operating ambient temperature</td><td>:</td><td colspan="2">0 to 85 deg C (without indicator). 0 to 70 deg C (with indicator).</td></tr><tr><td>Power supply</td><td>:</td><td colspan="2">24V DC +/- 10%.</td></tr><tr><td>Accessories</td><td>:</td><td colspan="2">Mounting arrangements including clamps etc.</td></tr><tr><td>Composite Accuracy (Refer note 2)</td><td>(i)</td><td colspan="2">For head mounted and DIN-rail mounted types: RTD =<0.4% of 0-250 deg C span T/C-K type =<0.4% of 0-600 deg C span T/C-R type =<0.4% of 0-1000 deg C span CJC accuracy (for thermocouples) shall be =< 1 deg C</td></tr><tr><td></td><td>(ii)</td><td colspan="2">For dual-input type: RTD =<0.25% of 0-250 deg C span T/C-K type =<0.2% of 0-600 deg C span CJC accuracy (for thermocouples) shall be =< 1 deg C</td></tr></table> e. Field bus compatible temperature transmitters Temperature transmitters of this category shall be field mounting type & shall be capable of withstanding operating ambient temperature upto 85 deg C. These modules shall be connected to DDCMIS through field bus such as Profibus, Foundation Field bus etc directly from the transmitter. Maximum Number of inputs per such temperature transmitter shall be eight. These shall be mounted in cabinets/enclosures/JBs in non-AC areas.				Output	:	2-wire (power supply from input card of Control System) with 4-20mA output with superimposed HART protocol signal.		Input	:	Same transmitter shall be capable to handle Pt-100 RTD, Thermocouples –K & R types (input type to be selectable at site through HART terminal).		Isolation	:	Min. 500 V AC.		EMC compatibility	:	As per EN 61326.		Operating ambient temperature	:	0 to 85 deg C (without indicator). 0 to 70 deg C (with indicator).		Power supply	:	24V DC +/- 10%.		Accessories	:	Mounting arrangements including clamps etc.		Composite Accuracy (Refer note 2)	(i)	For head mounted and DIN-rail mounted types: RTD =<0.4% of 0-250 deg C span T/C-K type =<0.4% of 0-600 deg C span T/C-R type =<0.4% of 0-1000 deg C span CJC accuracy (for thermocouples) shall be =< 1 deg C			(ii)	For dual-input type: RTD =<0.25% of 0-250 deg C span T/C-K type =<0.2% of 0-600 deg C span CJC accuracy (for thermocouples) shall be =< 1 deg C	
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CLAUSE NO.	TECHNICAL REQUIREMENTS 			
	As an alternate, these signals from temperature transmitters can be connected to DDCMIS through standard remote I/O modules of the DCS, in which case, the temperature transmitter signals will be acquired through 4-20mA input modules in the remote I/O cabinet for connecting to DDCMIS through remote I/O bus. Air conditioned panel shall be provided for remote I/O. Notes (Common for a) to d) above):- 1. In case of failure (open or burn-out) of RTD/thermocouple, temp. Transmitter shall provide low temperature output. 2. Composite Accuracy is to be calculated as summation of all applicable accuracies of temp transmitter, for converting sensor input to output in 4-20 mA (e.g., basic accuracy, digital accuracy, D/A accuracy, etc.) and temperature effect on these accuracies at ambient temperature of 50 deg C, based on the figure/ formula given in the standard product catalogue for span as specified above for various types of Temperature Elements specified. All such accuracy/ temp effect figures in catalogue shall be first converted to deg C, and then percentage of this converted accuracy in specified span shall be calculated to compare with the specified composite accuracy figures. All temperature transmitters are to be interchangeable (i.e. can be used for either RTD or thermocouple) and composite accuracy shall be met for each type of input specified in (i) & (ii).			
~~4.00.00~~	ELECTRICAL METERING INSTRUMENTS			
	Electrical metering instruments shall be furnished in accordance with the following general specifications. However, the scope shall be governed by the Contract quantity given in appendix-1 to part-A. Application standard for electrical metering instruments shall be as per IS: 1248- 2003 (Revised). The size of each instrument shall be as approved by Employer during detailed engg. All metering instruments shall be flush panel mounting type.			
4.01.00	(a) Frequency meters for Synchronization purposes: Accuracy: $\pm 1.5\%$ of full scale. (b) Synchroscope: Accuracy class: 0.5 or better. (c) Voltmeters: Accuracy: $\pm 2.0\%$ of full scale or better.			
4.02.00	Synchronizing Relays Synchronizing check relay with necessary ancillary equipment shall be provided which shall permit breakers to close after checking the requirements of synchronizing of incoming and running supply. The phase angle setting shall not exceed 10 Degree and this angle shall be adjustable and shall take the account the circuit breaker closing period. This relay shall have a response time of less than 200 milliseconds when the two system conditions are met within preset limits and with the timer disconnected. The relay shall have a frequency difference setting not exceeding 0.45% at rated value and at the minimum time setting. The relay shall have a continuously adjustable time setting range of 0.5-3 secs. Additionally, a guard relay shall be provided to prevent the closing attempt by means of synchronizing check relay when control switch is kept in closed position long before the two systems are in synchronism. The Control Voltage shall be 220V DC and PT input Voltage shall be 110 V AC.			
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CLAUSE NO.	TECHNICAL REQUIREMENTS		
8.00.00	~~In case it is the proven standard practice of a Contractor to provide vibration monitoring PC with TFT LCD monitor, instead of dedicated monitors with the signal conditioning equipment in control equipment room, the same shall also be acceptable. However, all relevant functional requirements detailed above shall be met and the system shall be subject to Employer's approval.~~		
	E-P Converter		
	E-P converters and associated accessories shall be furnished in accordance with the specifications given below :		
	A. Fail Freeze Type E/P convertes		
	1	Air supply Pressure	: 2 kg/sq. cm.
	2	Input signal	: 4-20mA DC
	3	Output signal	: 0.2 to 1.0 kg/sq. cm
	4	Linearity	: 0.5% of span or better.
	5	Span/Zero Adjustment	: To be provided
	6	Hysteresis	: 0.5% of span or better.
	7	Fail Freeze Feature	: Stay put at last position on failure of 4 –20mA signal.
	8	Allowable drift rate	: Maximum 2% set point/ hour.
	9	Ambient Temperature Effect	: less than 0.02% of span per deg C between -
	10	Mounting	: Surface/Pipe/Bracket Mounting.
	11	Protection class	: IP 65.
12	Connection Port Sizes	: ¼ inch NPT (F)	
13	Electrical Cable Entry	: ½ inch NPT	
14	Output Pressure Gauge	: 1/4 inch NPT connection, 2 inch dial.	
15	Accessories	: All accessories like mounting brackets, fittings etc. required for installation is to be supplied.	
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE –I (3X 800MW) TECHNICAL SPECIFICATIONS SECTION – VI, PART-B BID DOC. NO.: CS:9585-001-2 SUB-SECTION-IIIC-04 MEASURING INSTRUMENTS (PRIMARY & SECONDARY) PAGE 23 OF 46			

CLAUSE NO.	TECHNICAL REQUIREMENTS			
	B. Fail Safe type E/P converters			
	1	Air supply Pressure	:	2 kg/sq. cm.
	2	Input signal	:	4-20mA DC
	3	Output signal	:	0.2 to 1.0 kg/sq. cm
	4	Linearity	:	0.5% of span or better.
	5	Span/Zero Adjustment	:	To be provided.
	6	Hysteresis	:	0.5% of span or better.
	7	Fail Safe Feature	:	Output shall drive to minimum on failure of either 4-20mA signal or air supply.
	8	Mounting	:	Surface/Pipe/Bracket Mounting.
	9	Ambient Temperature Effect	:	less than 0.02% of span per deg C between -20 to +60 deg C.
	10	Protection class	:	IP 65.
	11	Connection Port Sizes	:	¼ inch NPT (F)
	12	Electrical Cable Entry	:	½ inch NPT
	13	Output Pressure Gauge	:	1/4 inch NPT connection, 2 inch dial.
	14	Accessories	:	All accessories like mounting brackets, fittings etc. required for installation is to be supplied.
9.00.00	NOT USED			
10.00.00	AMBIENT AIR QUALITY MONITORING STATION (AAQMS)			
10.01.00	General Specifications for AAQMS			
10.01.01	The Analysers / Monitors should be 19" Rack Mounted with the ON / OFF switch and display of all important status signals including Lamps, etc should be preferably on the front panel.			
10.01.02	The system must function properly in the weather and atmospheric conditions mentioned in Sub-Section-IIIC-01, in view of ambient temperature, relative humidity and high dust levels for instruments / equipments housed in an enclosure.			
10.01.03	The system should function without frequent servicing / maintenance. The parts requiring regular service / maintenance must be easily accessible.			
10.01.04	All ambient Gas Analysers and Dust Monitor shall conform to the US EPA reference or equivalent method. A proof of approvals and certificates of the above compliance along with copy of the Test Report (in English) from internationally reputed agencies such as US EPA, TUV / UAB of Germany, Env't Canada, Env't Japan, EEC etc shall be furnished.			
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CLAUSE NO.	TECHNICAL REQUIREMENTS		एनडीपीसी NTPC																										
13.04.00	Root valve size	1 inch																											
	Impulse pipe of same material up to root valve	Required																											
	Tapping	3 Nos. of tappings for each Venturi as per ISO 5167-4:2003																											
	Beta Ratio	0.4 to 0.7																											
	Beta Ratio calculation to be Submitted	Yes																											
	Assembly drg. and flow Vs DP Curves	Yes																											
	Accessories	Root valves, vent and drain hole.																											
	Contractor shall submit certified flow calculation and differential pressure vs. Flow curves for each element for employer's approval. Sizing calculation, precise flow calculation for all the flow elements, fabrication and assembly drawings and installation drawings shall be submitted for employer's approval.																												
	ROTAMETERS																												
	<table><tr><th>Sr. No.</th><th>Features</th><th>Essential / minimum requirements</th></tr><tr><td>1.</td><td>Type</td><td>Variable Area Metal Tube</td></tr><tr><td>2.</td><td>Fluid media</td><td>Water/oil</td></tr><tr><td>3.</td><td>Tube body</td><td>SS316</td></tr><tr><td>4.</td><td>Material of float</td><td>316 SS</td></tr><tr><td>5.</td><td>Indicator</td><td>Linear scale</td></tr><tr><td>6.</td><td>Accessories</td><td>Flange, orifice in case of bypass Rota meter (for line size above 100 mm)</td></tr><tr><td>7.</td><td>Housing protection class</td><td>IP-55</td></tr><tr><td>8.</td><td>Accuracy</td><td>± 2% of measured value.</td></tr></table>	Sr. No.	Features	Essential / minimum requirements	1.	Type	Variable Area Metal Tube	2.	Fluid media	Water/oil	3.	Tube body	SS316	4.	Material of float	316 SS	5.	Indicator	Linear scale	6.	Accessories	Flange, orifice in case of bypass Rota meter (for line size above 100 mm)	7.	Housing protection class	IP-55	8.	Accuracy	± 2% of measured value.	
Sr. No.	Features	Essential / minimum requirements																											
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7.	Housing protection class	IP-55																											
8.	Accuracy	± 2% of measured value.																											
14.00.00	POSITIVE DISPLACEMENT TYPE FLOW TRANSMITTERS																												
The Bidder shall provide positive displacement type flow transmitters for fuel oil flow measurement, suitable for the fuel oil being used for the project, i.e., keeping in view the pressure, temperature and viscosity of the fuel oil. The meter shall be a volumetric meter type consisting of two meshing oval wheels driven by the fluid. Each revolution of the oval wheels shall displace a precisely known volume of the fluid from inlet to outlet. The housing/measuring chamber and oval wheels shall be of 316 SS.																													
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CLAUSE NO.	TECHNICAL REQUIREMENTS			
15.00.00	The measurement accuracy of the transmitter shall be better than +0.2%. The transmitter shall provide suitable 4-20mA dc output signal for control and indication/recording. Converters if necessary shall be provided to generate the 4-20mA signal. A local indicator of fuel oil flow shall also be provided. The instrument shall be calibrated in Tons/hr. Suitable strainer shall be provided before the transmitter for the protection of oval wheel meters against foreign matter contained in the fuel oil. The exact model no. and type of material being used, etc., shall be subject to Employer's approval during detailed engineering without any price repercussion to Employer.			
	PROCESS ACTUATED SWITCHES			
	FEATURES	ESSENTIAL / MINIMUM REQUIREMENTS		
		Pressure/ Draft Switches/ DP Switches	Temperature switches	Level switches
	Sensing Element	Piston actuated for high pressure and diaphragm or bellows for low pr./ vacuum	Vapor pressure sensing, liquid filled bellow type with SS bulb and capillary (5 m minimum, to suit application)	Capacitance types, float type, conductivity type, RF type, Ultrasonic type as per suitability to the application. .
	Material	316 SS	Bulb 316 SS/ capillary 304 SS	316 SS
	End connection	½ inch NPT (F)	½ inch NPT (F)	Manufacturer standard
	Over range/ proof pressure	150% of maximum operating pr.	-	150% of maximum operating pr.
	Repeatability	+/- 0.5% of full range		
	No. of contacts	2 No.+2NC. SPDT snap action dry contact		
	Rating of contacts	60 V DC, 6 VA (or more if required by DDCMIS)		
	Elect. Connection	Plug in socket.		
Set point adjustment	Provided over full range.			
Dead band adjustment	Adjustable/ fixed as per requirement of application.			
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CLAUSE NO.	TECHNICAL REQUIREMENTS				एनटीपीसी NTPC
	Enclosure	Weather and dust proof as per IP-55, metallic housing.			
	Accessories	Siphon, snubber, chemical seal, pulsation dampeners as required by process	Thermo well of 316 SS and packing glands	All mounting accessories	
	Mounting	Suitable for enclosure/ rack mounting or direct mounting	Suitable for rack mounting or direct mounting	-	
	Power Supply (wherever required)	As per Contractor's Standard practice.			
	Notes :-				
	1) Where the process fluids are corrosive, viscous, solid bearing or slurry type, diaphragm seals shall be provided. Parts below the diaphragm shall be removable for cleaning. The entire volume above the diaphragm shall be completely filled with an inert liquid suitable for the application.				
	2) Pressure/ Diff pressure switches for very low press/ DP measurements can have sensor material other than SS316 in case of any technical limitation and the offered product is standard product of the manufacture for very low pressure applications.				
	3) Repeatability can be upto +/-1% of full range in case of switches with diaphragm seals or very low pressure/DP range.				
	4) The specifications of switches for air conditioning & ventilation system / process can be as per system manufacturer's standards. The manufacturer shall submit the adequate supporting documents for establishing their standard practice.				
	16.00.00	NOT USED			
17.00.00	SOLENOID VALVES				
	Solenoid valves shall fulfil the following requirements:				
	a. Type 2/3/4 way SS 316/Forged Brass (depending on the application subject to Employer's approval during detailed Engg.)				
	b. Power supply : 24 V DC $\pm$ 10%.				
	c. Plug and socket electrical connection.				
	d. Insulation : Class 'H'				
18.00.00	REVERSE ROTATION INDICATOR (RRI)				
	Reverse rotation indicator comprising of proximity sensors, processing electronics with output of 4-20mA (corresponding to speed) interconnecting cables, speed display in rpm,				
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CLAUSE NO.	TECHNICAL REQUIREMENTS	एनटीपीसी NTPC																														
19.04.00	Parshall Flume The Bidder shall provide all the control and Instrument devices including primary sensors, transmitters, flow indicator cum integrator / totaliser and shall include all required accessories for the flow measurement of raw water through the clarifier. The system shall be of reputed make and acceptable to the owner. Level measurement shall be based on ultrasonic/radon technology. The flow compensation is to be implemented in the transmitter itself. The transmitter shall provide 4-20 mA DC in direct proportion to flow and shall be able to drive a load impedance of 500 ohms minimum Accuracy shall be +/- 1 % or better. All the mounting hardware and accessories required for erection and commissioning of the same are to be provided by the contractor. Mounting fittings material shall be SS316. All weather canopy is to be provided for electronics/sensor to protect the same from rain/sunlight etc. The Type makes and models no. shall be subject to Owner's approval.																															
19.05.00	Electronic Flow-Meter The electronic flow meter shall include flow sensor and flow indicator cum integrator / totaliser and shall include all required accessories for satisfactory operation. The flow meter shall be based on full bore electromagnetic principle and shall be electronic type of proven design, make and model acceptable to the owner. The Bidder shall submit all necessary technical literature and details of selection criteria of the instrument offered to substantiate the model selected. The Bidder shall also furnish list of similar installation along with feed back on satisfactory performance of the instruments. The flow meter shall meet or exceed the following requirement : <table><tr><td>(a)</td><td>Output</td><td>:</td><td>4-20 mA DC Isolated output</td></tr><tr><td>(b)</td><td>Accuracy</td><td>:</td><td>± 0.5% of calibrated span or better *</td></tr><tr><td>(c)</td><td>Repeatability</td><td>:</td><td>± 0.2% of calibrated span or better</td></tr><tr><td>(d)</td><td>Power Supply</td><td>:</td><td>240V AC ± 10%, 50 HZ ± 5%/ 24 V DC, to be arranged by the contractor.</td></tr><tr><td>(f)</td><td>Protection class</td><td>:</td><td>IP-55</td></tr><tr><td>(e)</td><td>Flow tube</td><td>:</td><td>SS304</td></tr><tr><td>(f)</td><td>liner</td><td>:</td><td>Hard Rubber</td></tr></table> The flow meter shall provide local indication for instantaneous flow. It should also be possible to get local display for daily and monthly discharge. The flow meter shall indicate totaliser/ integrator to get the daily and monthly discharge as stated above.	(a)	Output	:	4-20 mA DC Isolated output	(b)	Accuracy	:	± 0.5% of calibrated span or better *	(c)	Repeatability	:	± 0.2% of calibrated span or better	(d)	Power Supply	:	240V AC ± 10%, 50 HZ ± 5%/ 24 V DC, to be arranged by the contractor.	(f)	Protection class	:	IP-55	(e)	Flow tube	:	SS304	(f)	liner	:	Hard Rubber			
(a)	Output	:	4-20 mA DC Isolated output																													
(b)	Accuracy	:	± 0.5% of calibrated span or better *																													
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(f)	Protection class	:	IP-55																													
(e)	Flow tube	:	SS304																													
(f)	liner	:	Hard Rubber																													
20.00.00	AC PLANT RELATED SPECIAL INSTRUMENTS																															
20.01.00	HUMIDITY SENSOR <table><tr><td>Sensor</td><td>:</td><td>Capacitance type</td></tr><tr><td>Accuracy</td><td>:</td><td>+/-3% R.H</td></tr><tr><td>Range</td><td>:</td><td>0-100% R.H</td></tr><tr><td>Output</td><td>:</td><td>4-20 ma</td></tr></table>	Sensor	:	Capacitance type	Accuracy	:	+/-3% R.H	Range	:	0-100% R.H	Output	:	4-20 ma																			
Sensor	:	Capacitance type																														
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EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE -I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION – VI, PART-B BID DOC. NO.: CS:9585-001-2	SUB-SECTION-IIIC-04 MEASURING INSTRUMENTS (PRIMARY & SECONDARY)	PAGE 41 OF 46																												

CLAUSE NO.	TECHNICAL REQUIREMENTS 		
22.07.00	ENCLOSURE/CABINETS / PANELS The enclosure shall accommodate all EQMS Analyser. The enclosure shall provide protection from dust, humidity, precipitations, sunlight and environmental pollution. The material for the enclosure shall be of steel plate with minimum 2 mm thick frame and 1.6 mm thick CRCA steel sheet of protection IP 55 or better with safety lock of good quality. The lighting provision in the cabinet and the canopy for the cabinet is to be provided. The cabinets shall be designed such that the wet section and dry section are separate, the exact details shall be finalized during detailed engineering. In order to ensure the healthy operation of the installed electronic modules, cards, analyzers, etc inside the enclosure during continuous operation, the EQMS enclosure shall be provided with Air conditioner unit . 23.00.00 ~~Monitoring System for Coal Bunker, Fly Ash Silo and ESP Hopper (First Field)~~ ~~Complete Level Monitoring System comprising of Acoustic Frequency Based 3D Level Scanners, PC, electronic modules, splitters, modems, junction boxes, mounting kit, enclosures, interconnecting cables, software and all other accessories required to make the system complete and fully functional, shall be provided on as required basis for continuous level measurement and monitoring of level of each coal bunker, each Fly Ash Silo and each ESP Hopper (First Field of ESP Only) complying with following requirements:~~		
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE –I (3X 800MW)	TECHNICAL SPECIFICATIONS SECTION – VI, PART-B BID DOC. NO.: CS:9585-001-2	SUB-SECTION-IIIC-04 MEASURING INSTRUMENTS (PRIMARY & SECONDARY)	PAGE 45 OF 46

SPECIFICATIONS FOR PR. GAUGE, D.P. GAUGE, TEMP. GAUGE AND LEVEL GAUGE.

Sl. No	FEATURES	ESSENTIAL/MINIMUM REQUIREMENTS		
		Pr. Gauge/ DP Gauge/ Draught gauges	Temperature Gauge	Level Gauge
1	Sensing Element and material	Bourdon for high pressure, Diaphragm/Bellow for low pr. Of 316 SS	Mercury in steel for below 450°C and inert gas actuated for above 450°C of SS bulb and capillary.	Tempered * toughened Borosilicate gauge glass steel armoured reflex or transparent type.
2	Body material	Die-cast aluminium	Die-cast aluminium	Forged carbon steel/304 SS
3	Dial size	150mm	150 mm	Tubular covering entire range
4	End connection	1/2 inch NPT (M)	3/4" NPT (M)	Process connection as per ASME PTC and drain/vent 15 NB
5	Accuracy	±1% of span	± 1% of span	± 2%
6	Scale	Linear, 270° arc graduated in metric units	Linear, 270° arc graduated in °C	Linear vertical
7	Range selection	Cover 125% of max. of scale	Cover 125% of max. of scale	Cover 125% of max. of scale
8	Over range test	Test pr. for the assembly shall be 1.5 to the max. Design pr. at 38°C.		
9	Housing	Weather and dust proof as per IP-55	Weather and dust proof as per IP-55	CS/304 SS leak proof
10	Zero/span adjustment	Provided	Provided	--
11	Identification	Engraved with service legend or laminated phenolic name plate		

12	Accessories	Blow out disc, SS Thermowell siphon, snubber, pulsation dampener, chemical seal (if required by process) gauge isolation valve	Gasket for all KEL-F shield for transparent type vent and drain valves of Steel/SS as per CS/Alloy process Requirement.
13	Material of Bourdon/ movement	316 SS / 304 SS	316 SS / 304 SS

Notes:-

*Bicolour type level gauges will be provided for applications involving steam and water except for condensate and feed water services.

Length of gauge glass shall not be more than 1400 mm. If the vessel is higher, multiple gauge glasses with 50 mm overlapping shall be provided.

Where the process fluids are corrosive, viscous, solid bearing or slurry type, diaphragm seals shall be provided. Parts below the diaphragm shall be removable for cleaning. The entire volume above the diaphragm shall be completely filled with an inert liquid suitable for the application.

FIELD MOUNTED LOCAL JUNCTION BOXES

- | | | |
|--------|---------------------------------|---|
| (i) | No. of ways | 12/24/36/48/64/72/96/128 with 20% spares terminals. |
| (ii) | Material and Thickness | 4mm thick Fiberglass Reinforced Polyester (FRP). |
| (iii) | Type | Screwed at all four corners for door. Door gasket shall be of synthetic rubber. |
| (iv) | Mounting clamps and accessories | Suitable for mounting on walls, columns, structures etc. The brackets, bolts, nuts, screws, glands required for erection shall be of SS, included in Bidders scope of supply. |
| (v) | Type of terminal blocks | Rail mounted cage-clamp type suitable for conductor size upto 2.5 mm ² . A M6 earthing stud shall be provided. |
| (vi) | Protection Class | IP: 55 minimum for indoor & IP-65 minimum for outdoor applications. |
| (vii) | Grounding | To be provided. |
| (viii) | Color | RAL 7305. |

(e) **Flow Switch (to be provided with isolating valves)**

(i)	Body	Forged steel
(ii)	Extension Rod/wire	SS-304
(iii)	Sleeve and Sleeve pipe	SS-304
(iv)	Cover	Die cast aluminum
(v)	Max. working pressure	10 kg/sq.cm
(vi)	Repeatability	± 0.5%
(vii)	No. of contacts	2 NO + 2 NC
(viii)	Type of contact	Adjustable throughout the range.
(ix)	Protection class	IP – 65

(f) **Level Switch**

(i)	Type	Displacer operated magnetic type
(ii)	Displacer	SS – 316
(iii)	Wire rope	SS – 316
(iv)	Spring Housing Spring and sleeve pipe	SS – 316
(iv)	Cover	Cast Aluminum
(v)	No. of Contacts	2 NO + 2 NC

PH Analyser

1. Type	Cell - flow through
2. Accuracy	< $\pm 1\%$ of span
3. Range	0 - 14 pH, programmable
4. No. of streams	Single
5. Stability	< 0.001 pH / week
6. Temp. Coefficient / Temp. error	0.001 pH / Deg. C
7. Type of electronics	Microprocessor based with self-diagnostic Facility.
8. Indication	Digital
9. Enclosure	Weather dust proof (IP55) Die cast aluminum.

Dew point meter

Sensor

Type	:	Capacitance type with change in output proportional to moisture present.
Service	:	Dry Air
Range	:	-50 to 0 Degree Centigrade Dew-Point
Sensor Accuracy	:	Better than $\pm 0.5^\circ$
Operating Temperature	:	0 to 50 degree C.
Operating Pressure	:	0-10 Kg./Cm ² , suitable for process application.

Analyser

Input	:	Change in capacitance from dew point sensor.
Display	:	Combined enclosure with two three-digit seven segments LED display with decimal point after two digits. LED height shall be 4 inches, clearly legible from a distance of atleast 10 meters.
Range	:	-50 to 0 Degree Centigrade Dew-Point
Display Accuracy	:	Better than ± 2 Degree C.
Mounting	:	Table top/Flush mounting, to be finalised during

Power supply : 240V AC, 50 Hz to be arranged by the contractor.

Output : 5-20 mA DC capable of driving a load impedance of 500 ohms minimum.

4-20 mA DC Output signal is to be connected to control system in Contractor's Scope (Interconnection cables are to be provided by the Contractor).

In case the system is not suitable for Direct online mounting, then all the required sampling system is to be provided by the contractor.

All required accessories including cables, sensor holder, desiccant chambers, mounting fixtures etc. are to be supplied by the Contractor within his quoted lumpsum price.

Conductivity Monitors

Specific conductance cell			
Specific conductance cell shall be provided with suitable electrode material and cell body material taking into account the various factors of actual service conditions, corrosion resistance etc. Cell constant shall be subject to Owner's approval, the cell shall be provided with automatic temperature compensation. The specific conductance cell shall be suitable for use in the plant discharge water.			
Conductivity cells are shall be compatible with the conductivity monitors.			
The monitor shall have the following design features :			
a)	Power supply	:	240V AC 50, Hz single phase/ 24 V DC
b)	Range	:	0-1, 0-10, 0-100, 0- 1000, 0- 10,000 micro mho/cm programmable. 0-2500 ppm for dissolved solids.
c)	Signal accuracy excluding meter accuracy	:	Approximately 1% of full scale
d)	Temperature compensation	:	Automatic
e)	Response time	:	<=1 sec.
f)	Identification	:	Phenolic nameplate stating monitor number, sample and conductivity cell number.
g)	Output	:	4-20 mA DC buffered output capable of driving a minimum load impedance of 500 Ohms.
Analysers, monitors shall be microprocessor based.			
The monitor shall be of multi-range type, single range monitor shall not be acceptable.			

SIGHT GLASS

Sr. No.	Description	
1.	Make	
2.	Type	Double Window
3.	Connection	Flanged
4.	Flow Directions	Horizontal
5.	Indicator	Bi- Directional Flapper
6.	Body	A106 Gr B
7.	Cover Plates	IS2062
8.	Bolts/Studs and Nuts	GI
9.	Gaskets	NON CAF
10.	Glass	Toughened
11.	Flapper	AISI 316
12.	Process Flanges	IS2062 / A105
13.	Flange rating	150#RF ANSI B16.5
14.	Tag plate	SS

Process Connection & Piping																		
TESTS		Visual ®	GA, BOM, Layout of component & construction feature®	Dimension ®	Paint Shade/thickness ®	Flattening,flaring,hydrottest,hardness check as per ASTM standard (A)	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
ITEMS																		
Local Instrument enclosure		Y	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	Y			
Junction Box		Y	Y	Y	Y*		Y		Y	Y				Y				
Gauge Board		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			
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																		

CLAUSE NO.	QUALITY ASSURANCE									
MEASURING INSTRUMENTS (PRIMARY AND SECONDARY)										
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(BS-6447 / 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 (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) Detailed procedure of Environmental Stress Screening Test shall be as per Quality Assurance Programme in General Technical Conditions										
2) 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											
ITEMS	TESTS	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	Y**	Y
17. Flow nozzle(BS-1042)		Y	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. Flue Gas analyser		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) Detailed procedure of Environmental Stress Screening test shall be as per Quality Assurance Programme in General Technical Conditions 2) 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													
		CONTROL PANEL							SQE_25						
Attributes Characteristics	Item Components Sub System Assembly	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	Specification requirement
	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							
	Contractor/ 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							
	LVS, Mosaics														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				
	Control 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												
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 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	Y
Note: 1) Detailed procedure of Environmental Stress Screening test shall be as per Quality Assurance Programme in General Technical Conditions 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.														
® - Routine Test (A) - Acceptance Test Y - Test applicable														

	CHECK LIST FOR PRESSURE / DIFFERENTIAL PRESSURE GAUGE (Mechanical Auxiliary Packages)		SPECIFICATION NO.:	
			VOLUME	
			SECTION	
			REV. NO.	DATE:
			SHEET 1	OF 1
Data Sheet No.: PE-CL-999-145-I026-0				

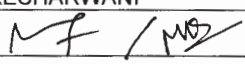
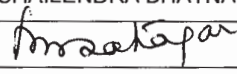
SL NO	TESTS/CHECKS	QUANTM OF CHECK	REFERENCE DOC. ACCEPTANCE NORMS	AGENCY			REMARKS
				P	W	V	
1.0	CHECK FOR		APPROVED TECHNICAL REQUIREMENT/ DATA SHEET				MFR TO CARRY OUT ROUTINE TEST ON 100%. WHEN MATL CORRELATION ARE NOT AVAILABLE MFR'S COMPLIANCE TO BE PROVIDED
	1.1 DIAL SIZE	100%		M	C	C	
	1.2 MODEL NO/TAG NO	100%		M	C	C	
	1.3 RANGE/SCALE	100%		M	C	C	
	1.4 END CONNECTION	100%		M	C	C	
	1.5 SWITCH CONTACT RATING & NOS	100%		M	C	C	
2.0	CALIBRATION						
	2.1 ACCURACY	100%		M	C	B	
	2.2 REPEATABILITY (FOR SWITCH)	100%		M	C	B	
	2.3 SET POINT ADJUSTMENT FOR SWITCH	100%		M	C	C	
3.0	OVER PRESSURE & LEAK TEST	100%		M	C	C	
4.0	OPERATION OF PR. RELIEF DEVICE	ONE PER TYPE		M	C	C	
5.0	REVIEW OF T.C. FOR MATERIAL OF--						
	5.1 SENSOR	FOR LOT		-	-	B	
	5.2 MOVEMENT			-	-	B	
	5.3 PROCESS CONNECTION			-	-	B	
	5.4 HOUSING			-	-	B	
6.0	REVIEW OF T.C. FOR DEGREE OF PROTECTION	TYPE TEST		-	-	B	
7.0	REVIEW OF T.C. FOR CONTACT RATING OF SWITCH	ONE PER TYPE		-	-	B	
8.0	ACCESSORIES AS APPLICABLE	100%		M	C	C	

LEGEND:

M: MANUFACTURER/ SUB CONTRACTOR, C: CONTRACTOR/ NOMINATED INSP AGENCY, B: BHEL. P: PERFORM, W: WITNESS, V: VERIFICATION.

NOTE:

CONTRACTOR TO PROVIDE COMPLIANCE CERTIFICATE FOR TESTS/CHECKS VERIFIED BY CONTRACTOR AND SUBMIT THE SAME ALONGWITH TEST CERTIFICATES TO BE VERIFIED BY BHEL.

	PREPARED BY	CHECKED BY	APPROVED BY
NAME	S C NARANG/ MAYANK KESHARWANI	DIPESH PALIT	SHAIENDRA BHATNAGAR
SIGNATURE			
DATE	21.08.08	21.08.08	21.08.08

CLAUSE NO.	TECHNICAL REQUIREMENTS 		
2.00.00 2.01.00	SPECIAL REQUIREMENT FOR SOLID STATE EQUIPMENTS/ SYSTEMS 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 shall be as indicated below: i) Surge Withstand Capability (SWC) for Solid State Equipments/ Systems 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 37.90.1/ 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 37.90.1/ 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 along with the proposal. As an alternative to above, suitable class of EN 61000-4-12 which is equivalent to ANSI 37.90.1/ IEEE-472 may also be adopted for SWC test. ii) Dry Heat test as per IEC-68-2-2 or equivalent. iii) Damp Heat test as per IEC-68-2-3 or equivalent. iv) Vibration test as per IEC-68-2-6 or equivalent. v) Electrostatic discharge tests as per EN 61000-4-2 or equivalent. vi) Radio frequency immunity test as per EN 61000-4-6 or equivalent. vii) Electromagnetic Field immunity as per EN 61000-4-3 or equivalent. Test listed at item no. v, vi, vii, above are applicable for electronic cards only as defined under item (i) above.		
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)	TECHNICAL SPECIFICATIONS SECTION – VI, PART-B BID DOC. NO.: CS:9585-001-2	SUB-SECTION-IIIIC-10 TYPE TEST REQUIREMENTS	PAGE 2 OF 9

CLAUSE NO.	TECHNICAL REQUIREMENTS						एन टी पी सी NTPC	
3.00.00	TYPE TEST REQUIREMENT FOR C&I SYSTEMS							
	Sl. No	Item	Test Requirement	Standard	Test To Be Specifically Conducted	NTPC's Approval Req. On Test Certificate		
	Col 1	Col 2	Col 3	Col 4	Col 5	Col 6		
	1	Elect. Metering instruments	As per standard (col 4)	IS-1248	No	Yes		
	2	Transducers	As per standard (col 4)	IEC-60688,IS12784	No	Yes		
	3	Thermocouple	Degree of protection test	IS-13947	No	No		
	4	RTD	As per standard (col 4)	IEC-60751	No	No		
	5	Electronic transmitter	As per standard (col 4)	BS-6447 / IEC-60770	No	Yes		
	6	E/P converter	As per standard (col 4)	Mfr. standard	No	No		
	7	Dust emission monitor	Degree of protection test	IS-13947	No	Yes		
	8	Instrumentation Cables Twisted & Shielded*						
		-Conductor	Resistance test	VDE-0815	No	Yes		
			Diameter test	IS-10810	No	Yes		
			Tin Coating test (Persulphate test)	IS-8130	No	Yes		
		-Insulation	Loss of mass	VDE 0472	No	Yes		
			Ageing in air ovens**	VDE 0472	No	Yes		
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)			TECHNICAL SPECIFICATIONS SECTION – VI, PART-B BID DOC. NO.: CS:9585-001-2		SUB-SECTION-IIIC-10 TYPE TEST REQUIREMENTS		PAGE 3 OF 9	

CLAUSE NO.	TECHNICAL REQUIREMENTS 																																																																																						
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EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)	TECHNICAL SPECIFICATIONS SECTION – VI, PART-B BID DOC. NO.: CS:9585-001-2	SUB-SECTION-IIIIC-10 TYPE TEST REQUIREMENTS	PAGE 4 OF 9																																																																																				

CLAUSE NO.	TECHNICAL REQUIREMENTS					एनटीपीसी NTPC
		Cold bend/ cold impact test	VDE-0472	No	Yes	
		Oxygen index test	ASTMD-2863	No	Yes	
		Smoke Density Test	ASTMD-2843	No	Yes	
		Acid gas generation test	IEC-60754-1	No	Yes	
	-fillers	Oxygen index test	ASTMD-2863	No	Yes	
		Acid gas generation test	IEC-60754-1	No	Yes	
	-AL-MYLAR shield	Continuity test		No	Yes	
		Shield thickness		No	Yes	
		Overlap test		No	Yes	
	-Over all cable	Flammability Test	IEEE 383	No	Yes	
		Swedish Chimney Test	SEN 4241475	No	Yes	
		Noise interference	IEEE Trans- actions	No	Yes	
		Dimensional checks	IS 10810	No	Yes	
		Cross talk	VDE-0472	No	Yes	
		Mutual capacitance	VDE-0472	No	Yes	
		HV test	VDE-0815	No	Yes	
		Drain wire continuity		No	Yes	
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION – VI, PART-B BID DOC. NO.: CS:9585-001-2		SUB-SECTION-IIIC-10 TYPE TEST REQUIREMENTS		PAGE 5 OF 9

CLAUSE NO.	TECHNICAL REQUIREMENTS																												
	* 1.0 All cables to be supplied shall be of type tested quality. The Contractor shall submit for Owner's approval the reports of all the type tests as listed in this specification and carried out within last Ten years from the date of bid opening. These reports should be for the tests conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client. 2.0 In case the Contractor is not able to submit report of the type test(s) conducted within last Ten years from the date of bid opening, or in case the type test report(s) are not found to be meeting the specification requirements, the Contractor shall conduct all such tests either in an independent laboratory or at manufacturer's works in presence of Owner's representative under this contract free of cost to the Owner and submit the reports for approval. **These tests shall be carried out as per VDE0207 Part 6 & ASTM-D-2116 for TEFLON insulated & outer sheathed cables ***Applicable for armoured cables only 9 DC Power Supply System (Applicable for each model and rating) 1)The Type Test reports for offered rectifier module and the controller module irrespective of the rectifier bank shall be acceptable <table><tr><td>Surge Withstand Capability(SWC)</td><td>ANSI 37.90.1, No IEEE-472,EN 61000-4-12</td><td>Yes</td></tr><tr><td>Dry Heat Test</td><td>IEC-68-2-2 or No equivalent</td><td>Yes</td></tr><tr><td>Damp Heat test</td><td>IEC-68-2-3 or No equivalent</td><td>Yes</td></tr><tr><td>Vibration test</td><td>IEC68-2-6 or No equivalent</td><td>Yes</td></tr><tr><td>Electrostatic discharge test</td><td>EN 61000-4-2 No orr equivalent</td><td>Yes</td></tr><tr><td>Radio frequency immunity test</td><td>EN-61000-4-3 No orr equivalent</td><td>Yes</td></tr><tr><td>Electromagnetic field immunity</td><td>EN 61000-4-3 No orr equivalent</td><td>Yes</td></tr><tr><td>Degree of Protection</td><td>IS-13947 or No equivalent</td><td>Yes</td></tr></table>					Surge Withstand Capability(SWC)	ANSI 37.90.1, No IEEE-472,EN 61000-4-12	Yes	Dry Heat Test	IEC-68-2-2 or No equivalent	Yes	Damp Heat test	IEC-68-2-3 or No equivalent	Yes	Vibration test	IEC68-2-6 or No equivalent	Yes	Electrostatic discharge test	EN 61000-4-2 No orr equivalent	Yes	Radio frequency immunity test	EN-61000-4-3 No orr equivalent	Yes	Electromagnetic field immunity	EN 61000-4-3 No orr equivalent	Yes	Degree of Protection	IS-13947 or No equivalent	Yes
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EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)	TECHNICAL SPECIFICATIONS SECTION – VI, PART-B BID DOC. NO.: CS:9585-001-2	SUB-SECTION-III-C-10 TYPE TEST REQUIREMENTS	PAGE 6 OF 9																										

CLAUSE NO.	TECHNICAL REQUIREMENTS				एनटीपीसी NTPC	
	10	Battery ^{##}	As per standard (col 4)	IS-10918 (Ni-Cd Batteries)	No	Yes
				IS-1652 (Lead Acid Plante Batteries)	No	Yes
	11	NOT APPLICABLE				
	12	UPS (Applicable for each model and rating)				
		1) Type Test reports of same series of UPS with similar PCB's cards and controllers as the target UPS system shall be acceptable.				
		2) For Dry heat, Damp heat and vibration, the tests conducted on individual PCB's shall be acceptable.				
		Surge Withstand Capability(SWC)	ANSI 37.90.1, IEEE-472,EN 61000-4-12	No		Yes
		Dry Heat Test	IEC-68-2-2 or equivalent	No		Yes
		Damp Heat test	IEC-68-2-3 or equivalent	No		Yes
		Vibration test	IEC68-2-6 or equivalent	No		Yes
		Electrostatic discharge test	EN 61000-4-2 or equivalent	No		Yes
		Radio frequency immunity test	EN-61000-4-3 or equivalent	No		Yes
		Electromagnetic field immunity	EN 61000-4-3 or equivalent	No		Yes
		Degree of protection test	IS-13947	No		Yes
		Fuse Clearing Capability	Approved procedure	No		Yes
		Short Circuit current capability	IEC 60146-2	No		Yes
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION – VI, PART-B BID DOC. NO.: CS:9585-001-2		SUB-SECTION-IIIC-10 TYPE TEST REQUIREMENTS		PAGE 7 OF 9

CLAUSE NO.	TECHNICAL REQUIREMENTS						
	13	Voltage Stabilisers	Over Load Test	Approved procedure	No	Yes	
			Temp rise test without redundant fans	Approved procedure	No	Yes	
	14	Public Address System					
		- Amplifiers	As per standard (col 4)	IS 9302, Part-II	No	Yes	
		Microphones	As per standard (col 4)	IS 9302, Part-III IS 15482:2004/ IEC 61842(2002)	No	Yes	
		Loudspeaker	As per standard (col 4)	IS 9302, Part-IV	No	Yes	
	15	LIE / LIR	Degree of protection test	IS-13947	No	Yes	
	16	Flue analyzers	gas Degree of protection test	IS-13947	No	Yes	
	17	Master Clock	Functional test	As per approved procedure	No	Yes	
	18	CJC Box	Degree Of protection test	IS-13947	No	Yes	
	19	Junction Box	Degree Of protection Test	IS-13947	No	Yes	
	20	OPC Access Data Server, Data Exchange & Server	OPC Compliance Testing		No	Yes (Self certification is also	
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)			TECHNICAL SPECIFICATIONS SECTION – VI, PART-B BID DOC. NO.: CS:9585-001-2		SUB-SECTION-IIIC-10 TYPE TEST REQUIREMENTS	PAGE 8 OF 9	

CLAUSE NO.	TECHNICAL REQUIREMENTS																																									
	Historical Data Access Server acceptable) <table><tr><td>21</td><td>Conductivity Type Level Switch</td><td>Degree of protection test</td><td>of IS-2147</td><td>No</td><td>No</td></tr><tr><td>22</td><td>Local Gauges</td><td>Degree of protection test</td><td>of IS-2147</td><td>No</td><td>No</td></tr><tr><td>23</td><td>Process actuated Switches</td><td>Degree of protection test</td><td>of IS-2147</td><td>No</td><td>No</td></tr><tr><td>24</td><td>Control Valves</td><td>CV test</td><td>ISA 75.02& 75.11</td><td>No</td><td>Yes</td></tr><tr><td>25</td><td>PLCs</td><td>As per standard (Col 4)</td><td>IEC 1131</td><td>No</td><td>No</td></tr><tr><td>26</td><td>Flow Nozzle Orifice plates</td><td>Calibration</td><td>ASME PTC BS 1042</td><td>No</td><td>Yes</td></tr></table> ## The contractor shall submit for Employers approval the reports of all the type test as per latest IS-10918 carried out within last ten years from the date of Bid opening and the test(s) should have been either conducted at an independent laboratory or in presence / owners representative. The complete type test reports shall be for any rating of Battery in a particular group based on plate dimensions being manufactured by supplier. Note: Type Tests are to be conducted only for the items, which are being supplied as a part of this Package.						21	Conductivity Type Level Switch	Degree of protection test	of IS-2147	No	No	22	Local Gauges	Degree of protection test	of IS-2147	No	No	23	Process actuated Switches	Degree of protection test	of IS-2147	No	No	24	Control Valves	CV test	ISA 75.02& 75.11	No	Yes	25	PLCs	As per standard (Col 4)	IEC 1131	No	No	26	Flow Nozzle Orifice plates	Calibration	ASME PTC BS 1042	No	Yes
21	Conductivity Type Level Switch	Degree of protection test	of IS-2147	No	No																																					
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24	Control Valves	CV test	ISA 75.02& 75.11	No	Yes																																					
25	PLCs	As per standard (Col 4)	IEC 1131	No	No																																					
26	Flow Nozzle Orifice plates	Calibration	ASME PTC BS 1042	No	Yes																																					
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION – VI, PART-B BID DOC. NO.: CS:9585-001-2		SUB-SECTION-IIIC-10 TYPE TEST REQUIREMENTS		PAGE 9 OF 9																																				

No.	Major Equipment	QP Inspection Category	QP No. 9582 001-QVI-Q	QP Submission SCH	QP Approval SCH	Proposed Sub Supplier	Country	SS Approval Status	SS Detail Sub.SCH	SS Approval SCH	Remark
		II				Berhold Technologies	Germany	A			
		*				M and W	Denmark	DR			M/s BHEL will forward only one proposal after details review of NTPC Technical specification requirements.
		*				EMERSON	India	DR			
		*				Yokogawa	Bangalore	DR			
		*				Forbes Marshall	Pune	DR			
11	Furnace Exit Gas Temperature Probe	III				Diamond Power	India /UK/USA	NOTED			
		III				Clyde Bergmann	India /USA	NOTED			
12	Boiler tube leak detection system	II				Procon	UK	A			
		II				Raman Instruments	Delhi	A			M/s Procon, UK make System
		II				Acoustic Monitoring International Inc.	USA	A			
		II				Hi Tech System and Service	Kolkata	A			M/s AMI, USA make System
		II				Instotech	South Africa	A			
		II				Rectusan	Korea	A			
		II				BHELSONIC	Trichy	A			
13	Coal bunker Level monitor	%				%					% type, vendor and inspection category will be decided during detail Engineering
14	Tube thickness Meter	III				Main Supplier approved sources		NOTED			
15	POSITIVE DISPLACEMENT FLOW METER/	III				BROOKS	USA	A			Calibration reports to be submitted.
		III				BOPP & ROUTHIER	GERMANY	A			
		III				OVAL	JAPAN	A			
		II				Toshniwal corporation Hyvac	Chennai	A			Up to 4 inch only
16	Coriolis Type Mass Flow	III				Krohne	Germany	NOTED			
		III				E & H	Aurangabad	NOTED			
		III				Siemens	Germany	NOTED			Subject to type acceptance from NTPC Engineering.
		III				Yokogawa	Bangalore	NOTED			
		III				Emerson	Pawane	NOTED			
17	Control Valve for Start Up System	II				CCI	USA/Switzerland/ Korea	A			
		II				Tyco Sampell	Germany	A			
		*				EMERSON (Fisher)	USA/France/Japa	DR			Reference list and
		*				Dressor Masonellian	France	DR			performance feedback are to

No.	Major Equipment	QP Inspection Category	QP No. 9582 001-QVI-Q	QP Submission SCH	QP Approval SCH	Proposed Sub Supplier	Country	SS Approval Status	SS Detail Sub.SCH	SS Approval SCH	Remark
		*				CCI	India	DR			Approved for 840 Series 8 Inch, 600 Class
		*				Daume Regelmaturean GmbH	Germany	DR			M/s BHEL will forward only three proposals after details review of NTPC Technical specification requirements.
		*				Metso Singapore PTE Ltd.	South Korea	DR			
		*				Severn Glocon	Chennai	DR			
		*				Spx Corporation	USA	DR			
		*				Ringo Valvulas SL	Spain	DR			
		*				Valitalia SPA	Italy	DR			
		*				R K Controls	Thane	DR			
		*				Circor (Leslie)	Coimbatore	DR			
		*				Spx Flow Technologies	USA	DR			
		*				KOSO	Nasik	DR			
		*				Parcol Spa	USA	DR			
		*				Schenjiang valve co. Ltd.	China	DR			
		*				Spx Flow Technologies	Ahmadabad	DR			
20	Temperature Transmitter	III				EMERSON	U.S./Pawane / Singapore	A			
	(Single and Dual Input)	III				Yokogawa	Japan	A			Final testing at M/S YIL, Bangalore is also acceptable
		III				Moore	USA	A			
		III				M System	JAPAN	A			
		III				ABB	GERMANY/ Bangalore	A			
		III				ENDRESS & HOUSER	Aurangabad	A			
		*				Khrone		DR			M/s BHEL will forward only two proposals after details review of NTPC Technical specification requirements.
		*				Tokyo Keiso	Japan	DR			
		*				Honeywell	Pune	DR			
		*				INOR	Sweden	DR			
		*				P & F	Bangalore	DR			
		*				Siemens		DR			
		*				Yamatake	JAPAN	DR			
		*				Yamari	JAPAN	DR			
		*				Foxboro		DR			
21	Conduits/Pipe(GI)					Refer Electrical List					

No.	Major Equipment	QP Inspection Category	QP No. 9582 001-QVI-Q	QP Submission SCH	QP Approval SCH	Proposed Sub Supplier	Country	SS Approval Status	SS Detail Sub.SCH	SS Approval SCH	Remark
22	Electronic transmitters (pressure, DP)	III				EMERSON (Rosemount)	USA/ Pawane	A			
		III				FUJI ELECTRIC	China	A			
		III				YOKOGAWA	JAPAN	A			Testing and Calibration at M/s YIL, Bangalore is also acceptable.
		II				ABB	Bangalore	A			Model - 2600 T
		III				ABB	GERMANY / Italy	A			Model - 2600 T
		III				Siemens	France / India	A			
		III				Honeywell	Pune	A			
		*				ENDRESS & HOUSER	Aurangabad/ Germany	DR			
23	Thermocouples, RTD & Thermowell	III				HERAUS SENSOR	GERMANY	A			
		III				WISE Control	Korea	A			
		II				Tempens	Udaipur	A			
		II				Pyroelectric	Goa	A			
		II				Detriv Instrumentation & Electronics Ltd	Mumbai	A			
		III				Minco	USA	A			
		III				OKAZAKI corporation	JAPAN	A			
		III				Yamari	JAPAN	A			
		III				Yamari	Singapore	A			For RTD Reference list and Performance feedback is to be submitted.
		III				ABB(SENSYCON)	Germany	A			
		III				EMERSON (Rosemount)	Germany	A			
		II				EMERSON (Rosemount)	Pawane	A			Imported from Emerson, Germany (make)
		II				Thermal Instruments(GIC)	Savantwadi	A			
		II				Techno Instruments	Ahamadabad	A			
		II				GOA Instrument Industries	GOA	A			For Thermowell only
		*				GOA Instrument Industries	GOA	DR			M/s BHEL will forward only two proposals after details review of NTPC Technical specification requirements.
		*				WIKI	Pune	DR			
		*				Toshniwal Industries	Ajmer	DR			
		*				E & H	Aurangabad	DR			

No.	Major Equipment	QP Inspection Category	QP No. 9582 001-QVI-Q	QP Submission SCH	QP Approval SCH	Proposed Sub Supplier	Country	SS Approval Status	SS Detail Sub.SCH	SS Approval SCH	Remark
		*				Nestech	Vapi	DR			
		*				Baumer	Vapi	DR			
24	Ultrasonic type level Transmitter	III				E & H	Aurangabad/ Germany	A			
		III				EMERSON	Pawane	A			
		III				SIEMENS MILTRONICS	CANADA	A			
		III				Nivelco	Hungary	A			
		*				Vega	Germany	DR			
		*				Khrone	France / USA/ Pune	DR			M/s BHEL will forward only two proposals after details review of NTPC Technical specification requirements.
		*				Yokogawa	Bangalore	DR			
		*				Honeywell	India	DR			
		*				Magnetrol	Belgium	DR			
		*				ABB	Germany / India	DR			
25	Orifice plate assembly	III				Instrumentation Limited	Paighat	A			
		III				Microprecision	Faridabad	A			
		III				Starnech	Pune	A			
		III				Flow Star	Faridabad	A			
		III				SEIKO	Austria	A			
		III				MINCO (GIC)	GOA	A			
		III				WISE Control	Korea	A			
		III				T M Technomatic	Italy	A			
		*				IEPL	Hyderabad	DR			
		*				Engg. Specialities	Kolkata	DR			
		*				BALIGA	CHENNAI	DR			
		*				Pyroelectric	Mumbai	DR			
		*				Hydropneumatics	Mapusa	DR			
26	Pressure, DP Gauge	III				BUDENBERG	UK	A			
		III				ASHCROFT	USA/Germany/ India	A			
		III				Wika	GERMANY	A			
		III				WISE Control	Korea	A			
		III				Nagano KEIKI	Japan	A			
		III				H.Guru South India	Bangalore	A			Not for MS & FW application
		III				A.N. Instruments	Kolakkatta	A			Not for MS & FW application
		III				Gauge Bourdon(GIC)	Parvel	A			

No.	Major Equipment	QP Inspection Category	QP No. 9582 001-QVI-Q	QP Submission SCH	QP Approval SCH	Proposed Sub Supplier	Country	SS Approval Status	SS Detail Sub.SCH	SS Approval SCH	Remark
		III				Goa Thermostatic	GOA	A			Not for MS & FW application
		III				Wika	Pune	A			DR for MS & FW application
		III				Baumer	Vapi	A			DR for MS & FW application
		III				Ashcroft (Mass Brand)	Gandhinagar	A			Not for MS & FW application
		III				H Guru	Rishra/Muzaffarpur	A			Not for MS & FW application
		*				US Gauge	USA	DR			
		*				Winters	USA	DR			
		III				Forbes Marshall	Hyderabad	A			
		*				Manometer	Mumbai	DR*			
		III				Walchandnagar Industries Ltd.	Dharwad	A			
		*				Nesstech	Vapi	DR			
		*				Gauges Bourdon	UK	DR			
27	Level gauge (Transparent & Reflex, Tubular type)	III				Nihon Klingage Co., Ltd	Japan	NOTED			
		III				Bunkabokei Kogyo Co., Ltd	Japan	NOTED			
		III				tokyo keiso	Japan	NOTED			
		III				Chemtrol Samil (I) Pvt. Ltd.	Mumbai	NOTED			
		III				Levcon	Kolkatta	NOTED			
		III				Sigma	Mumbai	NOTED			Up to 40 Kg/cm2
		III				SBEM	Pune	NOTED			Up to 40 Kg/cm3
		III				Chemtrol	GOA	NOTED			Up to 40 Kg/cm4
		III				ASIAN INDUSTRIAL VALVES	CHENNAI	NOTED			Up to 40 Kg/cm5
		III				D.K.Instruments	Kolkotta	NOTED			Up to 40 Kg/cm2
		III				Flow Star	Faridabad	NOTED			Up to 40 Kg/cm2
		III				V-Automat	NewDelhi	NOTED			
		III				DEMPER KOGYO	JAPAN	NOTED			
		III				Kubler	Germany	NOTED			
		III				WIKI	PUNE	NOTED			Up to 40 Kg/cm2
		III				WAREE	VAPI	NOTED			Up to 40 Kg/cm2
		III				Gauges Bourdon (GIC)	Parvel	NOTED			
		III				Magnetrol	Belgium	NOTED			
		III				Khrona	Germany	NOTED			
		III				PUNE TECHTROL	Pune	NOTED			
		III				E & H	Aurangabad	NOTED			
28	Press, DP, Vacuum Switch	III				SOR	USA	A			
		III				DRESSOR (ASHCROFT)	USA/Germany	A			

No.	Major Equipment	QP Inspection Category	QP No. 9582 001-QVI-Q	QP Submission SCH	QP Approval SCH	Proposed Sub Supplier	Country	SS Approval Status	SS Detail Sub.SCH	SS Approval SCH	Remark
		III				ITT BARTON	USA	A			
		III				HERION	GERMANY	A			
		III				BARSDALE	GERMANY	A			
		*				Nagano KEIKI	Japan	DR			
		I				Switzer Process Instrument	Chennai	A			Up to 40kg/cm2 & not for Compound Switch and except 900 series
		I				Trafag	Gurgaon	A			Up to 40kg/cm2 & not for Compound Switch
		I				Switzer Process Instrument	Ghaziabad	A			Up to 40kg/cm2 & not for Compound Switch
		III				Delta control	UK	A			
		I				Gauges Bourdon (GIC)	Panvel	A			Up to 40kg/cm2 & not for Compound Switch
		I				ASHCROFT	Gandhinagar	A			
		*				Wilka	Pune	DR			
		III				Gorgeion	France	A			M/s BHEL will forward only two proposals after details review of NTPC Technical specification requirements.
		III				United Electric	USA	A			
		*				SMC	Japan	DR			
		*				Neodyne	USA	DR			
		*				IMI NORGEN	Noida	DR			
		*				WISE Control	Korea	DR			
		*				Baumer	Vapi	DR			
29	Temperature Switch	III				SOR	USA	A			
		III				DRESSOR (ASCHROFT)	USA/Germany	A			
		III				ITT BARTON	USA	A			
		III				DELTA CONTROLS	UK	A			
		I				Switzer Process Instrument	Chennai	A			up to 200 Deg. C
		I				Switzer Process Instrument	Ghaziabad	A			up to 200 Deg. C
		I				Trafag	Gurgaon	A			up to 200 Deg. C
		I				ASHCROFT	Gandhinagar	A			
		*				Wilka	Pune	DR			
		III				Gorgeion	France	A			
		III				United Electric	USA	A			
		*				SMC	Japan	DR			
30	Flow switch	III				UNIVERSAL FLOW METER	USA	A			

No.	Major Equipment	QP Inspection Category	QP No. 9582 001-QVI-Q	QP Submission SCH	QP Approval SCH	Proposed Sub Supplier	Country	SS Approval Status	SS Detail Sub.SCH	SS Approval SCH	Remark
		III				Switzer	Chennai	A			
		III				Levcon	Kolkatta	A			
		III				DK Instrument	Kolkatta	A			
		III				Khrone Marshal	Pune	A			
		III				Chemtrol	India	DR			
		III				V Automat	NewDelhi	DR			
		III				Gauges Bourdon	Panvel	A			
		III				Magnetrol	Belgium	A			
		III				Ashcroft	Germany	A			
		III				Auxitrol	UK	A			
		III				Mericoild	USA	A			
		III				Delta Control	UK	A			
		III				Merium	USA	A			
		*				Sunag Corporation		DR			
31	Condensing Pots	III				INSTRUMENTATION LIMITED	PALGHAT	NOTED			
		III				MICRO PRECISION	FARIDABAD	NOTED			
		III				WOOJIN	Korea	NOTED			
		III				SAM IL	Korea	NOTED			
		III				Excel Hydro	Mumbai	NOTED			
		III				Flow tech	Calcutta	NOTED			
		III				Baldota	Mumbai	NOTED			
		III				Precision	Mumbai	NOTED			
		III				Metpress	Calcutta	NOTED			
		III				HP Valves and fittings	Chennai	NOTED			
		III				Main Contractor Approved Sources		NOTED			
32	Electric to Pneumatic converter	III				IMI NORGEN	India	A			Make : WATSON SMITH
		III				Fair child	USA	A			
		*				ABB	India	A			Subject to meeting the NTPC specification requirement
		*				SMC Pneumatics	Noida	DR			
		*				P & F	Bangalore	DR			
		*				Fairchild India Pvt. Ltd.	Noida	DR			
		*				FESTO	Bangalore	DR			

No.	Major Equipment	QP Inspection Category	QP No. 9582 001-QVI-Q	QP Submission SCH	QP Approval SCH	Proposed Sub Supplier	Country	SS Approval Status	SS Detail Sub.SCH	SS Approval SCH	Remark
		II				Sumitomo/kawasaki/Nippon	Japan	A			
		II				TPS TECHNITUBE	Germany	A			
		II				Veluric & mannessmann	Germany	A			
		II				BHEL	Trichy	A			
		II				Trouvay and Cauvin	France	A			Makes shall be as per approved list (Sr. No. 41)
		II				ISMT	Ahamadnagar	A			Carbon steel only.
		II				Sandvik		A			For SS only.
		*				TUBACES	Spain	DR			
		*				Salzgitter Mannesmann International	Germany	DR			
		*				Jindal saw	India	DR			
		II				Ratanamani Metal and Tubes	Ahamadabad	A			SS only
		II				Heavy metals and Tubes	Ahamadabad	A			SS and CS only.
		*				Shubhalaxmi Metal and Tubes	Mumbai	DR			
39	Compression fittings	III				Parker	USA	A			
		III				Precision	Mumbai	A			
		III				Astech	Mumbai	A			
		III				Fluid control Pvt. Ltd.	Pune	A			
		III				HP Valves and fittings	CHENNAI	A			Ferruleas are to be hardened at Exim Holand for pressure above 9000 psi.
		III				Excel hydro	Mumbai	A			Ferruleas are to be hardened at Exim Holand for pressure above 9000 psi.
		III				Swagelock	USA	A			
		III				Panam	Mumbai	A			
		*				Parker Hannifin India Pvt. Ltd.		DR			
		*				Prime Engineers		DR			
		*				Arya Craft		DR			
40	Instrument valves	III				BHEL	Trichy	A			
		II				Excel Hydro	Mumbai	A			
		II				Instrumentation Ltd.,	Palghat	A			
		III				Swagelok	USA	A			
		III				Parker	USA	A			
		II				HP Valves and fittings	CHENNAI	A			

No.	Major Equipment	QP Inspection Category	QP No. 9582 001-QVI-Q	QP Submission SCH	QP Approval SCH	Proposed Sub Supplier	Country	SS Approval Status	SS Detail Sub.SCH	SS Approval SCH	Remark
		II				Fluid control Pvt. Ltd.	Pune	A			
		II				Baldota	Mumbai	A			
41	Valve manifolds	III				Excel hydro	Mumbai	A			
		III				SCHNEIDER	Germany	A			
		III				Anderson Greenwood	USA	A			
		III				Astech	Mumbai	A			
		III				HP Valves and fittings	CHENNAI	A			
		III				Fluid control Pvt. Ltd.	Pune	A			
		III				Microprecision	Faridabad	A			
		III				Parker	USA	A			
		III				Swagelock	USA	A			
		III				Baldota	Mumbai	A			
		*				Melpress Engg. works	Kolkata	DR			
42	Local Instrument Enclosure/Rack	I				Pyrotech	Udaipur	A			
		I				Instrumentation Limited	Kota	A			
		I				Sajas electrical	Trichurapalli	A			
		I				Prammen	Puddukottai	A			
		I				Chemin	Pondicherry	A			
		*				Forbes Marshall	Pune	DR			
		*				Positronics	Vadodara	DR			
		*				Procon	Chennai	DR			
43	Instrument Cables	I				Paramount	Khushkhera	A			PVC,FRLS type,RQP
		I				Polycab	Daman	A			PVC,FRLS type,RQP
		I				Delton	Faridabad	A			PVC,FRLS type,RQP
		I				KEI	Bhiwadi	A			PVC,FRLS type
		I				Elkey Telelinks	Faridabad	A			PVC,FRLS type
		I				CORDS	Chopanki	A			PVC,FRLS type,RQP
		I				CORDS	Kaharani	A			PVC,FRLS type,RQP
		I				Nicco	Kolkata	A			PVC,FRLS type
		II				TEW & C	USA	A			
		II				Habia cables	Sweeden	A			
		II				Kerpen cables	Germany	A			
		II				Lapp cables	Germany	A			
		II				Thermo electra Bv	Netherland	A			
		I				Universal Cable	Satna	A			PVC,FRLS type

No.	Major Equipment	QP Inspection Category	QP No. 9582 001-QVI-Q	QP Submission SCH	QP Approval SCH	Proposed Sub Supplier	Country	SS Approval Status	SS Detail Sub.SCH	SS Approval SCH	Remark
		I				Thermocables	Hyderabad	A			
		I				Finolex Cable	Pune	DR *			
		I				Incab	Pune	DR *			
		I				Gupta Power Infrastructure Ltd.	Khurda	A			
		*				Lapp cables	India	DR			
		*				Lioni cable	Pune	DR			
		*				RR Kabel	Silvassa	DR			
		*				Gemscab	Bhiwadi	DR			
		*				KEC International	Mysore	DR			
		*				Advance cable Technologies	Bangalore	DR			
		*				Suyog Electricals Ltd.	Vadodara	DR			
		*				Special Cable	India	DR			
		*				CMI	Faridabad	DR			
44	Electrical actuator	III				Auma	Germany	A			
		III				Limitorqe	USA	A			
		III				Rotorq	UK	A			
		II				Limitorque	Faridabad	A			
		II				Rotork	Chennai/ Bangalore	A			
		III				Nippon gear	Japan	A			
		II				Auma	Bangalore	A			
		III				Harold Beck	USA	A			
		III				Drehmo	Germany	A			
		*				Lindoo	USA	DR			
		*				Siemens	Germany	DR			
45	Electrical actuator for ID/ED/PA Blade pitch and Guide vane control	III				Harold Beck	USA	A			
		III				SIPOS Aktorik GmbH	Germany	A			
		*				ABB	Germany	DR			
46	Flow nozzle / Ventruri assembly	II				Microprecision	Faridabad	A			
		II				SEIKO	Austria	A			
		II				TECHNOMATIC	Italy	A			
		II				Instrumentation Limited	Palghat	A			
		II				Starmech	Pune	A			DR for P-91 Material
		II				WISE Control	Korea	A			

No.	Major Equipment	QP Inspection Category	QP No. 9582 001-QVI-Q	QP Submission SCH	QP Approval SCH	Proposed Sub Supplier	Country	SS Approval Status	SS Detail Sub.SCH	SS Approval SCH	Remark
		*				SAMIL	Korea	DR			
		*				MINCO	GOA	DR			
		*				Engg. Specialities	Kolkata	DR			
		*				Pyroelectric	Mumbai	DR			
		*				Hydropneumatics	Mapusa / GOA	DR			
		*				ASIAN INDUSTRIAL VALVES	Chennai	DR			
47	HIGH Temp. cable (PTFE/FEP)	II				Habia cables	Sweden	A			
		II				Lapp cables	Germany	A			
		II				Kerpen cables	Germany	A			
		II				TEW & C	USA	A			
		II				Thermo-Electra Bv	Netherland	A			
		II				Habia cables	China	A			
		II				Thermocables	Hyderabad	A			
		*				Tempens	Udaipur	DR			
		*				Delton Cables	Faridabad	DR			
		*				RJ Cables	Roorkee	DR			
48	Fiber optic cable	II				HFCL	Goa	A			
		II				R&M	Switzerland	A			
		II				Aksh Fibre	Bhiwadi	A			
		II				Finolex	Pune/Goa	A			
		II				Birla Ericson	Rewa	A			
		II				Molex	UK	A			
		II				Corning	USA	A			
		II				Schneider	GOA	Noted			Previously known as D Link / Smarlink, Goa
		*				RPG Cables	India	DR			
		*				Uniflex Cables	India	DR			
49	Pneumatic Actuator (Power Cylinder e. g. FOR SADC)	II				Dong Woo Valve Control Co. LTD	Korea	A			
		II				Shin Hwa Engineering Co. LTD	Korea	A			
		I				Instrumentation Limited	Palghat	A			
		I				Kelton	Cochin(Alleppy)	A			
		I				SMC Pneumatics	Noida	A			Up to 12 inch only
		I				Rotex	Mumbai	A			Conditional
		*				Emerson Process Management	Chennai	DR			
		*				MIL Controls	Alwaye	DR			

No.	Major Equipment	QP Inspection Category	QP No. 9582 001-QVI-Q	QP Submission SCH	QP Approval SCH	Proposed Sub Supplier	Country	SS Approval Status	SS Detail Sub.SCH	SS Approval SCH	Remark
		*				Festo	Bangalore	DR			
		*				IMI Norgen	Noida	DR			
50	Level switch capacitance type	III				ENDRESS & HOUSER	Aurangabad	A			
		III				MAGNETROL	BELGIUM	A			
		III				SBEM	PUNE	A			
		III				PUNE TECHTROL	PUNE	A			
		III				LEVCON	KOLKATA	A			
		III				Nivo Controls	Indore	A			
		*				V AUTOMAT	New Delhi	DR			
		*				D K Instrument	Kolkata	DR			
		*				Siemens	Germany	DR			
		*				ABB	Korea	DR			
		*				Rosemount	Korea	DR			
51	Transducer	II				AE	Mumbai	A			
		II				Southern Transducer	Chennai	A			
		II				Elster	Mumbai	A			
		III				Camille Bauer	Germany	A			
		III				Metrawat	Germany	A			
		II				Rishab	Nasik	A			
		*				Pyrotech	Udaipur	DR			
		*				Masibus	Gandhinagar	DR			
		*				SIEMENS	Germany	DR			
52	Mini UPS up to 3.5 KVA	III				EMERSON	Mumbai	A			
		III				EMERSON	Pune	A			
		III				Hitachi Hi- Rel	Gandhinagar	A			
		III				APC	Bangalore	A			
		III				APLAB	Mumbai	A			
		III				Delta	Gurgaon	A			
		*				Powertronix	Bangalore	DR			Submit one proposal only
		*				Schneider	Bangalore	DR			
53	Level switch- cond type	III				EMERSON (Solartron mobrey)	UK	A			Levelstate, UK System
		II				Hi Tech	Kolkata	A			
		III				Yarway	USA	A			
		III				LEVELSTATE	UK	A			
		II				Raman Instruments	Delhi	A			Emerson (Mobrey) System
		*				BHEL	Trichy	DR			

No.	Major Equipment	QP Inspection Category	QP No. 9582 001-QVI-Q	QP Submission SCH	QP Approval SCH	Proposed Sub Supplier	Country	SS Approval Status	SS Detail Sub.SCH	SS Approval SCH	Remark
		III				Jafferson	Argentina	A			
		III				Asco	Chennai/USA	A			
		III				Festo	Bangalore	A			
		III				SMC	Noida	A			
		III				Parker	Brand Name	A			
		*				Schneider	Germany	DR			
		*				Neucon Industries Pvt. Ltd.		DR			
59	Lube oil control valve - Self Regulating	III				NUOVO PIGNONE	ITALY	A			
		III				EMERSON	CHENNAI	A			
		III				SAMSON	GERMANY / PUNE	A			
		III				Forbes Arca	Pune	A			Approved up to 4" , 150 Class.
60	Guided wave Radar type level transmitter	III				Magnetrol	Belgium	A			
		III				Endress & Houser	Germany/ Aurangabad	A			
		III				Emerson Process Management	Sweden/ USA	A			
		III				ABB(K-Tech)	Japan	DR			
		*				Yokogawa	India	DR			
		*				ABB	Bangalore	DR			
		*				P & F	France	DR			
		*				Khrono	Pune	DR			
		*				HONEYWELL	Germany / India	DR			
		*				Vega	India	DR			
		*				Siemens	Pune	DR			
		*				SBEM		DR			
61	Maintenance and Calibration Equipment					Main Contractor will propose the vendors during detail Engineering.					
62	Temperature Gauge	III				BUDENBERG	UK	A			
		III				DRESSOR (ASHCROFT)	USA/Germany	A			
		III				Wilka	GERMANY/ Pune	A			
		III				WISE Control	Korea	A			
		III				Nagano KEIKI	Japan	A			
		III				H.Guru South India	Bangalore	A			

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		#				Siemens		N			
		#				Smarr		N			
		#				Yokogawa		N			
		#				EMERSON (Fisher Rosemount)		N			
		#				METSO		N			
		#				Yamatake		N			
		#				Moore		N			
68	ROTAMETER	III				IEPL	HYDRABAD	A			
		III				TRAC	HYDRABAD	A			
		III				PLACKA	CHENNAI	A			
		III				EUREKA	PUNE	A			
		III				SCIENTIFIC DEVICES	MUMBAI	A			UP TO 300 NB
		III				FLOW STAR	FARIDABAD	A			
		III				TOKOYO KEISO	JAPAN	A			
		*				Flowtech Instrument Services	Vadodara	DR			
		*				Samil Chemtrol	MUMBAI	DR			
		*				Gauges Bourdon	Parvel	DR			
69	~~SINGLE AND MULTI POINT~~ TEMPERATURE RECORDER (Microprocessor based)	III				YOKOGAWA INDIA	BANGALORE	A			Make Yokogawa, Japan
		III				CHINO CORPORATION	JAPAN	A			
		III				EUROTHERM	UK	A			
		III				EUROTHERM	INDIA	DR			
		III				YOKOGAWA	JAPAN	A			
		III				ABB	UK / GERMANY	A			
		III				FUJI	JAPAN	A			
		III				HONEYWELL	USA / NETHERLAND	A			
70	Reverse Rotation Indicator (RRI)	III				GE BENTLY NEVEDA	USA	A			ALL TSI VENDORS ARE ALSO ACCEPTABLE
		III				SHINKAWA	JAPAN	A			
		*				P & F	GERMANY	DR			
71	Instrument Tube Fittings (Air)					Main Supplier approved sources		NOTED			
72	pH/ Conductivity Analyser	III				HACH	Switzerland / USA	A			
		III				YOKOGAWA	Bangalore / Japan	A			Make Yokogawa- Japan
		III				ABB	UK / USA	A			

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		III				EMERSON	Pawane	A			
		*				Thermo orion		DR			
73	~~PADO~~					Main Contractor will propose the vendors during detail Engineering.					
74	DEW Point Sensor / meter	III				GE Sensing	USA / Ireland	A			Panametric brand
		III				Michell Instrument	UK	A			
		III				Shaw	UK	A			
		*				COSA XENTAUR	USA	DR			
		*				VAISHALA	Sweden / Japan	DR			
		*				DWER	USA	DR			
		*				Endee	Mumbai	DR			
75	Blank Panels / Cabinets	III				Rittal	Bangalore	A			
		III				Hoffman	BANGALORE	A			
		III				Pyrotech	Udaipur	A			
		III				BHEL	Bangalore	A			
		III				Schneider	Bangalore	DR			
76	CCTV Components (IP)	*				Sony	Japan	DR			
		*				Siemens	Pondichery	DR			
	Integrators will be decided during detail Engineering.	*				Dv Tel	USA	DR			
		*				Honey Well	Gurgaon	DR			
		II				Bosch	Bangalore	A			With Bosch Software
		II				Axis	Sweden	DR			With Bosch Software
		*				Pelco	USA	DR			
		II				Axis	Sweden	DR			With Milestone Software
77	Control Desk, Server / PC Rack for Unit Control room and Auxiliary control room.	I				Pyrotech works Space	Udaipur	A			
		I				Cosmos	Noida	A			
		I				Adarsh Control	Bangalore	A			
		*				Cherlin Controls	Pondichery	DR			
		*				Harmony Systems	New Delhi	DR			
78	Digital Indicators	III				Masibus	Gandhi Nagar	A			For Non mosaic mounting
		III				ABB	Germany	A			
		III				Foxboro	UK	A			
		III				Yokogawa	Japan	A			

APPROVED VENDOR LIST - BHEL

Package Name	Supplier Name	Supplier Communication Address	Tech Limit
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	
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	
PRESSURE SWITCH/DIFF. PRESSURE SWITCH	SWITZER PROCESS INSTRUMENTS PVT. LTD.	Mr. V S Jayaprakash, No.127 & 128, SIDCO North Phase, Ambattur Estates CHENNAI Phone- 044-26252017/2018 Pincode : 600050 Email : marketing@switzerinstrument.com	
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	
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,	
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	
PRESSURE SWITCH/DIFF. PRESSURE SWITCH	INDFOS INDUSTRIES LIMITED	B-20-21, INDUSTRIAL AREA, MEERUT ROAD, GHAZIABAD Phone- 0120-2712016 Pincode : Email : mktg@indfos.com	
PRESSURE SWITCH/DIFF. PRESSURE SWITCH	INDFOS (INDIA) LIMITED	MR.L.C.VENKATRANGAN/MR.B.KANNAN New No.17, II Floor, Adwave Towers, Dr.Sevalia Shivaji Salai, T.Nagar Chennai Phone- +91 44 24353407 Pincode : 600017 Email : delhi@indfos.com	
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 : pressure@vsnl.com,	
ANALYTICAL INSTS.SAMPLE COOLER	EMERSON PROCESS MANAGEMENT (INDIA) PVT.LTD.	Mr. Amit Patthankar/Vikram Raj Singh 206-210,BALARAMA BUILDING 2ND FLR. BANDRA EAST MUMBAI Phone- 9619121500 Pincode : 400051 Email : vikramraj.singh@emerson.com	
ANALYTICAL INSTS.SAMPLE COOLER	FORBES MARSHAL PVT. LTD.	A-33/34, MIDC ESTATE, H-BLOCK, PIMPRI, PUNE Phone- 27470171,27477472 Pincode : 411018 Email : nkaushal@forbesmarshall.com	
ANALYTICAL INSTS.SAMPLE COOLER	SIEMENS LIMITED	Dr. Armin Bruck/Sandeep Mathur 130, Pandurang Budhkar Marg Worli Mumbai Phone- 0124 383 7377 Pincode : 400018 Email : ankit.varshney@siemens.com	
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	
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	
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	
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	
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	
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	
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	
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,	
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	
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 : sdbpl@vsnl.com	
TEMPERATURE 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	
TEMPERATURE GAUGE	GOA INSTRUMENTS INDUSTRIES PVT.LTD.,	D2/5, Mapusa Industrial Estate, Mapusa, Goa, Phone- 09326054551, Pincode : 403507, Email : sumukh@goainstruments.com,	
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,	
TEMPERATURE GAUGE	GOA THERMOSTATIC INSTRUMENTS PVT.LTD.	FLAT -B , GF, HILL CROWN APTS., COLLEGE ROAD, MAPUSA Phone- Pincode : 403525 Email : gtilworks@pyro-electric.in	
TEMPERATURE GAUGE	H.GURU INSTRUMENTS (SOUTH INDIA) P. LTD	32,INDUSTRIAL SUBURB YESWANTHAPUR BANGALORE Phone- 080-23370300, Pincode : 560022 Email : info@hgurusouth.com	
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	
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	
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	
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	
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	
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 : sales.in@baumer.com	
TEMP. ELEMENT	DETRIVE INSTRUMENTATION & ELECTRONICS LTD.	320, TV INDUSTRIAL ESTATE, OFF.DR.A.BESANT ROAD, BEHIND GLAXO, WORLI, MUMBAI Phone 24934125,24938403 Pincode : 400025 Email : trivtech@vsnl.com	

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	
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@giconindia.com	
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,	
TEMP. ELEMENT	GOA INSTRUMENTS INDUSTRIES PVT.LTD.,	D2/5, Mapusa Industrial Estate, Mapusa, Goa, Phone- 09326054551, Pincode : 403507, Email : sumukh@goainstruments.com,	
TEMP. ELEMENT	TOSHNIWAL INDUSTRIES PVT. LTD.,	Industrial Estate, Makhupura, Ajmer, Phone- 9352009000, Pincode : 305002, Email : info@tipl.com,	
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 : sdbpl@vsnl.com	
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	
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	a)DISPLACEMENT TYPE TRANSMITTERS. b)PRESSURE AND DP TRANSMITTERS
TRANSMITTERS	ABB LIMITED	MR. RAJIV GOVIL 14, MATHURA ROAD, FARIDABAD Phone- 09971085678 Pincode : 121003 Email : vipin.swami@in.abb.com	PRESSURE TRANSMITTER, DP TRANSMITTER and TEMP TRANSMITTER
TRANSMITTERS	Pune Techtrol Pvt. Ltd.	N.P.Khatan/Sudhakar Badiger S-18, MIDC Bhosari, Pune Phone- 9850560042 Pincode : 411 026 Email : ho@punetechtrol.com	Only for capacitance Type Level Transmitter
TRANSMITTERS	TOSHNIWAL INDUSTRIES PVT. LTD.,	Industrial Estate, Makhupura, Ajmer, Phone- 9352009000, Pincode : 305002, Email : info@tipl.com,	
TRANSMITTERS	Endress + Hauser (India) Pvt. Ltd.,	Mr. Prakash Vaghela 215-216, DLF Tower 'A', Jasola District Centre, New Delhi, Phone- 9717593001, Pincode : 110025, Email : prakash.vaghela@in.endress.com,	"Except Displacement Type Level Transmitters"
TRANSMITTERS	YOKOGAWA INDIA LIMITED,	PLOT NO.96, ELECTRONICS CITY COMPLEX, HOSUR ROAD, BANGALORE, Phone- 080- 41586000, Pincode : Email : uday.shankar@in.yokogawa.com,	
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	FOR CAPACITANCE TYPE.
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	
TRANSMITTERS	PANAM ENGINEERS	Mr. Santosh Shukla 203, Jaisingh Business, Parsiwada, Sahar road, Andheri (East), Mumbai, Phone- 9892179529, Pincode : 400099, Email : santosh@panamengineers.com,	For Pressure and Diff. Pressure transmitter
TRANSMITTERS	Honeywell Automation India Limited	Mr. Ritwij Kulkarni 917, INTERNATIONAL TRADE TOWER, NEHRU PLACE, NEW DELHI Phone- 9890200584 Pincode : 110019 Email : rajesh.chaudhary@honeywell.com	
TRANSMITTERS	EMERSON PROCESS MANAGEMENT (INDIA) PVT.LTD.	Mr. Amit Pattharankar/Vikram Raj Singh 206-210, BALARAMA BUILDING 2ND FLR. BANDRA EAST MUMBAI Phone- 9619121500 Pincode : 400051 Email : vikramraj.singh@emerson.com	
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	
TRANSMITTERS	SMART INSTRUMENTS LTD, BRAZIL	Agents: Digital Electronic Ltd. 74/11 'C' Cross Road MIDC Andheri (East) MUMBAI Phone- 28208477 Pincode : 400093 Email : corp@delby.rpgms.ems.vsnl.net.in	LD-301 & T-301 TRANSMITTER FROM M/S SMART EQUIPMENTS BRAZIL.
TRANSMITTERS	NIVO CONTROLS PVT. LTD.	Mr. Praveen Toshniwal 104-115, Electronic Complex, Indore Phone- 0731-4081305 Pincode : 452010 Email : sales@nivocontrols.com	For Capacitance type only
TEMPERATURE SWITCH	SOR INC.	LARRY DEGARMO/Avdesh Chandra, 14685 W. 105TH STREET LENEXA Phone- 09810905139, Pincode : 66215 Email : Ldegarmo@sorinc.com, avdesh@sherman-india.com,	
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	
TEMPERATURE SWITCH	TOSHNIWAL BROTHERS PVT.LTD.	WORKS:TOSHNIWAL IND.PVT.LTD, INDUSTRIAL ESTATE MAKHUPURA, AJMER Phone- 441171 Pincode : 305002 Email : toshniwalprocess@gmail.com	
TEMPERATURE SWITCH	INDFOS (INDIA) LIMITED	MR.L.C.VENKATRANGAN/MR.B.KANNAN New No.17, II Floor, Adwave Towers, Dr.Sevalia Shivaji Salai, T.Nagar Chennai Phone- +91 44 24353407 Pincode : 600017 Email : delhi@indfos.com	
TEMPERATURE SWITCH	SWITZER PROCESS INSTRUMENTS PVT. LTD.	Mr. V S Jayaprakash, No.127 & 128, SIDCO North Phase, Ambattur Estates CHENNAI Phone- 044 26252017/2018 Pincode : 600050 Email : marketing@switzerinstrument.com	
SIGHT FLOW INDICATORS	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	
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	
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 : sdbpl@vsnl.com	
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 : ieddelhi@ieflowmeters.com	
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	
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	
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	
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	
JUNCTION BOX	SUCHITRA INDUSTRIES	NO-2,OPP-27 AECS LAYOUT 2ND STG REJAMAHALVILAS EXTN 2ND STG BANGALORE Phone- Pincode : Email : suchitra.industriesblr@gmail.com	
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	Metal type junction box only

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, imajmera@yahoo.com
Cold Junction Compensation Box (CJCB)	CREATIVE INSTRUMENTS & CONTROLS	NO-17/1, 1ST FLOOR, 11TH CROSS 1ST K BLOCK, RAJAJINAGAR, BANGALORE-560010 Phone Pincode : Email : crinstruments@gmail.com
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
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
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
INSTRUMENTS TUBE FITTINGS	AURA INCORPORATED	NIRAJ SHARAN/SUJIT KUMAR W-167A, GREATER KAILASH-II NEW DELHI Phone- 9810182430 Pincode : 110048 Email : niraj@aurainc.com
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@iefloflowmeters.com
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
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
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
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 : sdbpl@vsnl.com
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
INSTRUMENTS PIPE 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
INSTRUMENTS PIPE FITTINGS	AURA INCORPORATED	NIRAJ SHARAN/SUJIT KUMAR W-167A, GREATER KAILASH-II NEW DELHI Phone- 9810182430 Pincode : 110048 Email : niraj@aurainc.com
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
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
ULTRASONIC FLOW METERS	FLEXIM Flexible Industriestechnik GmbH	Boxberger Str., 4, Berlin Berlin Phone- 0049 30 93 66 76 60 Pincode : 12681 Email : info@flexim.de
ULTRASONIC FLOW METERS	Rockwin Flowmeter India Pvt. Ltd.	B-24, Site-IV, Sahibabad Industrial Area Ghaziabad, Phone- 9810129687 Pincode : 201010, Email : amiya@rockwin.com
ULTRASONIC FLOW METERS	FLASH FORGE PVT LTD	Mr. Gautam Makker, 503, 'A'-wing, Delhi, Orchard Avenue Road, Powai Mumbai Phone- 022-42784300 Pincode : 400076 Email : hemendrapatil@f-f.co.in
ULTRASONIC FLOW METERS	Electronet Equipments Pvt Ltd.	Plot No. 84, 85 & 86, Tiny Industrial Estate Kondhwa Budruk, Pune Phone- 020-2026932039 Pincode : 411048 Email : ho@eeplindia.com
ULTRASONIC FLOW METERS	NIVUS GMBH	Mr. Marcus Fischer Im Taele 2, D - 75031 Eppingen Phone- 00491712233770 Pincode : Email : carolin.schuster@nivus.com
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
INSTRUMENT FITTINGS	AURA INCORPORATED	NIRAJ SHARAN/SUJIT KUMAR W-167A, GREATER KAILASH-II NEW DELHI Phone- 9810182430 Pincode : 110048 Email : niraj@aurainc.com
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@com-fit.com
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
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@aryaengg.com
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
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
INSTRUMENT FITTINGS	VIKAS INDUSTRIAL PRODUCTS	S.R.SINGH/NAVEEN SINGH B - 2, SECTOR - 6, NOIDA Phone- +91-9810122070 Pincode : 201301 Email : naveensingh@vsnl.com
INSTRUMENT FITTINGS	PANAM ENGINEERS	Mr. Santosh Shukla 203, Jaisingh Business,Parsiwada, Sahar road,Andheri(East), Mumbai, Phone- 9892179529, Pincode : 400099, Email : santosh@panamengineers.com,
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
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
ELECTROMAGNETIC FLOW METER	Electronet Equipments Pvt Ltd.	Plot No. 84, 85 & 86, Tiny Industrial Estate Kondhwa Budruk, Pune Phone- 020-2026932039 Pincode : 411048 Email : ho@eeplindia.com
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 : sdbpl@vsnl.com

- The above sub-vendor list is tentative & reference only. However Sub-Vendor List is subject to BHEL/ end user approval without any commercial/ delivery implication.
- New Sub-Vendor if proposed by Vendor during contract stage shall subject to BHEL/ end user approval without any commercial/ delivery implication.

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3 x 800 MW PVUNL PATRATU TPP PHASE-I

KKS NUMBERING PHILOSOPHY

For identifying (tagging) an instrument / equipment in Power plant KKS numbering scheme is used. The purpose is to assign a unique number to every equipment in the power plant. For C&I equipment unique number are to be provided up to the signal level so that a unique number Input / Output exist in DCS for every signal.

Normally KKS number is a 10 digit alpha-numeric code and is typically split into the following:

X	X	X	A	A	Y	Y	B	B	B
---	---	---	---	---	---	---	---	---	---

First three digits indicate the Sub-System. The Code for the major system are given as per **Annexure-1**.

Fourth and Fifth digits are the **Numerical Keys at System Code Level** and used to distinguish between main systems having same Alpha Codes.

Sixth and Seventh digits are the **Equipment / Apparatus / Measuring Circuit Code**. The code of various Equipment / Apparatus / Measuring Circuit is shown in **Annexure-2**

Eight, Nine and tenth digits are the **Numerical Keys at Equipment / Apparatus / Measuring Circuit Code** and used to distinguish between various instruments in the same sub-group. Numerical keys at System / Equipment / Apparatus / Measuring Circuit is shown in **Annexure-3**.

	DOCUMENT TITLE KKS NUMBERING PHILOSOPHY
	3 x 800 MW PVUNL PATRATU TPP PHASE-I

ANNEXURE-1

List of System / Sub-System Codes used in Power Plant:

ANNEXURE-2

Standard Equipment Codes:

AA	Valves including drives, also hand operated
AB	Seclusions, Lock, Gates, Doors
AC	Heat Exchanger
AE	Turning, Driving, Lifting equipment
AF	Continuous conveyors, Feeders
AG	Generator Units
AH	Heating and Cooling Units
AK	Pressing and Packaging equipment
AM	Mixer, Stirrer
AN	Blower, Air Pumps / Fans, Compressor Units
AP	Pump Units
AT	Purification, Drying, Filter
AV	Combustion Equipment e.g. grates

Standard Apparatus Codes:

BB	Vessels and Tank
BF	Foundation
BG	Boiler Heating Surfaces
BN	Injector, Ejector
BP	Flow and throughput limitation equipment (Orifice)
BQ	Holders, Carrying Equipment, Support
BR	Piping, Ducts, Chutes, Compensator
BS	Sound Absorber
BU	Insulations, Sheatings

Standard Measuring Circuits Codes:

CD	Density
CE	Electrical Quantities
CF	Flow, throughput
CG	Distance, Length, Position
CK	Time
CL	Level

	DOCUMENT TITLE	
	KKS NUMBERING PHILOSOPHY	
3 x 800 MW PVUNL PATRATU TPP PHASE-I		

CMHumidity

CQAnalysis (SWAS)

CSpeed, Velocity, Frequency

CTTemperature

CYVibration, Expansion

ANNEXURE-3

Numerical Keys

A) Numerical Keys at System Code Level

i) Use 10, 20, 30... To distinguish between main systems having same Alpha Codes. Examples:

a) Main Steam (Left) and Main Steam (Right)

b) BFP – A/B/C

c) ID Fan – A/B, FD Fan A/B, AH – A/B

ii) For branch off from main system path having code say 10, keep the same alpha code and use 11, 12, 13 etc. Similarly for other branch off from main system path having code say 20, keep the same alpha code and use 21, 22, 23 etc and shall carry on further in the same way.

iii) If the branch off from main system / sub system path is used for some other system, where different alpha codes can be applied, then in that case the said branch line will be designated by the alpha codes of the system to which it is providing the input.

B) Numerical keys at Equipment Code level:

There are three numerical keys available for each type of equipment code. Following has been agreed upon considering present practice, better flexibility and ease in sorting.

i) Valves and Dampers --- Equipment Code – AA

		N1	N2 N3
Motorised (on/off duty)	-	0	01 to 50
Motorised (inching duty)	-	0	51 to 99
Pneumatic (Control)	-	1	01 to 50
Motorised (thyrestor Control)	-	1	51 to 99
Sol. Operated	-	2	01 to 99
(Open / Close duty (Valves, NRVs, Gate)			
Hydraulic	-	3	01 to 99

	DOCUMENT TITLE																										
	KKS NUMBERING PHILOSOPHY																										
	3 x 800 MW PVUNL PATRATU TPP PHASE-I																										
<table><tr><td>NRV (Without actuation)</td><td>-</td><td>4</td><td>01 to 99</td></tr><tr><td>Manual</td><td>-</td><td>5</td><td>01 to 99</td></tr><tr><td>Manual</td><td>-</td><td>6</td><td>01 to 99</td></tr><tr><td>Relief & Safety Valves</td><td>-</td><td>7</td><td>01 to 99</td></tr><tr><td>Reserve</td><td>-</td><td>8</td><td>01 to 99</td></tr><tr><td>Reserve</td><td>-</td><td>9</td><td>01 to 99</td></tr></table>				NRV (Without actuation)	-	4	01 to 99	Manual	-	5	01 to 99	Manual	-	6	01 to 99	Relief & Safety Valves	-	7	01 to 99	Reserve	-	8	01 to 99	Reserve	-	9	01 to 99
NRV (Without actuation)	-	4	01 to 99																								
Manual	-	5	01 to 99																								
Manual	-	6	01 to 99																								
Relief & Safety Valves	-	7	01 to 99																								
Reserve	-	8	01 to 99																								
Reserve	-	9	01 to 99																								
ii) Field Instruments																											
<table><tr><td>Field Transmitters & Analog Signals</td><td>-</td><td>0</td><td>01 to 99</td></tr><tr><td>Field Switches & Binary Signals</td><td>-</td><td>1</td><td>00 to 99</td></tr><tr><td>PG Test Point</td><td>-</td><td>4</td><td>00 to 99</td></tr><tr><td>Gauges</td><td>-</td><td>5</td><td>00 to 99</td></tr><tr><td>Automatic Turbine Tester (ATT)-HWR</td><td>-</td><td>2</td><td>00 to 99</td></tr></table>				Field Transmitters & Analog Signals	-	0	01 to 99	Field Switches & Binary Signals	-	1	00 to 99	PG Test Point	-	4	00 to 99	Gauges	-	5	00 to 99	Automatic Turbine Tester (ATT)-HWR	-	2	00 to 99				
Field Transmitters & Analog Signals	-	0	01 to 99																								
Field Switches & Binary Signals	-	1	00 to 99																								
PG Test Point	-	4	00 to 99																								
Gauges	-	5	00 to 99																								
Automatic Turbine Tester (ATT)-HWR	-	2	00 to 99																								
(Reserved for protection Signals used by Hardwar)																											
Example of Numerical Key Usage:																											
In line with the philosophy adopted for Valves / Dampers /instruments etc. pumps and fans in the main systems (having different system code) can be numbered as AP/N100 and as AP/N101, 102, ... Where system code is same.																											

CLAUSE NO.	LIST OF MANDATORY SPARES FOR PLANT UTILITY			
2.00.00	<u>Compressed Air System:</u>			
2.01.00	Oil free Screw Air Compressor (As applicable)			
2.01.01	H. P. Stage Complete HP Stage assembly consisting of high pressure element, Bearing for male and female rotors (drive end), Bearing for male and female rotors (non-drive end), Timing gears, Graphite ring shaft for compressor chamber seals or white metal labyrinth, suction valve, discharge valve, packing set, Axial thrust bearing, Labyrinth oil seal or radial seals or double acting seals for drive shafts.	1 Set of each type/rating		
2.01.02	L. P. Stage Complete LP Stage assembly consisting of high pressure element, Bearing for male and female rotors (drive end), Bearing for male and female rotors (non-drive end), Timing gears, Graphite ring shaft for compressor chamber seals or white metal labyrinth, suction valve, discharge valve, packing set, Axial thrust bearing, Labyrinth oil seal or radial seals or double acting seals for drive shafts.	1 Set of each type/rating		
2.01.03	Motor Bearings	2 Sets		
2.01.04	LP stage Gear and Pinion	1 Set		
2.01.05	HP stage Gear and Pinion	1 Set		
2.01.06	Air Intake Filter Element With Gaskets	4 Sets		
2.01.07	Oil Filter Element With Gaskets & Seals	4 Sets		
2.01.08	Safety Valve Springs and Gaskets for HP stage	1 Set		
2.01.09	Safety Valve Springs and Gaskets for LP stage	1 Set		
2.01.10	Valves (within the compressor house with actuators	2 nos of each type/ratings/ size.		
2.01.11	Oil Pump/Motor			
2.01.11.1	Oil Pump and Motor complete assembly	1 Set		
2.01.11.2	Pump impeller/rotor with shaft	1 Set		
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)		TECHNICAL SPECIFICATION SECTION-VI, PART-F BID DOC. NO. CS-9585-001-2	MANDATORY SPARES CHAPTER - 04 PLANT UTILITY	PAGE 4 OF 21

CLAUSE NO.	LIST OF MANDATORY SPARES FOR PLANT UTILITY		
2.01.11.3	Set of bearings	2 Set	
2.01.11.4	Set of Seals	2 Set	
2.01.12	Drain / Moisture Trap	2 Set of each type/size.	
2.01.13	Oil Cooler Gaskets & Seals	2 sets	
2.02.00	Centrifugal Compressor (as applicable)		
2.02.01	Pinion Shaft Journal Bearing Assembly	2 Sets	
2.02.02	Thrust Bearing Assembly	2 Sets	
2.02.03	Shaft Seals for Air-Oil (All stages)	2 Sets	
2.02.04	Gasket / O rings	3 Sets each type/size	
2.02.05	Air Filter Elements	4 Sets each type/size	
2.02.06	Lub Oil System		
2.02.06.1	Main oil pump complete	1 No	
2.02.06.2	Aux. oil pump complete	1 No	
2.02.06.3	Complete coupling for Main & Aux. oil pump , spacer	1 No	
2.02.06.4	Cartridge filter elements with gaskets and seals	4 Sets	
2.02.06.5	Motor Bearings	2 sets	
2.02.07	Drain / Moisture Trap	2 Set of each type/size.	
2.02.08	Oil Cooler Gaskets & Seals	2 sets	
2.03.00	AIR DRYING PLANT (Twin tower type) FOR IA SYSTEM (As applicable)		
2.03.01	Pre filter element(Ceramic candle or as applicable)	2 sets	
2.03.02	After filter element(Ceramic candle or as applicable)	2 sets	
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)		TECHNICAL SPECIFICATION SECTION-VI, PART-F BID DOC. NO. CS-9585-001-2	MANDATORY SPARES CHAPTER - 04 PLANT UTILITY PAGE 5 OF 21

CLAUSE NO.	LIST OF MANDATORY SPARES FOR PLANT UTILITY			
2.03.03	Heater element(if applicable)	1 sets		
2.03.04	Blower bearing(if applicable)	1 sets		
2.03.05	Blower motor bearing(if applicable)	2 sets		
2.03.06	Valves & Valve Actuators (pneumatic/hydraulic)	2 sets		
2.03.07	Heater coil for temperature stabilization (for HOC type)(as applicable)	2 sets		
2.04.00	COMPRESSOR HOUSE CRANE			
2.04.01	All bearings	2 set of each type/rating		
2.04.02	Brake assembly and its liners	2 set of each type/rating		
2.04.03	Wire rope	2 complete length for each type / rating.		
2.05.00	MEASURING INSTRUMENTS			
	1 Electronic Transmitters			
	(i) Transmitters of all types, ranges and model no. (for the measurement of Pressure, differential pressure flow, level, etc.)	10% or 1 No. of each type and model, whichever is more		
	2 Temperature elements			
	(i) RTD's* of each type and length	10% or 2 Nos. of each type and length Which ever is more		
	(ii) Thermocouples of each type like K-type, R-type, metal etc. and length *	10% or 2 Nos. of each type and length Which ever is more		
	(iii) Thermowell	10% or 2 Nos. of each type and length Which ever is more		
	(iv) Temperature transmitters	10% or 02 nos whichever is more		
	3 Local Indicators like temperature gauges, pressure gauges, differential pressure gauges, flow gauges flow meters etc.,	5% or 1 No. of each make, model and type whichever is more (to be divided to various ranges in proportion to main of all make,		
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)		TECHNICAL SPECIFICATION SECTION-VI, PART-F BID DOC. NO. CS-9585-001-2	MANDATORY SPARES CHAPTER - 04 PLANT UTILITY	PAGE 6 OF 21

CLAUSE NO.	LIST OF MANDATORY SPARES FOR PLANT UTILITY		
	4	Process Actuated Switch Devices Includes all types of Pressure, differential pressure, flow, temperature, differential temperature, level switch Devices	10% or 1 No. of each type and model whichever is more
	5	Dew Point meters	5% or 1 No. of each type and model whichever is more
2.06.00	MICROPROCESSOR BASED/PLC BASED CONTROL/ELECTRONIC BASED CONTRAL PANEL (IF APPLICABLE)		
	1	Fully programmed controller of electronic modules of each type (as applicable)	10% or 1 no. whichever is more
	2	Power supply module (if applicable)	10% or 1 no. whichever is more
2.07.00	Rotary drum type Air drying plant for Instrument Air system (As applicable)		
	Drive assembly consisting of motor, gear boxes, drive shaft & coupling		1 set
2.08.00	a) Plant air compressor motor		1 no.
	b) Instrument air compressor motor		1 no.

LIST OF MANDATORY SPARES FOR SG & AUXILIARIES



SI. NO.	PARTICULARS	QUANTITY
		make and model or 1 no. whichever is more
	b) Local indicator	2 nos. per unit
	11. Any other instruments (If applicable)	10% or 1 no. whichever is more
	12. Any other control system (If applicable)	10% or 1 no. whichever is more
2.03.00	MEASURING INSTRUMENTS (for all systems supplied under this package including Auxiliary Boiler, FOPH, Dosing System, ECW, Air compressor system, CHP, FGD, NOx, Skids, Limestone & Gypsum Handling system etc.)	
	1. Electronic Transmitters	
	1.1 Transmitters of all types, ranges and model no. (for the measurement of Pressure, differential pressure flow, level, etc.)	10% or 1 no. of each type and model, which ever is more
	1.2 Level Transmitters (Ultrasonic/ radar type)	50% of each type and length, including sensors
	2. Temperature elements	
	2.1 RTD's * of each type and length(with head assembly, terminal block & nipple)	10% or 2 nos. of each type and length, whichever is more
	2.2 Thermocouples of each type like K-type, R-type, metal etc.* (with head assembly, terminal block & nipple)	10% or 2 nos. of each type and length which ever is more
	2.3 Thermowell for application like mill outlet temperature and SH/RH/Eco/ flue gas temp. in furnace	10% or 2 nos. of each type and length whichever is more
	2.4 Temperature transmitters	10% of each type and model
	3. Local Indicators like temperature gauges, pressure gauges, differential pressure gauges, flow gauges, flow meters etc.,	5% or 1 no. of each make, model and type whichever is more (to be divided to various ranges in proportion to main of all make, model, type population)
	4. Process Actuated Switch Devices Includes all types of Pressure, differential pressure, flow, temperature, differential temperature, level switch Devices	5% or 1 no. of each type and model whichever is more
	5. PD Type Flow Transmitters	1 no. of each type and model
	6. Any other instrument (If applicable)	10 % or 1 no. of each type and model whichever is more
	7. Analyzers (Flue gas and Steam water)	2 Nos of each type complete with accessories
2.04.00	POWER SUPPLY SYSTEM	
	(24 V DC power supply system) (To be provided for each system)	

CLAUSE NO.	MANDATORY SPARES			
	(m)	Rotameter/Air flow meter	2 nos. of each type, model and rating	
	2 (II) Oxygen Analyzer (Low & High Temp.)			
	(a)	Oxygen measurement instrument	1 no complete instrument (along with probe assembly) of each type and model	
	(b)	Electronic card assembly/ PCBs, power supply modules	10% of each type, model and rating	
	(c)	Set of gaskets/O-rings/ seals	200% of each type, model, rating and size	
	(d)	Temp. Sensor	20% of each type and model	
	(e)	Heater assembly	20% of each type and model	
	(f)	Solenoids	2 nos. of each type, model and rating	
	(g)	Filters	100% of each type, model and rating	
	(h)	Calibration gases of all types and ranges.	one year supply	
	(l)	Rotameter/Air flow meter	2 nos. of each type, model and rating	
	3	Measuring Instruments		
	a)	Transmitters		
	(i)	Transmitters of all type, range and model no. (For the measurement of Pressure, differential pressure flow, level, temperature etc.)	10%- of each type and model	
	(ii)	Interface modules at field(between field transmitter & DDCMIS)like Zener barrier, power supply isolator, isolater(as applicable)etc.	10% of each type	
	b)	Temperature elements		
	(i)	RTD's	10% of each type and length	
	(ii)	Thermocouples	10% of each type and length	
	(iii)	Thermo well for above applications	10% of each type and length	
	c)	Impact Head Type flow element	20% or 2 no's of each make and type whichever is more.	
	4	AAQMS (SO2, NOx, CO, Mercury, Ozone, Dust monitoring)		
	(i)	Analyzer for SO2, NOx, CO, Dust monitoring	1 no. complete instrument of each type and model	
(ii)	Electronic Card Assemblies/PCBs, power supply modules	10% of each type and model		
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)		TECHNICAL SPECIFICATION SECTION-VI, PART-F BID DOC. NO. CS-9585-001-2	MANDATORY SPARES CHAPTER-15 CONTROL & INSTRUMENTATION	PAGE 5 OF 12

PROVENESS CRITERIA

PROVENESS CRITERIA

1. Measuring instruments (primary & secondary), PLC, HMI, SWAS equipment offered for this package shall have at least one year's satisfactory operation in one power station having unit rating of 200 MW or above.
2. The 24 V DC modular charger offered for this package shall have at least one year's satisfactory operation in any industry or telecommunication application with a rating of 500 A or above.
3. The UPS system offered for this project, shall have atleast one(1) year's satisfactory operation, in one(1) power station for a rating of 105 KVA or above.
4. The Bidder should have carried out Engineering of Control and Instrumentation System of the complete plant including offsite plants of at least one (1) unit of a coal fired power station having unit rating 200 MW or above which is in successful operation for a period of not less than one (1) year. In case the Bidder does not have the engineering experience of the complete plant as described above, then the Bidder shall get the Control and Instrumentation engineering of the remaining plant area (s) done through any of its sub vendor(s) / supplier(s) or through Engineering firm(s) who meets the above requirement for the respective plant area(s).
5. Engineering referred in Para 4 above shall include the followings as a minimum.
 - a. Preparation of basic logic / loop diagrams (not just the implementations), I/O List, Drive list, Instrument list etc for each of the plant areas of the complete plant including offsite systems based upon Flow schemes / Write ups by the OEM (s)
 - b. Engineering of power supply system for DDCMIS, Process connection and piping, SWAS, Control Valves.
 - c. Instrumentation, cable engineering including preparation of Interconnection Cable Diagram, Cable schedule etc.

Documents in support of the above shall be submitted along with the Bid.

PROVENESS CRITERIA

5.00.00 INSTRUMENTS (PRIMARY & SECONDARY)

- (i) Type of Instrument
- (ii) Make / Model
- (iii) Name of Power Station
(Location & Address)
- (iv) Unit Size (MW)
- (v) Commissioning date

Whether above instruments have
atleast one (1) year satisfactory
operation
in one (1) power station having
unit rating of 200 MW or above.

Yes/No

- (vi) Client's certificate attached

Yes/No

3 X 800MW PATRATU STPS

SECTION-II

(STANDARD TECHNICAL SPECIFICATIONS)



BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA-INDIA

3 X 800MW PATRATU STPS

TECHNICAL SPECIFICATION
FOR
COMPRESSED AIR SYSTEM

SECTION-IIA
(FORMAT FOR O& M MANUAL)



BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA-INDIA

Check List for Operation & Maintenance Manual

Project name:

Project number:

Package Name:

Sl.no. & Sections	Description	Yes	No	Not Applicable	Remarks
1.	Cover page				
1.1	Project Name				
1.2	Customer Name				
1.3	Name of Package				
1.4	Supplier details with phone, FAX email address				
1.5	Name and sign of prepared by , checked by & approved by				
2.0	Index				
2.1	showing the sections & related page nos All the pages should be numbered section wise				
3.0	Description of Plant				
3.1	Description /write up of operating principle of system equipment/ associated sub-systems & accessories/controls system , operating conditions, performance parameters under normal , start up and special cases				
3.2	Equipment list and basic parameter with Tag numbers				
3.3	Data sheets approved by Customer/for information and catalogues provided by original manufacturer				
3.4	Associated other packages and Interface /terminal points				
3.5	P&ID & Process Diagrams				
3.6	GA Layout drawings, As-built drawings				
3.7	Single line/wiring diagrams				
3.8	Control philosophy /control write-ups				
4.0	Commissioning Activities (if not covered in separate document i.e. erection manual, commissioning manual)				
4.1	Pre-Commissioning Checks				
4.2	Transportation and handling at site				
4.3	Storage at site				
4.4	Unpacking & Installation procedure				
5.0	Operation Guidelines for plant personal/user/operator				
5.1	Interlock & Protection logic along with the limiting values of protection settings for the				

	equipment along with brief philosophy behind the logic, drawings etc. to be provided.				
5.2	Start up and shut down procedure for equipments along with the associated systems in step by step mode. Valve sequence chart, step list, interlocks etc with Equipment isolating procedures to be mentioned.				
5.3	Do's & Don't of the equipments.				
5.4	Safety precautions to be taken during normal operation. Safety symbols, Emergency instructions on total power failure condition/lubrication failure/any other condition				
5.5	Parameters to be monitored with normal values and limiting values				
5.6	Trouble shooting with causes and remedial measures				
5.7	Routine operational checks, recommended logs & records				
5.8	Changeover schedule if more than one auxiliary for the same purpose is given				
5.9	Painting requirement and schedule				
5.10	Inspection, repair , Testing and calibration procedures				
6.0	Maintenance guidelines for plant personal				
6.1	List of Special Tools and Tackles required for Overhaul/Trouble shooting including special testing equipment required for calibration etc.				
6.2	Stepwise dismantling and re-assembly procedure clearly specifying the tools to be used, checks to be made, records to be maintained, clearances etc. to be mentioned. Tolerances for fitment of various components to be given.				
6.3	Preventive Maintenance & Overhauling schedules linked with running hours/calendar period along with checks to be given				
6.4	Long term maintenance schedules especially for structural, foundations etc.				
6.5	Consumable list along with the estimated quantity required during commissioning, normal running and during maintenance like Preventive Maintenances and Overhaul.				
6.6	List of lubricants with their Indian equivalent, Lubrication Schedule, Quantity required for each equipment for complete replacement is to be given				

6.7	List of vendors & Sub-vendors with their latest addresses, service centres ,Telephone Nos., Fax Nos., Mobile Nos., e-mail IDs etc.				
6.8	List of mandatory and recommended spare parts list				
6.9	Tentative Lead time required for ordering of spares from the equipment supplier				
6.10	Guarantee and warranty clauses				
7.0	Statutory and other specific requirements considerations.				

3 X 800MW PATRATU STPS

TECHNICAL SPECIFICATION
FOR
COMPRESSED AIR SYSTEM

SECTION - IIB

(SITE STORAGE AND PRESERVATION MANUAL)



BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA-INDIA

SITE STORAGE AND PRESERVATION GUIDELINES

FOR

MECHANICAL BOPs

(Doc No: PE-DC-SSG-A001 REV.00)



PROJECT ENGINEERING MANAGEMENT, POWER SECTOR
BHARAT HEAVY ELECTRICALS LIMITED-NOIDA

CONTENT

- 1 SCOPE OF THE DOCUMENT
- 2 PURPOSE OF STORAGE & PRESERVATION
- 3 MEASURES TO BE TAKEN FOR STORAGE AND PRESERVATION
 - a) GENERAL STORAGE REQUIREMENTS
 - b) GENERAL PRESERVATION REQUIREMENTS
 - c) GENERAL INSPECTION REQUIREMENTS
- 4 TYPE OF STORAGE FOR VARIOUS EQUIPMENT
5. CONCLUSION
6. STACKING ARRANGEMENT FOR PLATES AND STRUCTURAL STEEL

1. SCOPE OF THE DOCUMENT

This guideline is prepared in intent to provide proper site storage and preservation of the Mechanical, Electrical and C & I items / equipment supplied under various bought out packages/items. This storage procedure shall be followed at different power plant sites by concerned agency for storage and preservation from the date of equipment received at site until the same are erected and handed over to the customer.

2. PURPOSE OF STORAGE & PRESERVATION

Many of the items may be required to be kept in stores for long period. It shall therefore be essential that proper methods of storage and preservation be applied so that items do not deteriorate, loose some of their properties and become unusable due to atmospheric conditions and biological elements.

3. MEASURES TO BE TAKEN FOR STORAGE, HANDLING & PRESERVATION

a) GENERAL STORAGE REQUIREMENTS

1. To the extent feasible, materials should be stored near the point of erection. The storage areas should have adequate unloading and handling facilities with adequate passage space for movement of material handling equipment such as cranes, fork lift trucks, etc. The storage of materials shall be properly planned to minimise time loss during retrieval of items required for erection.
2. The outdoor storage areas as well as semi-closed stores shall be provided with adequate drainage facilities to prevent water logging. Adequacy of these facilities shall be checked prior to monsoon.
3. The storage sheds shall be built in conformity with fire safety requirements. The stores shall be provided with adequate lights and fire extinguishers. 'No smoking' signs shall be placed at strategic locations. Safety precautions shall be strictly enforced.
4. Adequate lighting facility shall be provided in storage areas and storage sheds and security personnel positioned to ensure enforcement of security measures to prevent theft and loss of materials.
5. Adequate number of competent stores personnel and security staff shall be deployed to efficiently store and maintain the equipment / material.
7. The equipment shall be stored in an orderly manner, preserving their identification slips, tags and instruction booklets, etc., required during erection. The storage of materials shall be equipment-wise. Loose parts shall be stored in sheds on racks,

preserving the identification marks and tags in good condition. The group codes shall be displayed on the racks

6. At no time shall any materials be stored directly on ground. All materials shall be stored minimum 200 mm above the ground preferably on wooden sleepers

b) GENERAL PRESERVATION REQUIREMENTS

1. All special measures to prevent corrosion shall be taken like keeping material in dry condition, avoiding the equipment coming in contact with corrosive fluid like water, acid etc.
2. Materials which carry protective coating shall not be wrapped in paper, cloth, etc., as these are liable to absorb and retain moisture. The material shall be inspected and in case of signs of wear or damages to protective coating, that portion shall be cleaned with approved solution and coated with an approved protective paint. Complete record of all such observations and protective measures taken shall be maintained.
3. Generally equipment supplied at site are properly greased or rust protective oil is applied on machined/ fabricated components. However periodic inspection shall be carried out to ensure that protection offered is intact.
4. While handling the equipment, no dragging on the ground is permitted. Avoid using wire rope for lifting coated components. Use polyester slings (if possible) otherwise protective material (e.g. clothes, wood block etc.) should be used while handling the components with rope / slings
5. For Equipment supplied with finished paint, touch paint shall be done in case any surface paint gets peeled off during handling. Otherwise such surfaces shall necessarily be wrapped with polythene to avoid any corrosion. Further for equipment wherein finish coat is to be applied at site, site to ensure that equipment is received with primer coat applied.
6. It shall be ensured by periodic inspection that plastic inserts are intact in tapped holes, wherever applicable.
7. Pipes shall be blown with air periodically and it shall be ensured that there is no obstruction.
8. Silica gel or approved equivalent moisture absorbing material in small cotton bags shall be placed and tied at various points on the equipment, wherever necessary.
9. Heavy rotating parts in assembled conditions shall be periodically rotated to prevent corrosion/jamming due to prolonged storage.

10. All the electrical equipment such as motors, generators, etc. shall be tested for insulation resistance at least once in three months and a record of such measured insulation values shall be maintained.
11. Following preservatives/preservation methods can be used depending upon type of equipment
 - a. Rust preventive fluid (RPF)
 - b. Rust protective paints
 - c. Tarpaulin covers, in case of outdoor storage
 - d. De-oxy aluminate for weld-ments

c) GENERAL INSPECTION REQUIREMENTS

1. Period inspection of materials with specific reference to –
 - Ingress of moisture and corrosion damages.
 - Damage to protective coating.
 - Open ends in pipes, vessels and equipment -
 - In case any open ends are noticed, same shall be capped.
2. Any damages to equipment / materials.
 - In case of any damages, these shall be promptly notified and in all cases, the repairs / rectification shall be carried out.
 - Any items found damaged or not suitable as per project requirements shall be removed from site. If required to store temporarily, they shall be clearly marked and stored separately to prevent any inadvertent use.

4. TYPE OF STORAGE FOR VARIOUS EQUIPMENT

The types of storage are broadly classified under the following heads:

i **Closed storage with dry and dust free atmosphere. (C)**

The closed shed can be constructed by using cold-rolled / tubular components for structure and corrugated asbestos sheets / galvanised iron sheets for roofing. Brick walls / asbestos sheets can be used to cover all the sides. The floor of the shed can be finished with plain cement concrete suitably glazed. The shed shall be provided with proper ventilation and illumination.



ii **Semi-closed storage. (S)**

The semi closed shed can be constructed by using cold-rolled / tubular components for structure and corrugated / asbestos sheets for roofing. The floor shall be brick paved. If required a small portion of sides can be covered to protect components from rainwater splashing onto the components.





iii Open storage (O)

The open yard shall be levelled, well consolidated to achieve raised ground with the provision of feeder roads for crane approach along with access roads running all sides. One part of the open yard shall be stone pitched, levelled and consolidated with raised ground suitable for storing / stacking heavier and critical components with due space to handle them by cranes etc . Adequate number of sleepers, concrete block etc. to be provided to make raised platforms to stack critical materials.

A separate yard to be identified as “scrap yard” slightly away from main open yard to store wooden/steel scraps, which are to be disposed off. This is required to avoid mix up with regular components as well as to avoid fire hazard.

Some of the components, which are having both machined & un-machined surfaces and are bulky, shall be stored in open storage area on a raised ground and suitably covered with water proof / fire retardant tarpaulin.



The equipment listed below shall be stored and inspected as per requirement mentioned in the table below.

Sl. No.	Description of the equipment	Type of Storage	Check for	Remarks
Raw material /mechanical items like pipes, plates, structure sections etc.)				
1.	Steel pipes (lined/unlined)	S	Damage , paint, corrosion, rubber lining peeling	Provide end cap
2.	MS Plates	S	Damage, paint, corrosion	
3.	SS Plates	S	Damage	
4.	Non-metallic pipes	S	Damage, cracks	Provide end cap
5.	Stainless steel pipes	S	Damage ,	Provide end cap
6.	MS sections, beams	S	Damage, paint, corrosion	
7.	Cable trays	S	Damage, condition of preservations	
8.	Insulation sheets	S	Damage	
9.	Insulation	C	Damage, packing	
10.	Hangers Rods	S	Damage, paint, packing	
11.	Tubes	S	Damage, paint , packing	Provide end cap
12.	Hume pipes	O	Damage	
13.	Castings	O	Damage, paint, corrosion	
Fabricated mechanical items (pressure vessels, tanks etc.)				
14.	Pressure vessels (unlined)	O	Damage, paint, corrosion,	Covered nozzles
15.	Atmospheric storage tanks (unlined)	O	Damage, paint, corrosion	Covered nozzles

Sl. No.	Description of the equipment	Type of Storage	Check for	Remarks
16.	Pressure vessels (lined)	S	Damage, paint, corrosion, rubber lining	
17.	Atmospheric storage tanks(lined)	S	Damage, paint, corrosion, rubber lining	
18.	Support structures	O	Damage , paint, corrosion	
19.	Flanges	C	Damage , paint, corrosion	
20.	Fabricated pipes	S	Damage , paint, corrosion	Provide end cap
21.	Vessels internals	C	Damage , paint, corrosion ,packing	
22.	Grills	S	Damage , paint, corrosion	
23.	Angles	S	Damage , paint, corrosion	
24.	Bridge mechanism/clarifier mechanism	O	Damage , paint, corrosion	
25.	Cranes, rails	S	Damage , paint, corrosion	
26.	Stair cases	O	Damage , paint, corrosion	
27.	Ladders/handrails	O	Damage , paint, corrosion	
28.	Fabricated ducts	S	Damage , paint, corrosion	
29.	Isolation Gates	O	Damage , paint, corrosion	
30.	Fabricated boxes/panels	S	Damage , paint, corrosion	
Mechanical components like valves, fittings, cables glands, spares etc.)				
31.	Valves	S	Damage , packing	

Sl. No.	Description of the equipment	Type of Storage	Check for	Remarks
32.	Fittings	S	Damage , packing	Provide end cap
33.	Cable glands	C	Damage , packing	
34.	Tools & tackles	C	Damage , packing	
35.	Nut , bolts, washers,	C	Damage , packing	
36.	Gasket & Packings	C	Damage , packing	
37.	Copper tubes	C	Damage , packing, corrosion	Provide end cap
38.	SS tubing	C	Damage , packing	Provide end cap
Rotating assemblies (pumps, blowers, stirrers, fans, compressors etc.)				
39.	Pumps	S	Damage , packing, corrosion	Shaft rotation
40.	Blowers/Compressors	S	Damage , packing, corrosion	Shaft rotation
41.	Agitators/stirrers/radial launders	C	Damage , packing, corrosion	Shaft rotation
42.	Rollers for chlorine tonner mounting	C	Damage , packing, corrosion	
43.	Centrifuge	S	Damage , packing,	
44.	Gear box	C	Damage , packing, corrosion	
45.	Bearings	C	Damage , packing, corrosion	
46.	Fans	S	Damage , packing, corrosion	
47.	Dosing skids	S	Damage , packing, corrosion	
48.	Pump assemblies	S	Damage , packing, corrosion	
49.	Air washers(INTERNALS)	S	Damage , packing	
50.	Air conditioners (split)	C	Damage , packing	

Sl. No.	Description of the equipment	Type of Storage	Check for	Remarks
51.	Elevators(CONTAINERIZED)	O	Damage , packing, corrosion	
52.	Chillers/VA machines	S	Damage , packing	
53.	Air handling Unit/Package unit	S	Damage , packing	
54.	Chlorinators & Evaporators	C	Damage , packing	
55.	Ejectors	C	Damage , packing	
56.	Electrolyser	C	Damage , packing	
Miscellaneous items like chain pulley blocks, hoists etc.				
57.	Chain pulley blocks	S	Damage, Packing	
58.	Electric hoists	S	Damage, Packing	
59.	Fire extinguishers	C	Damage, expiry date	
60.	Fork Lift Truck	S	Damage, Packing	
61.	Hydraulic Mobile Crane	O	Damage, Packing	
62.	Mobile Pick Up & Carry Crane	O	Damage, Packing	
63.	Motor boats	O	Damage, Packing	
64.	Safety showers	S	Damage, Packing	
65.	Diffusers/dampers	S	Damage, Packing	
Chemicals and consumables (acid, alkali, paints, oils, reagents and special chemicals)				
66.	Hydro Chloric Acid (HCl)	Store in canes/ storage tank in dyke area	Date of production/ leakage/fumes	hazardous chemical
67.	Sulphuric acid (H ₂ SO ₄)	Store in canes/ storage tank in dyke area	Date of production/ leakage/fumes	hazardous chemical

Sl. No.	Description of the equipment	Type of Storage	Check for	Remarks
68.	Sodium hydroxide (NaOH)	Store in canes/ storage tank in dyke area	Date of production/ leakage/ fumes/ breather	hazardous chemical ,breather to be checked for air ingress
69.	Sodium hypo chlorite	To be stored under shed	Date of production/ leakage/ fumes	hazardous chemical ,self-life normally 15-30 days after which strength of chemical decays
70.	Ammonia	S	Date of production/ leakage/ fumes	Store in closed storage tanks, hazardous chemical
71.	CW treatment chemicals	S	Date of production , Self-life	Store in closed canes
72.	RO/UF cleaning chemicals	S	Date of production , Self-life	Store in closed canes
73.	Lime	C	Damage to packing , seepage	Prevent moisture, rain
74.	Alum bricks	C	Damage to packing	Prevent moisture, rain
75.	Poly electrolyte	S		Store in closed storage tanks
76.	Laboratory chemicals(powder)	C	Damage, Packing self-life	
77.	Laboratory chemicals(liquid)	C	Damage, Packing self-life	
78.	Lubrication oils	C	Leakage	
79.	Paints	S	Leakage ,air tightness	
80.	Sand	O	Damage of packing	No hooks
81.	Salt (NaCl)	C	Damage of packing, water ingress	Prevent moisture, rain
82.	Anthracite	S	Damage of packing	
83.	Activated carbon	S	Damage of packing	

Sl. No.	Description of the equipment	Type of Storage	Check for	Remarks
84.	Thermal insulation	S	Damage of packing	
85.	Cement	C	Damage of packing	Prevent moisture, rain
86.	Gravels	O	Damage of packing	
87.	ION exchange resins	C	Damage , packing	Refer manufacturer guidelines
88.	RO membranes	C	Damage , packing	Refer manufacturer guidelines
89.	UF membranes	C	Damage , packing	Refer manufacturer guidelines
90.	Cleaning chemicals	C	Damage , packing	Refer manufacturer guidelines
91.	Chemicals for analysers/calibration	C	Damage , packing	Refer manufacturer guidelines
Electrical and C & I items (motors, cables etc.)				
92.	Motors	C	Damage , packing	
93.	Cable drums	O	Damage	
94.	Control Panel /control desk, UPS ,JB	S	Damage, Packing	
95.	Instruments(gauges/analysers)	C	Damage	
Special items		As per Manufacturer's item, like Hydrogen cylinders, Ozonator, Analyser, Chlorine dioxide generators etc.		

5. CONCLUSION

Concerned storage agency at site should make sure that loss in equipment performance and wear & tear are minimised through proper storage and preservation. The above are broad guidelines and cover major equipment / materials. However specific storage practices shall be followed as per manufacturer recommendation. All the necessary measures even in addition to the ones mentioned above, if found necessary, should be taken to achieve the objective.

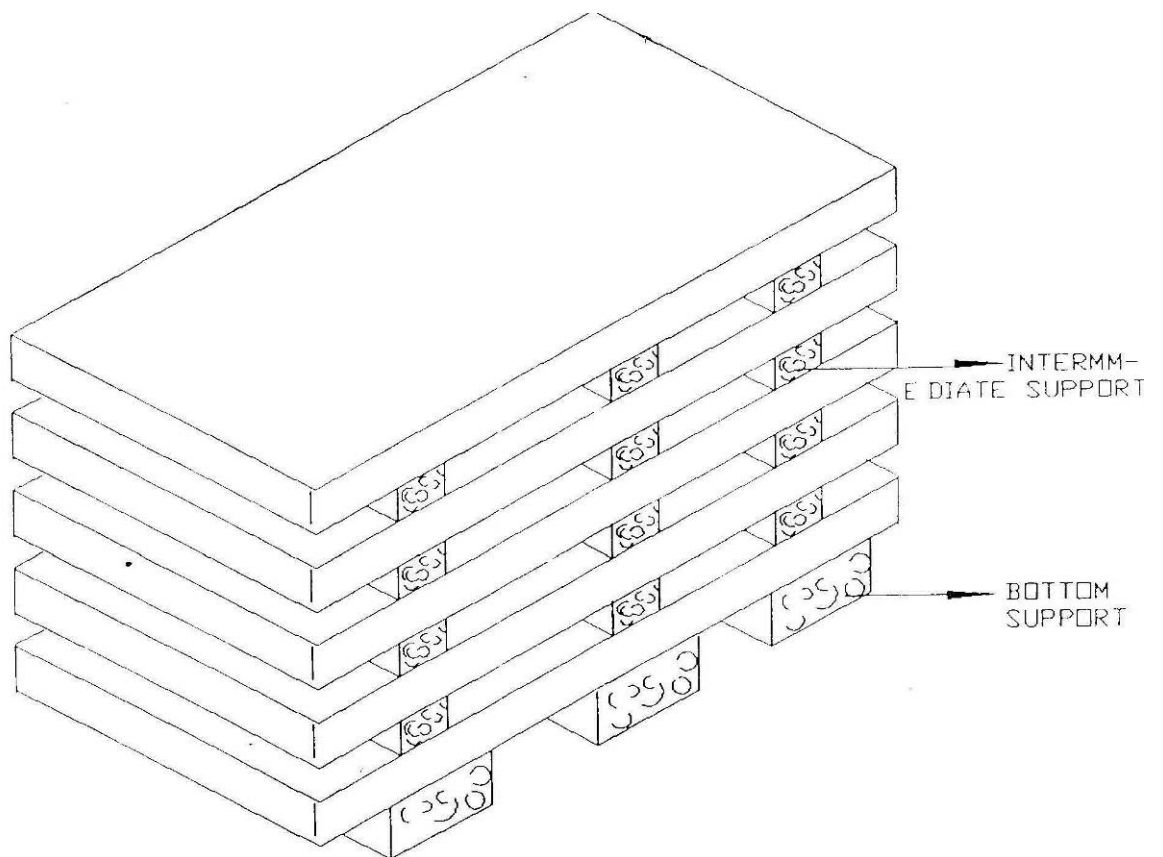


Figure – 1 – PLATE STACKING ARRANGEMENT

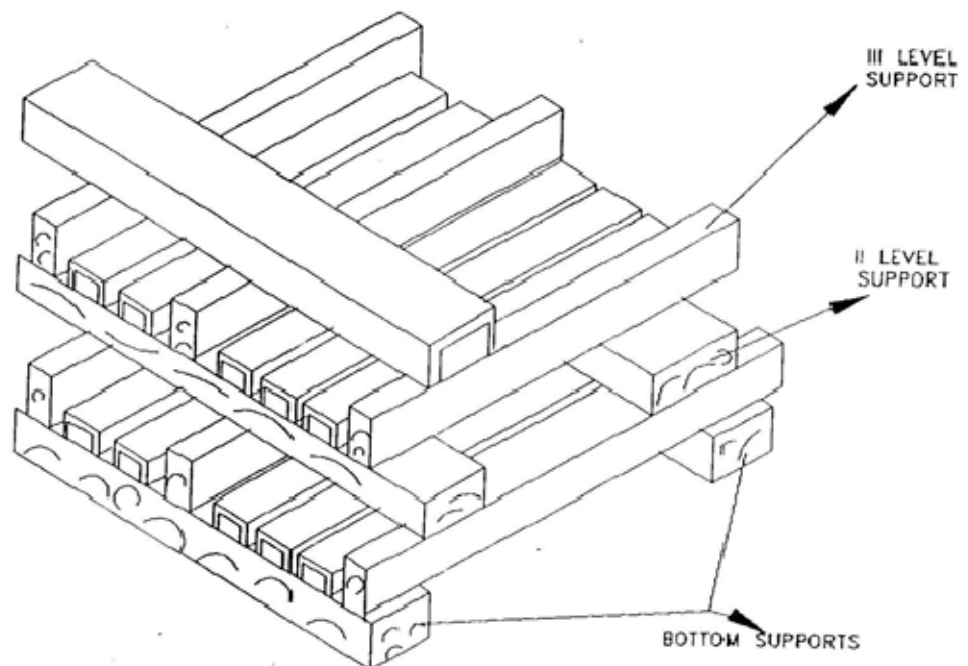


Figure – 2 – STRUCTURAL STEEL STACKING ARRANGEMENT

3 X 800MW PATRATU STPS
TECHNICAL SPECIFICATION
FOR
COMPRESSED AIR SYSTEM

SECTION - III

DOCUMENTS TO BE SUBMITTED BY BIDDER



BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR PROJECT
ENGINEERING MANAGEMENT
NOIDA-INDIA



**TECHNICAL SPECIFICATION FOR
COMPRESSED AIR SYSTEM
3x800MW PATRATU STPS**

SPECIFICATION NO. PE-TS-434-555-A001

SECTION IIIA

REV – 00

DATE

LIST OF DOCUMENTS TO BE SUBMITTED WITH THE BID

Bidder shall submit following drawings / documents along with their bid:

- a. Copy of pre-bid clarification, if any, duly signed and stamped.
- b. Copy of electrical scope between BHEL & vendor duly signed and stamped.
- c. Electrical equipment specification for Compressed air system duly signed and stamped.
- d. Electrical load list duly filled
- e. Deviation schedule with reference to specific clauses of the specification along with reason for such deviation.
- f. Copy of unpriced price bid indicating "QUOTED / NOT QUOTED" / "NOT APPLICABLE" as the case may be.
- g. Copy of drwg/doc schedule duly signed and stamped.
- h. Compliance cum confirmation certificate

NOTES:

OFFER WILL BE CONSIDERED AS INCOMPLETE IN ABSENCE OF ANY OF THE ABOVE DOCUMENTS.

DOCUMENTS OTHER THAN ABOVE, IF ANY, SUBMITTED WITH THE OFFER WILL NOT FORM PART OF CONTRACT AND ACCORDINGLY WILL NOT BE CONSIDERED FOR BID EVALUATION.

	TITLE:	SPEC. NO.: PE-TS-434-555-A001
	TECHNICAL SPECIFICATION	VOLUME: III
	3X800MW PATRATU STPS	SECTION: IIIB
	COMPLIANCE CUM CONFIRMATION	REV. NO. 0 DATE:.....
	CERTIFICATE	SHEET 1 OF 2

COMPLIANCE CUM CONFIRMATION CERTIFICATE

The bidder shall confirm compliance with following by signing/ stamping this compliance certificate (every sheet) and furnish same with the offer.

- a) The scope of supply, technical details, construction features, design parameters etc. shall be as per technical specification & there are no exclusions other than those mentioned under "exclusion" and those resolved as per 'Schedule of Deviations', if applicable, with regard to same.
- b) There are no other deviations w.r.t. specifications other than those furnished in the 'Schedule of Deviations'. Any other deviation, stated or implied, taken elsewhere in the offer stands withdrawn unless specifically brought out in the 'Schedule of Deviations'.
- c) Bidder shall submit QP in the event of order based on the guidelines given in the specification & QP enclosed therein. QP will be subject to BHEL/ CUSTOMER approval & customer hold points for inspection/ testing shall be marked in the QP at the contract stage. Inspection/ testing shall be witnessed as per same apart from review of various test certificates/ Inspection records etc. This shall be within the contracted price with no extra implications to BHEL after award of the contract.
- d) All drawings/ data-sheets/ calculations etc. submitted along with the offer shall be considered for reference only, same shall be subject to BHEL/ CUSTOMER approval in the event of order.
- e) The offered materials shall be either equivalent or superior to those specified in the specification & shall meet the specified/ intended duty requirements. In case the material specified in the specifications is not compatible for intended duty requirements then same shall be resolved by the bidder with BHEL during the pre - bid discussions, otherwise BHEL/ Customer's decision shall be binding on the bidder whenever the deficiency is pointed out.

For components where materials are not specified, same shall be suitable for intended duty, all materials shall be subject to approval in the event of order.
- f) The commissioning spares shall be supplied on 'As Required Basis' & prices for same included in the base price itself.
- g) All sub vendors shall be subject to BHEL/ CUSTOMER approval in the event of order.
- h) Guarantee for plant/equipment as applicable, shall be as per relevant clause of GCC /SCC /Other Commercial Terms & Conditions.
- i) In the event of order, all the material required for completing the job at site shall be supplied by the bidder within the ordered price even if the same are additional to approved billing break up, approved drawing or approved Bill of quantities. This clause will apply in case during site commissioning additional requirements emerges due to customer and/ or consultant's comments. No extra claims shall be put on this account.
- j) 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.



TITLE:

TECHNICAL SPECIFICATION
3X800MW PATRATU STPS
COMPLIANCE CUM CONFIRMATION
CERTIFICATE

SPEC. NO.: PE-TS-434-555-A001

VOLUME: III

SECTION: IIIB

REV. NO. 0 DATE:.....

SHEET 2 OF 2

- k) As built drawings shall be submitted as and when required during the project execution.
- l) The bidder has not tempered with this compliance cum confirmation certificate and if at any stage any tempering in the signed copy of this document is noticed then same shall be treated as breach of contract and suitable actions shall be taken against the bidder.

SIGNATURE: _____

NAME : _____

DESIGNATION: _____

COMPANY: _____

DATE: _____

COMPANY SEAL



TITLE

3X800 MW PATRATU STPS

SPECIFICATION NO. PE-TS-434 -555-A001

SECTION IIIC

REV 00

PRE-BID CLARIFICATION SCHEDULE

S.No.	Section/Clause/ Page No.	Statement of the referred clause	Clarification required

The bidder hereby certifies that above mentioned are the only clarifications required on the technical specification for the subject package.

SIGNATURE: _____

NAME : _____

DESIGNATION: _____

COMPANY: _____

DATE: _____

COMPANY SEAL

DEVIATION SHEET (COST OF WITHDRAWAL)
SECTION-IIIID



PROJECT:- 3 x 800MW PATRATU STPS

PACKAGE:- COMPRESSED AIR SYSTEM

TENDER ENQUIRY REFERENCE:-

NAME OF VENDOR:-

SL NO	VOULME/ SECTION	PAGE NO.	CLAUSE NO.	TECHNICAL SPECIFICATION/ TENDER DOCUMENT	COMPLETE DESCRIPTION OF DEVIATION	COST OF WITHDRAWAL OF DEVIATION	REFERENCE OF PRICE SCHEDULE ON WHICH COST OF WITHDRAWAL OF DEVIATION IS APPLICABLE	NATURE OF COST OF WITHDRAWAL OF DEVIATION (POSITIVE/ NEGATIVE)	REASON FOR QUOTING DEVIATION
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TECHNICAL DEVIATIONS

COMMERCIAL DEVIATIONS

PARTICULARS OF BIDDERS/ AUTHORISED REPRESENTATIVE

NAME	DESIGNATIONS	SIGN & DATE
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NOTES:

- For self manufactured items of bidder, cost of withdrawal of deviation will be applicable on the basic price (i.e. excluding taxes, duties & freight) only.
- For directly dispatchable items, cost of withdrawal of deviation will be applicable on the basic price including taxes, duties & freight.
- All the bidders have to list out all their Technical & Commercial Deviations (if any) in detail in the above format.
- Any deviation not mentioned above and shown separately or found hidden in offer, will not be taken cognizance of.
- Bidder shall submit duly filled unpriced copy of above format indicating "quoted" in "cost of withdrawal of deviation" column of the schedule above along with their Techno-commercial offer, wherever applicable.
- Bidder shall furnish price copy of above format along with price bid.
- The final decision of acceptance/ rejection of the deviations quoted by the bidder shall be at discretion of the Purchaser.
- Bidders to note that any deviation (technical/commercial) not listed in above and asked after Part-I opening shall not be considered.
- For deviations w.r.t. Payment terms, Liquidated damages, Firm prices and submission of E1/ E2 forms before claiming 10% payment, if a bidder chooses not to give any cost of withdrawal of deviation loading as per Annexure-VIII of GCC, Rev-06 will apply. For any other deviation mentioned in un-priced copy of this format submitted with Part-I bid but not mentioned in priced copy of this format submitted with Priced bid, the cost of withdrawal of deviation shall be taken as NIL.
- Any deviation mentioned in priced copy of this format, but not mentioned in the un-priced copy, shall not be accepted.
- All techno-commercial terms and conditions of NIT shall be deemed to have been accepted by the bidder, other than those listed in unpriced copy of this format.
- Cost of withdrawal is to be given separately for each deviation. In no event bidder should club cost of withdrawal of more than one deviation else cost of withdrawal of such deviations which have been clubbed together shall be considered as NIL.
- In case nature of cost of withdrawal (positive/negative) is not specified it shall be assumed as positive.
- In case of discrepancy in the nature of impact (positive/ negative), positive will be considered for evaluation and negative for ordering.

LOAD TITLE	RATING (KW / A)		UNIT (U)/STN (S)	Nos.		VOLTAGE CODE*	FEEDER CODE**	EMER. LOAD (Y)	CONT.(C)/ INTT.(I)	STARTING TIME >5 SEC (Y)	LOCATION	BOARD NO.	CABLE		BLOCK CABLE DRG. No.	CONTRO L CODE	REMARKS	LOAD No.
	NAME PLATE	MAX. CONT. DEMAND (MCR)		RUNNING	STANDBY								SIZE CODE	Nos				
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
INSTRUMENT AIR COMPRESSORS		595 KW	S	2	1	C	U	N	C		Compressor House							
SERVICE AIR COMPRESSORS		595 KW	S	2	0	C	U	N	C		Compressor House							
INSTRUMENT AIR COMPRESSOR FAN MOTOR (IF REQUIRED SEPARATE POWER SUPPLY)		5 KW	S	2	1	D	U	N	C		Compressor House							
SERVICE AIR COMPRESSOR FAN MOTOR (IF REQUIRED SEPARATE POWER SUPPLY)		5 KW	S	2	0	D	U	N	C		Compressor House							
INSTRUMENT AIR COMPRESSOR PANEL		0.75 KW	S	2	1	E	S	N	C		Compressor House							
SERVICE AIR COMPRESSOR PANEL		0.75 KW	S	2	0	E	S	N	C		Compressor House							
INSTRUMENT AIR COMPRESSORS MOTOR SPACE HEATER		0.63 KW	S	2	1	E	S	N	I		Compressor House							
SERVICE AIR COMPRESSORS MOTOR SPACE HEATER		0.63 KW	S	2	0	E	D	N	I		Compressor House							
AIR DRYER PLANT PANEL		5 KW	S	2	1	D	S	N	C		Compressor House							
AIR DRYER PLANT MOTOR		10 KW	S	2	1	D	U	N	C		Compressor House							
NOTES: 1. COLUMN 1 TO 12 & 18 SHALL BE FILLED BY THE REQUISITIONER (ORIGINATING AGENCY); REMAINING COLUMNS ARE TO BE FILLED UP BY PEM (ELECTRICAL)/ CUSTOMER 2. ABBREVIATIONS : * VOLTAGE CODE (7):- (ac) A=11 KV, B=6.6 KV, C=3.3 KV, D=415 V, E=240 V (1 PH), F=110 V (cc): G=220 V, H=110 V, J=48 V, K=+24V, L=-24 V : ** FEEDER CODE (8):- U=UNIDIRECTIONAL STARTER, B=BI-DIRECTIONAL STARTER, S=SUPPLY FEEDER, D=SUPPLY FEEDER (CONTACTER CONTROLLED)																		
LOAD DATA (ELECTRICAL)	JOB NO.		434				ORIGINATING AGENCY				PEM (ELECTRICAL)							
	PROJECT TITLE		3X800MW PATRAT STPS				NAME				DATA FILLED UP ON							
	SYSTEM		COMPRESSED AIR SYSTEM				SIGN.				DATA ENTERED ON							
	DEPTT. / SECTION		MAX				SHEET 1 OF 2		REV. 00		DE'S SIGN. & DATE							

LOAD TITLE	RATING (KW / A)		UNIT (U)/STN (S)	Nos.		VOLTAGE CODE*	FEEDER CODE**	EMER. LOAD (Y)	CONT.(C)/ INTT.(I)	STARTING TIME >5 SEC (Y)	LOCATION	BOARD NO.	CABLE		BLOCK CABLE DRG. No.	CONTRO L CODE	REMARKS	LOAD No.
	NAME PLATE	MAX. CONT. DEMAND (MCR)		RUNNING	STANDBY								SIZE CODE	Nos				
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
AUTO DRAIN TRAP		0.02 KW	S	9	-	E	S	N	I		5 nos. at Compressor House, 1 no each near TG hall of each unit, 1 no near DM plant							
Any other power supply as required by bidder	To be filled by bidder																	
Note: - Bidder to confirm that the above loads considered by BHEL would cater the system provided by them. In case there is any variation, the same should be clearly stated in the technical offer. No changes would be admissible during detailed engineering stage. - Bidder to note that for the system being supplied by them, only the above loads will be provided. In case any other load is required, the same would be derived / multiplied by bidder on their own from these feeders only. - Any change in the electrical load list shall be entertained only subject to its feasibility, and BHEL reserves the right to debit the vendor cost of any changes necessitated in the switch gear /MCC on account of changed loads.																		
NOTES: - COLUMN 1 TO 12 & 18 SHALL BE FILLED BY THE REQUISITIONER (ORIGINATING AGENCY); REMAINING COLUMNS ARE TO BE FILLED UP BY PEM (ELECTRICAL)/ CUSTOMER - ABBREVIATIONS : * VOLTAGE CODE (7):- (ac) A=11 KV, B=6.6 KV, C=3.3 KV, D=415 V, E=240 V (1 PH), F=110 V (cc): G=220 V, H=110 V, J=48 V, K=+24V, L=-24 V : ** FEEDER CODE (8):- U=UNIDIRECTIONAL STARTER, B=BI-DIRECTIONAL STARTER, S=SUPPLY FEEDER, D=SUPPLY FEEDER (CONTACTER CONTROLLED)																		
LOAD DATA (ELECTRICAL)	JOB NO.		434				ORIGINATING AGENCY				PEM (ELECTRICAL)							
	PROJECT TITLE		3X800MW PATRAT STPS				NAME				DATA FILLED UP ON							
	SYSTEM		COMPRESSED AIR SYSTEM				SIGN.				DATA ENTERED ON							
	DEPTT. / SECTION		MAX				SHEET 2 OF 2		REV. 00		DE'S SIGN. & DATE							

SUGGESTED PRICE FORMAT ANNEXURE-IIIIF Guaranteed Power Consumption For Air Compressor System				Doc No:	PE-PF-434-555-A001	
				Rev No:		
				Date of issue		
NAME OF PROJECT:		PATRATU STPS 3X800MW				
NAME OF PACKAGE:		COMPRESSED AIR SYSTEM				
TECHNICAL SPECIFICATION:		PE-TS-434-555-A001				
S.No. (1)	Description of Equipments (2)	Nos. of Equipment to be considered for guaranteed power consumption		Total Guaranteed Power Consumption for Each Equipment at Motor Input Terminals & control Panel (4)	Duty Factor (5)	Total (KW) (6) = (3A)*(4)*(5)
		Working	Standby			
		A	B			
1	Air Compressors for Service air application (Oil free Screw type / Centrifugal type) of capacity 65 Nm3/minute	2	0		0.33	
2	Air Compressors for Instrument air application (Oil free Screw type / Centrifugal type) of capacity 65 Nm3/minute	2	1		0.60	
3	Air Dyrer	2	1		0.50	
					TOTAL	1120.00
Note :						(Say 1120 KW)
1	Estimated Power Consumption Figure for the compressed air system (For Working Drives Only) considered is 1120 KW.					
2	Bidders Guaranteed power consumption at motor input terminals (Not Shaft Power) considering motor efficiency of 95% including power for control panel as furnished in guaranteed schedule shall be demonstrated by the successful bidder during performance testing at works/site.					
3	The price quoted by the bidder shall be loaded @ US \$ 3025 for every additional kW increase in consumption from the base figure indicated at Note no. 1.0 above.					
4	In case the successful bidder fails to establish / prove the guaranteed values of power consumption (base figure of auxiliary power consumption) on actual performance testing at the manufacturing works / site, penalty @ US \$ 3025 per kW increase in power consumption figure shall be levied.					
5	If the contract currency is other than US \$, then the liquidated damages shall be in equivalent amount in contract currency based on billing selling exchange rate of State Bank of India prevailing in the date of Award of Contract i.e. 08.03.2018.					
6	Guaranteed Power Consumption Format shall be submitted in open along with techno commercial offer only.					
Particulars of bidder / authorised representative						
Name	Designation	Signature	Date	Company Seal		