

		QUALITY PLAN		CUSTOMER :		PROJECT			SPECIFICATION :			
				BIDDER/ :		TITLE			NUMBER :			
		SHEET 2 OF 2		VENDOR		NUMBER PED-506-00-Q-006, REV-01			SPECIFICATION :			
		SYSTEM		ITEM AC ELECT. MOTORS BELOW 55KW (LV)			SECTION			VOLUME III		
SL. NO.	COMPONENT/OPERATION	CHARACTERISTICS CHECK	CAT.	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
1	2	3	4	5	6	7	8	9	P	W	V	11
		3.NAMEPLATE DETAILS	MA	VISUAL	100%	IS-325 & DATA SHEET	IS-325 & DATA SHEET	INSPN. REPORT	2	1	-	
NOTES: 1 ROUTINE TESTS ON 100% MOTORS SHALL BE DONE BY THE VENDOR. HOWEVER, BHEL SHALL WITNESS ROUTINE TESTS ON RANDOM SAMPLES. THE SAMPLING PLAN SHALL BE MUTUALLY AGREED UPON 2 WHERE EVER CUSTOMER IS INVOLVED IN INSPECTION, (1) SHALL MEAN BHEL AND CUSTOMERS BOTH TOGETHER. 3 FOR EXHAUST/VENTILATION FAN MOTORS OF RATING UPTO 1.5KW , ONLY ROUTINE TEST CERTIFICATES SHALL BE FURNISHED FOR SCRUTINY. <u>Legends for Inspection agency</u> 1. BHEL/CUSTOMER 2. VENDOR (MOTOR MANUFACTURER) 3. SUB-VENDOR (RAW MATERIAL/COMPONENTS SUPPLIER) P. PERFORM W. WITNESS V. VERIFY												
BHEL			PARTICULARS		BIDDER/VENDOR							
			NAME									
			SIGNATURE									
			DATE					BIDDER'S/VENDORS COMPANY SEAL				

CABLE SCHEDULE FORMAT

[illegible]

Explanatory notes for filling up cable list for routing through WinPath, the cable routing program (developed by Corporate R&D) being used in PEM.

1. For the purpose of clarity, it may please be noted that the information given in regard to the cables to be routed through WinPath as per the system elaborated below is called "Cable List", while the term "Cable Schedule" applies to the cable list with routing information added after routing has been carried out.
2. The cable list shall be entered as an MS Excel file in the format as per enclosed template EXT_CAB_SCH_FORMAT.XLS. No blank lines, special characters, header, footer, lines, etc. shall be introduced in the file. No changes shall be made in the title line (first line) of the template.
3. The field properties shall be as under:
 - a. UNITCABLENO: A/N, up to sixteen (16) characters; each cable shall have its own unique, unduplicated cable number. In case this rule is violated, the cable cannot be taken up for routing.
 - b. FROM: A/N, up to sixty (60) characters; the "From" end equipment/ device description and location to be specified here. Information in excess of 60 characters will be truncated after 60 characters.
 - c. TO: A/N, up to sixty (60) characters; the "To" end equipment/ device description and location to be specified here. Information in excess of 60 characters will be truncated after 60 characters.
 - d. PURPOSE: A/N, up to sixty (60) characters; the purpose (i.e. power cable/ indication/ measurement, etc.) to be specified here. Information in excess of 60 characters will be truncated after 60 characters.
 - e. REMARKS: A/N, up to forty (40) characters; Any information pertinent to routing to be specified here (e.g., cable number of the cable redundant to the cable number being entered). Information in excess of 40 characters will be truncated after 40 characters.
 - f. CABLESIZE: A/N, 7 characters exactly as per the codes indicated below shall be specified here. The program cannot route cables described in any other way/ format.
 - g. PATHCABLENO: Field reserved for utilization by the program. User shall not enter any information here.
4. One list shall be prepared for each system/ equipment (i.e., separate and unique cable lists shall be prepared for each system).
5. The cables shall be described as per the scheme listed below:

Explanatory notes for filling up cable list for routing through WinPath, the cable routing program (developed by Corporate R&D) being used in PEM.

A	NN	NNN
Cable	No. of cores	Cable size
Voltage	(e.g. 01,03,3H, 07)	(e.g. 035,185,2.5, 0.5)
Code (see B below)		

please refer below examples:

i) 3C x 120 sq. mm. (1.1kV) PVC FRLS, Unarmoured Aluminium cable, the voltage code shall be D03G120

ii) 3C x 2.5 sq. mm. (1.1kV) PVC FRLS, Unarmoured Copper cable, the voltage code shall be D03C2.5

iii) 3.5C x 120 sq. mm. (1.1kV) PVC non-FRLS, Armoured Aluminium cable, the voltage code shall be D3HF120

- (A) SYSTEM VOLTAGE CODES:
(ac) A = 11KV, B = 6.6KV, C = 3.3KV, D = 415V, E = 240V, F = 110V
(dc) G = 220V, H = 110V, J = 48V, K = +24V, L = -24V
- (B) CABLE VOLTAGE CODES:
A = 11KV (Power cables)
B = 6.6KV (Power cables)
C = 3.3KV (Power cables)
D = 1.1KV (LV & DC system power & control cables)
E = 0.6KV (0.5 sq. mm. Control cables)

(C)	<u>CABLE CODES</u>
<u>PVC Copper</u>	
A = Armoured FRLS	B = Armoured Non-FRLS
C = unarmoured FRLS	D = Unarmoured Non-FRLS

Explanatory notes for filling up cable list for routing through WinPath, the cable routing program (developed by Corporate R&D) being used in PEM.

- PVC Aluminium
E = Armoured FRLS
G = unarmoured FRLS

F = Armoured Non-FRLS
H = Unarmoured Non-FRLS
- XLPE Copper
J = Armoured FRLS
L = unarmoured FRLS

K = Armoured Non-FRLS
M = Unarmoured Non-FRLS
- XLPE Aluminium
N = Armoured FRLS
Q = unarmoured FRLS

P = Armoured Non-FRLS
R = Unarmoured Non-FRLS
- S = FIRE SURVIVAL CABLES
T = TOUGH RUBBER SHEATH
U = OVERALL SCREENED
V = PAIRED OVERALL SCREENED
W = PAIRED INDIVIDUAL SCREENED
Y = COMPENSATING CABLES
I = PRE-FABRICATED CABLES
Z = JELLY FILLED CABLES
6. Once a cable list has been given to PEM for routing, any subsequent changes required in the cable list (which may be in the form of addition of cables, deletion of cables, change of type or size of cable, etc.) must be informed as specific changes (as a separate file MS Excel of the same format as the original file) to the cable list given earlier if the cable list has been routed and cable schedule generated. The routing status of the cable list shall be got confirmed from PEM by the agency that has prepared the cable list before the changes are intimated. In case PEM confirms that the cable list in question has not been taken up for routing, and the revised cable list is acceptable,
- Rev 0

26 July 2016

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Explanatory notes for filling up cable list for routing through WinPath, the cable routing program (developed by Corporate R&D) being used in PEM.

the same may be sent. Since cable routing through the program involves adding each cable list to the project cable schedule database, the original cable schedule shall not be furnished to PEM with revisions incorporated within.

7. For any assistance or clarifications, please contact <mailto:praveendutta@bhelpem.co.in>

1098305/2022/PS-PEM-MAX



TITLE:

TECHNICAL SPECIFICATION FOR
COAL HANDLING PLANT
RUN-OFF WATER TREATMENT SYSTEM
3X800 MW PATRATU STPP EXT.PH-I

BHEL DOCUMENTS NO.: PE-TS-434-157-A001

VOLUME-II-B

SECTION-C3

REV. NO. 00

DATE:

SECTION-C3
(SPECIFIC TECHNICAL REQUIREMENT-C&I)

	3 x 800 MW PVUNL PATRATU TPP PHASE-I	SECTION: C
	TECHNICAL REQUIREMENTS (C&I) CHP WATER TREATMENT PLANT	

CONTROL AND INSTRUMENTATION FOR CHP WATER TREATMENT PLANT

	3 x 800 MW PVUNL PATRATU TPP PHASE-I		DESG	AR
	JOB NO: 434		CHKD	MK
	REV. NO. 00	DATE: 26.08.2022	APPD	SC



**C&I SPECIFICATION FOR
CHP WATER TREATMENT PLANT**

SECTION: C
SUB SECTION: C&I

**C&I SPECIFICATION FOR
CHP WATER TREATMENT PLANT**

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C&I SPECIFICATION FOR CHP WATER TREATMENT PLANT

SECTION: C
SUB SECTION: C&I

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4	GENERAL TECHNICAL SPECIFICATION
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6	MEASURING INSTRUMENTS (PRIMARY & SECONDARY)
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**C&I SPECIFICATION FOR
CHP WATER TREATMENT PLANT**

SECTION: C
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**C&I SPECIFIC TECHNICAL REQUIREMENT
FOR DCS BASED
CHP WATER TREATMENT PLANT**



C&I SPECIFICATION FOR CHP WATER TREATMENT PLANT

SECTION: C
SUB SECTION: C&I

Specific Technical Requirements (C&I):

1. CHP water treatment plant (CHWTP) shall be operated from DCS (BHEL's scope).
2. The Contractor shall provide complete Instrumentation for control, monitoring and operation of entire CHWTP. The requirements given are to be read in conjunction with detailed Technical specification enclosed in the specification. Further in case of any discrepancy in the requirement 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 shall prevail without any commercial implication.
3. 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.
4. All instruments and control elements shall be terminated on JB/LCP in field and both instrument and JB/LCP are in bidder scope. Number of Junction Boxes shall be sufficient and positioned in the field to minimize local cabling (max 12-15 mtrs) and trunk cable.
5. For cable scope refer to electrical scope between BHEL and vendor defined in electrical specification.
6. Bidder to provide mandatory spares as per mandatory spares list.
7. 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.
8. The specifications for instruments mentioned in the specification are minimum requirements. The detail specifications shall be finalized during detail engineering.
9. The bidders shall specifically mention any deviation they would like to take on the C&I specification. In absence of only deviation, a No deviation certificate is to be furnished.
10. 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.
11. 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.
12. 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.



C&I SPECIFICATION FOR CHP WATER TREATMENT PLANT

SECTION: C
SUB SECTION: C&I

13. 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. The make/model of various instruments/items/systems shall be as per customer/BHEL 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.
14. 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/ analyser installation not covered in the same shall be subject to customer and BHEL approval during detailed engineering.
15. temperature transmitter shall be provided for all temperature measurement applications.
16. Bidder to provide temperature transmitter, JB/Rack & other erection hardware.
17. Bidder to furnish electrical load/UPS load data during detailed engineering.
18. UPS Power supply shall be provided by BHEL at a single point, further distribution to various instruments/equipment 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 power requirement along with the bid.
19. Bidder's presence is required for 3 Man days (Excluding travel time) at EDN Bangalore during FAT of DDCMIS for certifying correctness & completeness of implementation of Control logic. Intimation to attained FAT shall be informed in 2 days advance. All the expenses like boarding, lodging and travel, Air fare etc. shall be in bidder's scope.
20. Bidder's presence is required for 10 Man days (in two visit) at site during commissioning of DDCMIS for assistance related to process correctness. Two visit with total 10 Man days (Excluding travel time) in which one visit shall be of 5 Man days each. All the expenses like boarding, lodging and travel, Air fare etc. shall be in bidder's scope.
21. Contractor shall furnish Instrument Schedule, I/O list, Drive list, Cable Schedule, Cable interconnection (DCS end terminal details shall be provided to vendor during detail engineering to incorporate in cable interconnection), JB grouping, Annunciation list, SOE list, List of Instruments/devices for HART in BHEL approved format. Also 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.
22. Interface of MCC, Solenoid valves, field instruments, Actuators etc. with DDCMIS based control system shall be as per Drive Control Philosophy enclosed in specification.
23. Local control panel if any required for operation shall be in bidder scope.



C&I SPECIFICATION FOR CHP WATER TREATMENT PLANT

SECTION: C
SUB SECTION: C&I

24. The solenoid operated valves/Dampers/Gate shall have a limit switch for open/close feedback. Solenoid Valve shall be rated for 24V Dc only.
25. All field instruments enclosure shall be IP65 local panel/cabinet enclosure shall be IP 55, unless otherwise specified.
26. Diaphragm seal shall be provided with Instruments having contact with corrosive media.
27. Redundancy of sensors shall be provided by bidder
 - (i) Triple redundancy for all analog and binary inputs required for protection of system/drives.
 - (ii) For all other control functions dual redundancy of the sensors shall be provided by the bidder.
28. Use of process actuated shall be avoided unless unavoidable.
29. Number of pairs to be selected for Screen /Control cable
 - a) F-Type: 2P/4P/8P/12P (Size: 0.5sqmm2)
 - b) G-Type: 2P/4P/8P/12P (Size: 0.5sqmm2)
 - c) Core Cable: 3CX2.5sqmm2/ 5CX2.5sqmm2/ 12CX1.5sqmm2
30. Instrument installation shall be as per the attached "Standard Hook-up diagram of instrument."
31. In addition to requirements specified here, all C&I systems/ sub-systems/ equipment/ devices shall also meet other requirements stipulated under other Sub-sections/ parts/ sections of specification.
32. In case of any conflict and repetition of clauses in the specification, BHEL discretion will prevail.
33. Measuring instruments (primary & secondary), analysers 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 (Annexure - 1).
34. All the outdoor field instruments such as analysers/transmitters/meters etc. shall be provided with suitable Free standing cabinet(s)/panel/rack so that the equipment are protected against rain/ sunlight etc.
35. One number of Conductivity Analyser shall be supplied by the bidder as a loose supply.

	C&I SPECIFICATION FOR CHP WATER TREATMENT PLANT	SECTION: C SUB SECTION: C&I
LIST OF DOCUMENTS/DELIVERABLES		



C&I SPECIFICATION FOR CHP WATER TREATMENT PLANT

SECTION: C
SUB SECTION: C&I

LIST OF DELIVERABLES OF PEM - C&I DEPARTMENT#

Sl. No.	DRAWING NO.#	DRAWING/DOCUMENT TITLE#	CATEGORY #
#	#	#	#
1#	PE-V1-434-145-I901#	CONTROL & OPERATIONAL WRITE-UP FOR THE # SYSTEM WITH SET POINTS#	A#
2#	PE-V1-434-145-I902#	CONTROL SCHEME/LOGIC DIAGRAM (TO BE # IMPLEMENTED IN DDCMIS)#	A#
3#	PE-V1-434-145-I903#	HMI PICTURES/PLANT SCHEMATICS#	A#
4#	PE-V1-434-145-I904#	INSTRUMENT SCHEDULE WITH SET POINTS#	A#
5#	PE-V1-434-145-I905#	I/O LIST (ANALOG & BINARY)#	A#
6#	PE-V1-434-145-I906#	DRIVE LIST/SOLENOID/ACTUATOR VALVE LIST # WITH LOCATION DATA#	A#
7#	PE-V1-434-145-I907#	FIELD JB/LIE/LIR,DRIVES TERMINATIONS#	A#
8#	PE-V1-434-145-I908#	DATASHEETS FOR INSTRUMENTS, JBs, etc.#	A#
9#	PE-V1-434-145-I909#	QUALITY PLANS (INSTRUMENTS, VMS, etc.)#	A#
10#	PE-V1-434-145-I910#	INSTRUMENT HOOK-UP DRAWING#	A#
11#	PE-V1-434-145-I911#	THERMOWELL SIZING CALCULATION#	A#
12#	PE-V1-434-145-I913#	CABLE SCHEDULE & INTERCONNECTION#	A#
13#	PE-V1-434-145-I914#	ANNUNCIATION & SOE LIST#	A#

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NOTES:#

ANY OTHER DOCUMENT DECIDED DURING DETAILED ENGINEERING SHALL BE PROVIDED BY BIDDER WITHOUT ANY COMMERCIAL/TECHNICAL IMPLICATION.#

CONTRACTOR TO SUBMIT REUSABLE DATABASE FORMATS IN BHEL/CUSTOMER 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.#

FORM NO. PEM-6666-0		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.					

CLAUSE NO.	TECHNICAL REQUIREMENTS																												
7.00.00 7.01.00	ENVIRONMENTAL CONDITIONS Instruments, devices and equipment for location in outdoors/indoor/air-conditioned areas shall be designed to suit the environmental conditions indicated below and shall be suitable for continuous operation in the operating environment of a coal fired utility station and also during periods of air conditioning failure without any loss of function, or departure from the specification requirements covered under this specification. <table border="1"> <tr> <td>Ambient Temperature(outside cabinets)</td><td>Pressure</td><td>Relative humidity</td><td>Atmosphere</td><td>Required protection Class of panels/ cabinets / desks to be provided by contractor.</td></tr> <tr> <td colspan="5">Outdoor Location</td></tr> <tr> <td>55 degree C max. / 4 degree C min.</td><td>Atmosphere</td><td>100 % Max./ 5 % min.</td><td>Air (dirty)</td><td>IP 55</td></tr> <tr> <td colspan="5">Indoor Location</td></tr> <tr> <td>55 degree C max. / 4 degree C min.</td><td>Atmosphere</td><td>95 % Max./5 % min.</td><td>Air</td><td>IP 54**</td></tr> </table>				Ambient Temperature(outside cabinets)	Pressure	Relative humidity	Atmosphere	Required protection Class of panels/ cabinets / desks to be provided by contractor.	Outdoor Location					55 degree C max. / 4 degree C min.	Atmosphere	100 % Max./ 5 % min.	Air (dirty)	IP 55	Indoor Location					55 degree C max. / 4 degree C min.	Atmosphere	95 % Max./5 % min.	Air	IP 54**
Ambient Temperature(outside cabinets)	Pressure	Relative humidity	Atmosphere	Required protection Class of panels/ cabinets / desks to be provided by contractor.																									
Outdoor Location																													
55 degree C max. / 4 degree C min.	Atmosphere	100 % Max./ 5 % min.	Air (dirty)	IP 55																									
Indoor Location																													
55 degree C max. / 4 degree C min.	Atmosphere	95 % Max./5 % min.	Air	IP 54**																									
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE –I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION – VI, PART-B DOC. NO. : CS:9585-001-2		SUB-SECTION-C-01 BASIC DESIGN CRITERIA																									
PAGE 3 OF 4																													

CLAUSE NO.	TECHNICAL REQUIREMENTS				
	Air Conditioned Areas				
	24 +/- 5 degree C normal/50 degree C max.*	Atmosphere	90% Max. / 10%min.	Air	IP 22***
	* During air conditioning failure for a short period of time.				
	**For non-ventilated equipment/ control system enclosures. For ventilated equipment/ control system enclosures, protection class shall be IP 42.				
	***With a suitable canopy at the top to prevent ingress of dripping water.				
	For Hazardous areas the protection class shall be in accordance with the requirements of the relevant NEC code for the location.				
	PCs, OWS, EWS, Servers, Network Switches, Printers, mini UPS and other peripherals, maximum temperature limit shall be 35 Deg. C. For LVS the same shall be around 25 Deg. C For the remote I/O cabinets mounted in non-AC areas, panel AC shall be provided.				
	7.02.00	All equipment / 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).			
	7.03.00	For coastal areas, all equipment / instruments/ accessories shall be provided with durable epoxy coating for housings and all exposed surfaces of the equipment / instruments/ accessories.			
	7.04.00	For coastal areas, all impulse piping / air supply piping / local instrument enclosures and racks/ accessories shall be provided with durable epoxy coating for all exposed surfaces.			
	7.05.00	For coastal areas, all conduits / cable sub trays / cabling accessories shall be provided with durable epoxy coating for all exposed surfaces.			
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE –I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION – VI, PART-B DOC. NO. : CS:9585-001-2		SUB-SECTION-C-01 BASIC DESIGN CRITERIA	
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**C&I SPECIFICATION FOR
EFFLUENT TREATMENT PLANT**

SECTION: C
SUB SECTION: C&I

**MEASURING INSTRUMENTS
(PRIMARY & SECONDARY)
&
SPECIFICATION FOR ELECTRONIC
TRANSMITTERS**

|

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).
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CLAUSE NO.	TECHNICAL REQUIREMENTS				
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											
2.03.00	Adjustment/ calibration	Using hand held HART calibrator/ centralized PC based system (as applicable).										
	Zero & span adjustment	Continuous, temper proof, remote as well as manual adjustability from instrument. It should be possible to calibrate the instrument without any level in the tank/sump etc.										
	Display	Integral digital display.										
	Load Impedance	500 ohms (minimum).										
	Electromagnetic compatibility	Shall meet EN 61326-1 (1997) and AmdtA1, class A equipment/EN 50081-2 & EN 5008 1-2 & EN 50082-2										
	Mounting	(i) External cage shall be provided where ever side mounting is required. External cage and other mounting accessories to be provided by the contractor. (ii) Where ever top mounting is required, all mounting accessories, stilling well (as required) etc., shall be provided by the contractor. (iii) All weather canopy shall be provided for protection from direct sunlight and direct rain for open locations.										
	Note: Four wire type transmitters can also be provided for applications where 2- wire transmitter has some technical limitations, subject to employer's approval during detailed engineering stage. However, in such cases isolated 4-20 mA DC (analog) output shall be provided. Power supply required for such transmitters shall be 240V AC / 24V DC.											
	Ultrasonic Type level Transmitter											
	<table><tr><th>S.No.</th><th>Features</th><th>Essential/Minimum requirement</th></tr><tr><td>1.</td><td>Type of Transmitter</td><td>Non-contact Microprocessor based 2 wire type (loop powered), HART protocol compatible Ultrasonic transmitter.</td></tr><tr><td>2.</td><td>Output signal</td><td>4-20 mA DC (Analog) along with superimposed digital signal (based on HART protocol).</td></tr></table>			S.No.	Features	Essential/Minimum requirement	1.	Type of Transmitter	Non-contact Microprocessor based 2 wire type (loop powered), HART protocol compatible Ultrasonic transmitter.	2.	Output signal	4-20 mA DC (Analog) along with superimposed digital signal (based on HART protocol).
	S.No.	Features	Essential/Minimum requirement									
1.	Type of Transmitter	Non-contact Microprocessor based 2 wire type (loop powered), HART protocol compatible Ultrasonic transmitter.										
2.	Output signal	4-20 mA DC (Analog) along with superimposed digital signal (based on HART protocol).										
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)									
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CLAUSE NO.	TECHNICAL REQUIREMENTS		
	3.	Accuracy	+/- 0.5% of calibrated span or minimum 5mm.
	4.	Power supply	24 V DC +/- 10%.
	5.	Temperature compensation	To be provided within transducer.
	6.	Housing	Weather proof as per IP-65, metallic housing with durable corrosion resistance coating.
	7.	Adjustment/calibration/ maintenance	Using hand held HART calibrator/ centralized PC based system (as applicable).
	8.	Zero and Span adjustment	Continuous, tamper proof, remote as well as manual adjustability from instrument. It should be possible to calibrate the instrument without any level in the tank/sump etc.
	9.	Sensor Material	Corrosion resistant material to suit individual application requirement.
	10.	False signal tolerance	Transmitter shall be capable of ignoring false echoes from internal tank/sumps obstructions such as pipes, heating coils or agitator blades. Also transmitter shall have adjustable damping circuitry.
	11.	Range	Range of transmitter shall be capable of covering the complete level span of tank taking care of blocking distance, frequency attenuation due to surface, obstructions, vapors etc.
	12.	Display	Integral digital display
	13.	Diagnostics	Loss of echo alarm etc.
	14.	Load Impedance	500 ohms (minimum).
15.	Electrical Connection	Plug and socket	
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CLAUSE NO.	TECHNICAL REQUIREMENTS 		
	16. Accessories	- All weather canopy shall be provided for protection from direct sunlight and direct rain for open locations. - All mounting accessories required for erection and commissioning shall be provided. - For hazardous area, explosion proof enclosure as described in NEC article 500	
	Note: - Contractor can also provide Radar type transmitter as per above specification in place of ultrasonic transmitter subject to approval by Employer during detailed Engineering. Sonic frequency based transmitters can also be provided under “ultrasonic transmitters” category for fly ash silo level. - Four wire type transmitters can also be provided for applications where 2- wire transmitter has some technical limitations, subject to employer’s approval during detailed engineering stage. However, in such cases isolated 4-20 mA DC (analog) output shall be provided. Power supply required for such transmitters shall be 240V AC / 24V DC. - For applications where transmitter location is not accessible, the transmitter shall have separate sensor unit and electronic unit for such applications. It shall be possible to mount the electronic unit at accessible location.		
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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-IIIIC-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 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.			
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CLAUSE NO.	TECHNICAL REQUIREMENTS		
	Minimum bending radius	30 mm	
	Length of T/C	On as required basis considering location of measurement point and the JB/TTJB location.	
	Notes : 1) The specification for thermocouples of bearings metal temp measurements can be as per their manufacturer standards. The manufacturer shall submit the adequate supporting documents for establishing their standard practice. However type of thermocouples shall be K-type. 2) For boiler metal temperature applications, considering the location of installations and response time, manufacturer's standard and proven specification for metal temperature measurement can also be accepted subject to employer's approval. The manufacturer shall submit adequate supporting documents for establishing their standard and proven practice.		
3.04.00	Thermo well (for all process temp. elements) (a) Shall be one piece solid bored type of 316 SS of step-less tapered design. (As per ASME PTC 19.3, 1974) (b) For Mill classifier outlet long life solid sintered tungsten carbide material of high abrasion resistance shall be provided. (c) For Air & Flue gas 316 SS protecting tube with welded cap. (However contractor shall provide better material for Flue gas service if required based on the specified boiler design parameters). (d) For furnace zone, impervious ceramic protecting tube of suitable material along with Incoloy supporting tubes and adjustable flanges.		
3.05.00	Not Used		
3.06.0	TEMPERATURE TRANSMITTER (TT) Following types of 2-wire (loop powered) temperature transmitter (directly powered from 4-20mA input cards of DDCMIS/PLC) shall be provided. The temperature transmitter shall be fully compatible with thermocouples and RTDs being provided by the contractor. Temperature compensation of the thermocouples shall be performed in the temperature transmitter itself. a. Single Input Head mounted Temperature Transmitter These shall be suitable for mounting in the head of temperature element itself. Temperature transmitter and associated temperature element shall be factory fitted. b. Single Input DIN-rail mounted Temperature Transmitter These shall be suitable for mounting on DIN-rails in JB's. The specifications of the JB's shall be same as indicated in Subsection INST CABLE with additional DIN-rails and IP 65 Protection class. This temperature transmitter shall be the ones which are		
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-04 MEASURING INSTRUMENTS (PRIMARY & SECONDARY) PAGE 9 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	
Output	:	2-wire (power supply from input card of Control System) with 4-20mA output with superimposed HART protocol signal.																																						
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Operating ambient temperature	:	0 to 85 deg C (without indicator). 0 to 70 deg C (with indicator).																																						
Power supply	:	24V DC +/- 10%.																																						
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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																																						
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	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: ± 1.5% of full scale. (b) Synchroscope: Accuracy class: 0.5 or better. (c) Voltmeters: Accuracy: ± 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	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.	
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9.00.00 10.00.00 10.01.00 10.01.01 10.01.02 10.01.03 10.01.04	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.
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CLAUSE NO.	TECHNICAL REQUIREMENTS 
13.00.00 13.01.00	SPECIFICATION FOR FLOW ELEMENTS Orifice Plate Features Essential/Minimum Requirements Type Concentric as per ASME PTC-19.5 (Part-II), ISA RP-3.2, 1960 or BS-1042, ISO 5167 Material 316 SS Thickness 3 mm for main pipe diameter up to 300 mm and 6 mm for main pipe dia above 300 mm. Material of branch pipe Same as main pipe Root valve type Globe Root valve material Same as pipe material Root valve size 1 / 2 inch or 1 inch (as applicable) Impulse pipe of same material up to root valve Required Tappings Flanged weld neck or D & D/2 with 3 pairs of tapping (as applicable). Root valves to be provided in all the tappings. Beta Ratio 0.34 to 0.7 Beta Ratio calculation to be submitted Yes Assembly drg. and flow Vs DP Curves Yes Accessories Root valves, flanges, Vent/drain hole (As required) 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.
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 35 OF 46

CLAUSE NO.	TECHNICAL REQUIREMENTS		एनटीपीसी NTPC																											
13.04.00	ROTAMETERS <table><thead><tr><th>Sr. No.</th><th>Features</th><th>Essential / minimum requirements</th></tr></thead><tbody><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></tbody></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.
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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.																													
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 37 OF 46																											

CLAUSE NO.	TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
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 ± 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,			
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 39 OF 46

CLAUSE NO.	TECHNICAL REQUIREMENTS			
	normal, reverse indication and required channel alarm contact shall be provided. The contact rating shall be 60VDC, 6VA (or more if required by Control system). The exact details of the RRI shall be strictly as approved by Employer during detailed engineering. The power supply of RRI is to be arranged by the Bidder			
19.00.00	WATER SYSTEM RELATED SPECIAL INSTRUMENTS (DM PLANT, CPU PLANT, PT PLANT, ETC)			
19.01.00	ANALYSER INSTRUMENTS: For Technical specification of Cation/Specific Conductivity, pH, Sodium, Silica, Turbidity, Total Dissolved Solids (TDS) and Concentration analysers, please refer Specification of Analysers, Part-B, Sub-section IIIC-13, SWAS chapter of this specification.			
19.02.00	Residual Chlorine Analyser a An automatic chlorine residual analyser of amperometric type shall be provided alongwith the chlorinating plant for monitoring the residual chlorine content of cooling water. The analyser shall be suitable for accurate residual measurement in open/closed systems. The measurement accuracy shall not be affected by presence of treatment chemicals as chromates, phosphates, de-former highly polluted water, change in temperature etc. b The analyser shall comply with the following specification requirements, as a minimum (i) Indicator : Provision of LC display in the panel of analyser. (ii) Range : 0 to 20.0 mg/L (ppm) (iii) Accuracy : 2% or better (iv) Sensitivity : 0.01 mg/1 (v) Output signal : 4-20mA DC isolated output, (vi) Alarm annunciation : High and low alarms to be provided on panel and shall be field adjustable. (vii) Calibration : Zero and span adjustment facility to be provided. Final calibration adjustments of the analyser to be done at site and duly verified by titration. Temperature compensation range 0 to 50degC. (x) Mounting : The analyser shall be suitable for field mounting conform to protection class IP-55. (xii) Electrodes : Platinum/Gold and copper electrodes shall be provided with cell cleaning system. (c) Circulating water as sample to residual chlorine analyser shall be taken from hot circulating water pipe work before entry to cooling towers. Exact location and layout of sampling arrangement shall be finalised during detailed engg. stage. Bidder shall provide necessary pumping system (with 100% standby) for meeting the analyser requirements, if needed. All the drains shall be terminated up to the nearest plant drainage system.			
19.03.00	All the outdoor field instruments such as analysers/transmitters/meters etc. shall be provided with suitable Free standing cabinet(s)/panel/rack so that the equipments are protected against rain/ sunlight etc.			
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 40 OF 46

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
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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																
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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 
20.02.00	Time constant : 2 mins. Output from the sensor is to be connected to respective control system. Contractor can also provide combined instrument for measurement of humidity and temperature subject to Employer's approval during detailed engineering. In all such cases, 4-20 ma outputs, each for temperature and humidity measurements are to be provided. TEMPERATURE/ HUMIDITY INDICATOR Sensor : RTD for(Pt 100) for temperature : Capacitance Type for Humidity (specs for humidity and temperature shall be as mentioned above) 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 at least 10 meters. Range : 0-60 Deg C for temperature. : 0-95.0 % for Relative Humidity. Accuracy : Better than +/- 0.5 % for Temperature : Better than +/- 2.5 % for Relative Humidity Mounting : Table Top/ wall mounting. Power supply : 240 V AC, 50 Hz. Output : 4-20 mA signal each for temperature. Qty. : 15 nos. each of temperature & Humidity indicators (combined indicators for Humidity and temperature is also applicable). One Set of output signal is to be connected to respective control system. Apart from displaying the temperature/humidity values on indicator. 21.00.00 Limit switches For offsite plant application Limit switches shall be gold plated with high conductivity and non corrosive type. Contact rating shall be sufficient to meet the requirement of DDCMIS subject to a minimum of 60 V, 6 VA rating. Protection class shall be IP 55. For main plant application limit switches are to be provided as per contractor standard and proven practice.
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 42 OF 46



SUB-SECTION – IIIC - 13

STEAM AND WATER ANALYSIS SYSTEM (SWAS)

EPC PACKAGE FOR
PATRATU SUPER THERMAL POWER STATION EXPANSION
PHASE –I (3X 800MW)

TECHNICAL SPECIFICATION
SECTION-VI
BID DOC. NO.: CS:9585-001-2

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CLAUSE NO.	 TECHNICAL REQUIREMENTS					
	Response Time (90 % of Full Scale)	≤ 5 sec.		≤ 16 min.		≤ 5 min.
	Range	0-1, 0-10, 0-100 micro-mho/cm (freely programmable) for Specific Conductivity. 0-1 micro-mho/cm log scale for Cation conductivity	6-11 pH freely programmable	0-10 ppm freely programmable	0-1000 ppb freely programmable	0 – 100, 0-200 MTU, programmable
	Temperature Compensation	Automatic/	Automatic	Automatic	Automatic	
	Sample Flow			50-150 ml/min		
	No. of Streams	Single	Single	Single	Single	
	Minimum specifications of analysers continued					
	Requirements	Hydrazine	Silica	Sodium	Dissolved O₂	Total Iron (Fe)
	Type	Automatic Continuous Electrochemical Type	Continuous Colorimetric Type	Continuous Flow Through sample	Continuous Flow Through sample	Continuous Flow Through sample
	Accuracy	≤ ± 5%	≤ ± 5% of reading	≤ ± 10% of reading	≤ ± 5% of reading	<±5 % of reading or ±0.005 ppm
	Response Time (90 % of Full Scale)	≤ 3 min.	≤ 15 min. (including sample switching)	≤ 4 min.	≤ 30 sec.	≤ 15 min. (including sample switching)
	Stability	Calibration Once in a Month		Calibration Once in a Month		
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-13 SWAS		PAGE 6 OF 9

CLAUSE NO.	TECHNICAL REQUIREMENTS						एनटीपीसी NTPC
4.00.00	Range	0-50, 0-100 ppb freely programmable	0-50, 0-100 ,0-500 ppb freely programmable	0-1,0-10, 0-200 ppb freely programmable	0-20,0-200 ppb freely programmable	0-50ppb, 0-150ppb, 0-300ppb, 0-1ppm, 0-5ppm freely programmable or as per the process requirement.	
	No. of Streams	Single	Multi stream with sequencer/ stream selector (min. 4 streams)	Multi stream with sequencer/ stream selector (min. 4 streams)	Single	Multi stream with sequencer/ stream selector (min. 4streams)	
	Temperature Compensation	Automatic	Automatic	Automatic	Automatic	Automatic	
	Sample Flow	170 ml/min (max)	50-150 ml/min	125 ml/min (max)	170 ml/min (max)	200ml/min (max)	
	REMARKS	All the analysers/cells shall have open Corrosion resistant drain to waste header.					
		Analysers/ monitors/ cells shall be suitable for operating under the conditions specified.					
		Dual cation exchange column shall be provided for cation conductivity.					
		For Hot well conductivity measurement, the Contractor shall provide direct insertion / withdrawal type conductivity cell whereas for all other samples it shall be flow-through type. Monitors for hot well conductivity shall be suitable for field mounting.					
	4.00.00	SAMPLE PIPING SYSTEM					
	4.01.00	This shall include piping, fittings, valves and accessories from tapping point upto SWAS conditioning panel located in SWAS room on as required basis. All sample piping shall be 3/4" NB seamless type of material ASTM A213 TP 316 H, conforming to ANSI B36.19. The schedule number shall be suitable for the particular application.					
4.02.00	All fittings shall be socket welding type and of material ASTMA182 F316H conforming to ANSI B 16.11.						
4.03.00	Single and multi tubes shall run with the minimum number of changes in direction. Suitable identification tags shall be provided for easy check up and for proper connections.						
4.04.00	The valves to be used in sample piping shall be of stainless steel conforming to ASTM A182. The pressure temperature ratings shall be as per ANSI B16.34. The valve design shall be such that the seats can be reconditioned and stem and disc can be replaced without						
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-13 SWAS		PAGE 7 OF 9	

CLAUSE NO.	TECHNICAL REQUIREMENTS							एनडीपीसी NTPC	
4.05.00	removing valve body from the line. The specification of End size, Pressure class, Type, End preparation, Body, etc. for different type of valves are specified in SWAS table in Clause No. 4.06.00 of Subsection IIIC-09, Section-VI, Part-B.								
	Material Specifications for Sample Pipe Lines								
	The piping to be furnished and installed for water and steam analysis system shall be as indicated below:								
	Piping System				Material				
	1.	Piping from the sample inlet bulk head fittings to the shut off valves				Stainless steel, ASTM A 213, Type 316H, 16 BWG tubing			
	2.	Piping for the high pressure samples and sample blow down piping				Stainless steel, ASTM A 213, Type 316 H. 14 BWG tubing			
	3.	Blow down header				Stainless steel, ASTM A 312, Type 304 Schedule 160			
	4.	Miscellaneous drains receiver holder				Stainless steel, ASTM A 312, Type 304 Schedule 40			
	5.	Piping from the shut-off valves to the terminal points including branch piping and the closed cooling water grab sample piping				Stainless steel, ASTM A 213, Type 316 H, 16 BWG tubing			
	6.	Closed cooling water piping except grab sample and water purge line				Carbon steel, ASTM A 53 Gr. A, Schedule 40.			
4.06.00	7.				Sample through drain piping and waste header piping				Carbon steel, ASTM A 53 Gr. A, Schedule 40.
	8.				Purge air piping/tubing and filling valves				Brass/Copper
	SWAS Valve Table:								
	S. No.	Service / Location	End Size	Pr. Class	Type	End Preparation	Body	Make (as specified or equivalent)	
	1	Sample Shut off valve	0.38	6000	Globe	SW	316SS	Thiedig	
	2	Sample blow down valve	0.38	6000	Ball valve	SW	316SS	Thiedig	
	3	Solenoid valve	--	--	2 way	--	316SS	ASCO	
	4	Pr. reducing Valve	0.38	--	Needle	Tube	316SS	Thiedig	
	5	Safety relief Valve	0.25	3000	Relief	Tube	316SS	Nupro	
	6	PI and FI isolation valve	0.25	3000	Needle	Tube	316SS	Whiety	
7	Back pr. regulating valve	0.25	300	C.W.	SCR	316SS	Cono. flow H30XT-		
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-13 SWAS		PAGE 8 OF 9	

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CLAUSE NO.	TECHNICAL REQUIREMENTS							एनडीपीसी NTPC
5.00.00							HAXXXG	
	8	Grab	0.25	300	3-way	Tube	316SS	Whiety
	9	Quick	--	--	ball	--	316SS	Hancock Walther
	10	Individual P.C. and S.C. inlet & outlet valve					316SS	Hancock/ ACKER MANN
	11	P.C. I/L & O/L header & chilled water I/L & O/L isolation valve	--	--	Gate	--	316SS	Hancock
	12	Safety relief valve at each PC & SC and cooling water header	--	--	Relief	--	316SS	Baldota
	13	High Pressure reducing valve	--	--	--	--	316SS	--
	14	Isolation valve before primary cooler	--	--	Needle	Tube	316SS	Whiety
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-13 SWAS		PAGE 9 OF 9

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

SI. 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.



**C&I SPECIFICATION FOR
EFFLUENT TREATMENT PLANT**

SECTION: C
SUB SECTION: C&I

**DATA SHEETS FOR MOTORISED VALVE
ACTUATOR**

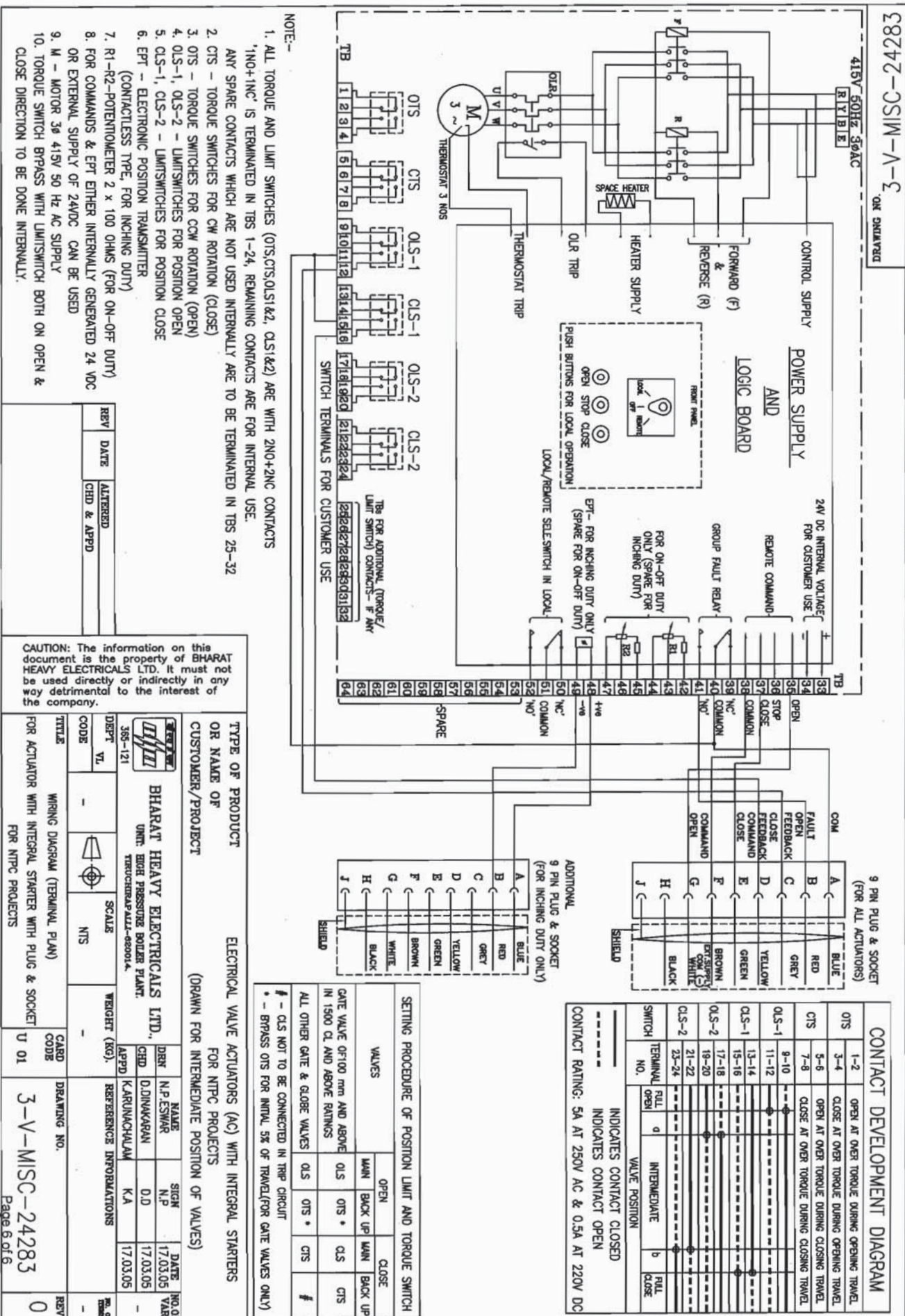
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FORM NO. PEM-6666-0		SPECIFICATION FOR MOTORISED VALVE ACTUATOR			
		REV. NO. 01		DATE: 11.05.2018	
SHEET 1 OF 4					
Data Sheet A & B					
DATA SHEET-A (TO BE FILLED BY PURCHASER)				DATA SHEET-B (TO BE FILLED-UP BY BIDDER)	
GENERAL *	* PROJECT	3 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			

FORM NO. PEM-6666-0		SPECIFICATION FOR MOTORISED VALVE ACTUATOR			
				REV. NO.	01
		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 INTERFACE WITH DC5	☐ 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			

FORM NO. PEM-6666-0		SPECIFICATION FOR MOTORISED VALVE ACTUATOR		
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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	$\pm 1\%$ 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)		

FORM NO. PEM-6666-0		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.	
NOTES: SCOPE: DESIGN, MANUFACTURE, INSPECTION, TESTING AND DELIVERY TO SITE OF ELECTRIC ACTUATOR FOR INCHING OR OPEN / CLOSE DUTY. 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 - TEMPERATURE RISE SHALL BE RESTRICTED TO 70 DEG. C FOR AMBIENT TEMPERATURE OF 50 DEG C. - CABLE GLANDS OF DOUBLE COMPRESSION TYPE, BRASS MATERIAL SHALL BE PROVIDED. - 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. - 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%. - 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. - IT SHALL BE POSSIBLE TO OPERATE THE ACTUATOR LOCALLY. LOCKABLE LOCAL/REMOTE SELECTION SHALL BE PROVIDED ON THE ACTUATOR. - POSITION INDICATOR SHALL BE PROVIDED FOR 0 TO 100 % TRAVEL - WIRING SHALL BE SUITABLE VOLTAGE GRADE COPPER WIRE.					
NAME SIGNATURE DATE	PREPARED BY	CHECKED BY	APPROVED BY	VENDOR COMPANY SEAL	
	Madhav gupta	Mayank kesharwani	Bharat Singh	NAME	
				SIGNATURE	
	01.03.2018 01.	03.2018	01.03.2018	DATE	
NOTES* = TO BE FILLED BY MPL (LEAD AGENCY). @ = TO BE FILLED BY ES					





ELECTRICAL ACTUATORS WITH INTEGRAL STARTERS

EPC PACKAGE FOR
PATRATU SUPER THERMAL POWER STATION EXPANSION
PHASE –I (3X 800MW)

TECHNICAL SPECIFICATION
SECTION – VI, PART-B
BID DOC NO. : CS-9585-001-2

CLAUSE NO.	TECHNICAL REQUIREMENTS	एनटीपीसी NTPC	
1.00.00	CODES AND STANDARDS:		
1.01.00	All standards, specifications and codes of practice referred to herein shall be the latest editions including all applicable official amendments and revisions. In case of conflict between this specification and codes, standards, etc, the former shall prevail.		
2.00.00	ELECTRIC ACTUATORS WITH INTEGRAL STARTERS		
2.01.00	TYPE:		
2.01.01	The actuators shall have integral starters along with over load relays with built in SPP (Single Phasing Preventer). Alternatively Smart non intrusive actuators are also acceptable. A 415, 3 phase 3 wire power supply shall be given to the actuator from switch board as applicable through a switch fuse unit. Control voltage of the motor starter shall be 110 V AC / 24 V DC, derived suitably from 415V power supply.		
2.01.02	In case supplier's standard control voltage for Open/Close contactors is 110V AC, the same is acceptable if suitable Opto Isolation circuit is provided with coupling relays for 24 V DC command inputs.		
2.02.00	INTERFACES:		
2.02.01	Open/Close command termination logic with position & torque Limit Switches, positioner circuit shall be suitably built in the PCB inside the actuator. (a) For Binary Drive (both ON-OFF and INCHING type) :- Open/Close command & status thereof and disturbance monitoring signal (common contact for Overload, Thermostat, control supply failure, L/R selector switch at local & other protections operated) shall be provided. Interface with the control system shall be through hardware signal only. Inter posing relays provided (with coil burden 2.5 VA) in the actuator shall be energized to initiate opening and closing, by 24V DC signal from the external control system. (b) For Modulating Drive:- the command to actuator shall be in form of 4-20mA signal. The necessary positioning circuit and motor protection shall be provided (c) Open/close command termination logic shall be suitably built inside actuator.		
2.03.00	RATING :		
	(a) Supply Voltage & frequency: 415V +/- 10%, 3 Phase, 3 Wire 50HZ +/-5%. (b) 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 regulating service 150 starts per hour or required cycles, whichever is higher.		
2.04.00	CONSTRUCTION:		
	(a) Enclosure:		
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 B-17 ELECTRIC ACTUATORS WITH INTEGRAL STARTERS
			PAGE 1 OF 5

CLAUSE NO.		TECHNICAL REQUIREMENTS		एनटीपीसी NTPC	
2.05.00		Totally enclosed weatherproof minimum IP-55 degree of protection.			
		(b) Gear Train : Metal (Fibre gears are not acceptable)) self-locking to prevent drift under torque switch (where ever applicable) spring pressure when motor is de-energized.			
2.06.00		(c) Manual Wheel: Shall disengage automatically during motor operation.			
		MOTOR :			
2.06.01		(a) Type : Squirrel cage induction motor suitable for Direct On Line (DOL)starting.			
		(b) Enclosure: Totally enclosed, self ventilated IP-55 degree of protection.			
2.06.01		(c) Insulation Class B or better. Temperature rise 70 Deg C. over 50 Deg C ambient			
		(d) Bearings: Double shielded, grease lubricated antifriction.			
2.06.01		(e) Earth Terminals: Two			
		(f) Protection: Single Phasing Protection, Over heating protection through Thermostat (as applicable) and wrong phase sequence protection shall be provided over and above other protection features standard to bidder's design Suitable means shall be provided to diagnose the type of fault locally.			
2.06.00		POSITION/TORQUE SWITCHES:			
2.06.01		Four nos. (2 each in open and close position) position limit switches/contacts and two nos. (one in open and other in close direction) torque switches/contacts each having two nos. NO and two nos. NC contacts shall be provided.			
2.06.01		Torque switches/contacts shall be bypassed in both the end positions with the other end Limit switches/contacts.			
2.06.01		Limit switches/contacts			
2.06.01		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.			
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 B-17 ELECTRIC ACTUATORS WITH INTEGRAL STARTERS	
				PAGE 2 OF 5	

CLAUSE NO.	TECHNICAL REQUIREMENTS			
	Limit switch/contacts and disturbance signals shall be available to DCS even when the power supply to the actuators is not available.			
2.07.00	LOCAL OPERATION:			
2.07.01	It shall be possible to operate the actuator locally also. Lockable local/remote selection shall be provided on the actuator.			
2.08.00	POSITION INDICATOR :			
2.08.01	To be provided for 0 to 100% travel.			
2.09.00	POSITION TRANSMITTER (FOR MODULATING/INCHING TYPE) :			
2.09.01	As required. Suitable for stabilized 4-20 mA signal, 2 wire inductive type, External 24 volts DC operated.			
2.10.00	WIRING :			
2.10.01	Suitable voltage grade copper wire.			
2.11.00	TERMINAL BOX :			
	(i) 9 pin plug and socket (1 no. per actuator to suit 4 pair 0.5 sq.mm. copper overall shielded (16 mm OD), instrumentation cable) suitably mounted in the starter box itself to terminate open/close command and status feedback signals with external control systems.			
	(ii) Additional one number 9 pin plug and socket (to suit 4 pair 0.5 sq.mm copper (16 mm OD) individual and overall shielded instrumentation cable) suitably mounted in the starter box itself for actuators with 4-20 mA position transmitters.			
	(iii) Necessary glands for power cables shall be provided.			
2.12.00	TERMINAL BLOCK :			
2.12.01	650V grade. For power cables.			
2.13.00	SPACE HEATER :			
2.13.01	Space heater of suitable rating. The supply shall be derived from the main power supply available in the actuator.			
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 B-17 ELECTRIC ACTUATORS WITH INTEGRAL STARTERS	PAGE 3 OF 5

CLAUSE NO.

TECHNICAL REQUIREMENTS



FOR TENDER PURPOSE ONLY NTPC LIMITED (A GOVERNMENT OF INDIA ENTERPRISE) ENGINEERING DIVISION PROJECT: TYPICAL THERMAL POWER PROJECT TITLE: INTERFACING OF ACTUATORS		REV. NO.	A
		DRG. NO.	0000-999-POI-A-063
SCALE	N.T.S.	SIZE	A3
DATE	3/06	APPROVED	
DESIGNED		CHECKED	
DRAWN		DESIGN	
CHKD.		BY	
CLEARED BY			
DESCRIPTION			
REV/NO			
A	FIRST ISSUE		

TERMINATION AT CONTROL SYSTEM END

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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 B-17
ELECTRIC ACTUATORS
WITH INTEGRAL STARTERS

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SUB-SECTION – B-23
VFD

EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE –I (3X 800MW)	TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC NO. : CS-9585-001-2

CLAUSE NO.	TECHNICAL REQUIREMENTS	
1.00.00	CODES AND STANDARDS DC Reactor IEC: 60289 Motor IS: 4722/IS: 325/IEC: 60034/NEMA 30 & 31 Transformer IEC: 60076/IS: 2026, IEC: 61378 Dry transformer IS: 11171 VFD IEC: 60034/ IEC: 61800 Harmonics & EM compatibility IEEE: 519/IEC: 61000 Contactor/Switches/Fuses etc. IEC: 60947, IS: 13947	
2.00.00	OPERATING CONDITIONS	
2.01.00	For the purpose of design of equipment/systems, an ambient temperature of 50 deg. Centigrade and relative humidity of 95% shall be considered.	
2.02.00	All equipment shall be suitable for rated frequency of 50 Hz with a variation of +3% & -5%, and 10% combined variation of voltage and frequency unless specifically brought out in the specification.	
2.03.00	All the equipment, material and systems shall, in general, conform to the latest edition of relevant National and international Codes & Standards, especially the Indian Statutory Regulations.	
2.04.00	The auxiliary AC voltage supply arrangement shall have 11/6.6/3.3kV and 415V systems (as applicable). It shall be designed to limit voltage variations as given below under worst operating condition: 11kV/ 3.3 kV/ 6.6 KV : +/- 6% 415V : +/- 10% Note: The Voltage level mentioned above is the Nominal Voltage available at the input of the VFD System from the MCC/ Switchgear/transformer, based on the system requirement/Availability. The voltage level for the VFD shall be as follows:- - Upto 400 kW : 415V/690V, Low Voltage, Three Phase AC - Above 400kW and upto 700 KW : 690V, Low Voltage, Three Phase AC - Above 700KW and upto 1500 KW : Medium Voltage, Three Phase AC Note: The voltage level mentioned above is the Nominal Voltage which is fed to the motor from the VFD. From here onwards in the specifications all the VFD Systems consisting of either 415 V or 690 V may be termed as LV VFD while the higher rated VFD System shall be termed as MV VFD. If nothing is mentioned than the Clause is applicable for both the LV and the MV VFD until deliberated otherwise.	
2.05.00	For Power Cables & Control Cables, please refer technical specification given elsewhere in the document.	
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 B-23 VARIABLE FREQUENCY DRIVES
PAGE 1 OF 10		

CLAUSE NO.	TECHNICAL REQUIREMENTS		
3.00.00	SYSTEM DESCRIPTION		
3.01.00	The VFD System shall include the following equipment for each drive. a) Power/control panels consisting of line converters, inverters and control system for drive including complete control & protection of drive and the motor. b) VFD transformer on the source side, as per system requirement. c) Breaker/Contactor on the VFD/Motor/Transformer/CT/PT/Meters/Bypass (if applicable) side with complete Control, Protection and Diagnostics features of the VFD, as per system requirement. d) Bypass Arrangement of the VFD system if specified. e) DC air core reactor or capacitor, as per the system requirement. f) Inverter Duty Motor suitable for VFD application g) Power & control cables and cabling as required under the scope of supply in the technical specifications.		
4.00.00	GENERAL REQUIREMENTS		
4.01.00	Medium Voltage VFD: The Variable frequency drive (VFD) system shall be of a modern proven design for similar applications in power plants/industry. The system shall be either Current Source Inverter (CSI) or Voltage Source Inverter (VSI) type with minimum eighteen (18) pulse design.		
4.02.00	415 V/690 V LV VFD: The Variable frequency drive (VFD) system shall be of a modern proven design for similar applications in power plants/industry. The system shall be either Current Source Inverter (CSI) or Voltage Source Inverter (VSI) type with minimum Twelve (12) pulse design. For drives less than 100 KW Six (6) pulse can be offered meeting all other requirements.		
4.03.00	The system shall be fully digital, PLC/Microprocessor based, energy efficient, and shall provide very high reliability, high power factor, low harmonic distortion and low vibration and wear and noise. It shall be easy to install in minimum time and expense and no special tools shall be required for routine maintenance.		
4.04.00	The offered equipment shall be with state of art technology and proven field track record. No prototype equipment shall be offered.		
4.05.00	The VFD model offered shall be from the existing VFD model series in the regular manufacturing range of the manufacturer. Along with the offer the Vendor shall submit the supply record and satisfactory performance record for 2 (two) years running of the offered VFD supplied in India or abroad.		
4.06.00	The VFD manufacturer shall ensure the proper coordination of their VFD with the Driven Motor and the Employer's system. All the Motors which are to be driven by VFDs will be of Inverter duty type. The VFD operation shall have no inherent detrimental impact on the Motors/ cables & employer's system.		
4.07.00	Vendor shall ensure availability of spare parts and maintenance support services for the offered equipment for at least for 15 years from the date of supply. After this period, if vendor		
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 B-23 VARIABLE FREQUENCY DRIVES PAGE 2 OF 10

CLAUSE NO.	TECHNICAL REQUIREMENTS	
	discontinues the production of spare parts, vendor shall give at least twelve (12) months' notice prior to such discontinuation so that owner may order his requirements of spares in one lot. The offered VFD manufacturer should have their maintenance service & spares supply network in India to provide quick maintenance service & Spares supply support. The vendor shall indicate the source for supply of spares & Maintenance service location in India.	
5.00.00	TECHNICAL AND OPERATIONAL REQUIREMENTS	
5.01.00	The system shall be designed to deliver the motor input current and torque for the complete speed torque characteristics of the driven equipment, with maximum input supply voltage and frequency variation. The system shall be suitable for the load characteristics and the operational duty of the driven equipment.	
5.02.00	The overload capacity of the controller shall be 150% of the rated current of the motor for one minute for constant torque applications and 110% of rated current for one minute for variable torque applications at rated voltage. If the motor load exceeds the limit, the drive shall automatically reduce the frequency and voltage to the motor to guard against overload.	
5.03.00	The drive system shall be designed to operate in one or more of the following operating modes as to suit characteristics of the driven equipment or specified by the load: a. Variable torque changing as a function of speed. b. Constant torque over a specific speed range. c. Constant power over a specific speed range. d. Any other as specified in data-sheet	
5.04.00	VFDs shall comply with the latest edition of IEEE 519 & IEC 61000 for both individual as well as total harmonic voltage and current distortion limits. The Voltage and Current limits shall be applicable at the Point of Common Coupling (PCC), which shall be the MCC/ Switchgear/ from which the VFD system is fed.	
5.05.00	The compliance shall be verified by the contractor by Harmonic studies conducted with maximum and minimum fault level, cable capacitance, system equipment reactance etc. Finally, the compliance shall be verified by the field measurements of harmonics at the PCC with and without VFDs operation.	
5.06.00	VFD shall be capable of withstanding the thermal and dynamic stresses and the transient mechanical torque, resulting from short circuit. Any damage resulting from such a short circuit or internal fault shall be limited to the component concerned.	
5.07.00	The system shall be suitable to maintain speed variation within range 10-110% with speed set accuracy of +1% of rated maximum speed and steady state regulation of +0.5% of rated speed as per system requirement.	
5.08.00	The VFD System shall maintain a power factor of 0.95 (minimum) from 25 % to 100 % of rated speed.	
5.09.00	Maximum allowable audible noise from the VFD system will be 85 dB (A) at a distance of one meter under rated loaded with all cooling fan operating conditions.	
6.00.00	VFD COMPATIBILITY WITH THE MOTOR	
6.01.00	For MV VFD Drives, to ensure that there are no problems with motor heating, VFD output current waveform, as measured at the motor, shall be inherently sinusoidal at nominal loads,	
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 B-23 VARIABLE FREQUENCY DRIVES PAGE 3 OF 10

CLAUSE NO.	TECHNICAL REQUIREMENTS	
	with a total harmonic current and voltage distortion within acceptable/standard limits. VFD utilizing output transformers are not acceptable.	
6.02.00	The system design shall not have any inherent output harmonic resonance in the operating speed range.	
6.03.00	VFD shall provide stable operation of motor from high-voltage dv/dt stress, regardless of cable length to motor. The vendor shall clearly state the limitations in the motor cable distance in his proposal. However, due to system requirements & constraints if the cable length becomes critical, filters/ chokes etc. shall be provided by the VFD manufacturers as an integral part of the VFD to mitigate the reflected wave effect of harmonics.	
7.00.00	BYPASS ARRANGEMENT (OPTIONAL, IF SPECIFIED)	
7.01.00	The VFD System shall have an optional feature to run the motor under bypass arrangement for operation of Motor with VFD bypassed. During starting (under rated conditions) the motor will be switched on in VFD Mode to limit the starting current and after gaining speed, the load would be switched over to bypass mode.	
7.02.00	Comprehensive motor protection scheme for protection and control for operation VFD during bypass mode shall be finalized during detailed engineering.	
8.00.00	STANDBY VFD ARRANGEMENT (OPTIONAL, IF SPECIFIED)	
8.01.00	A Common standby arrangement with auto/manual switchover shall be provided in case of failure of any VFD in a group of drives. Complete protection, interlocks & control required shall be provided in the changeover module.	
9.00.00	EFFICIENCY	
9.01.00	Efficiency (Drive only) shall be minimum 98% for both MV VFD and LV VFD. Overall efficiency shall be minimum 96.5% for both MV and LV VFD at rated load and speed. Overall Efficiency evaluation shall include input transformer, harmonic filters and power factor correction (if applicable), VFD converters, cooling fans and output filter, as applicable in the system. Auxiliary controls, such as internal VFD control boards, cooling fans/pumps.	
9.02.00	In absence of valid test report, a factory test shall be performed at the VFD manufacturer's facility verifying the efficiencies. Manufactures who are supplying Drive and transformer from different locations, efficiency test will be conducted separately for Drive and transformer.	
10.00.00	COOLING SYSTEM	
10.01.00	The VFD shall be designed to operate indoor under temperature range of 0 deg C to 50 deg C and relative humidity of 95%.	
10.02.00	VFD manufacturer to primarily offer Air cooled Design. However in case of large ratings, liquid cooled drives may be accepted subject to employer's approval. In case of liquid cooled system, there shall be no necessity of continuous water supply system.	
10.03.00	In case of Air cooled design, the VFD Cooling system shall be such that it puts minimum heat load inside the room and preferably throw the hot air outside the room with ventilation ducts. The Cooling system shall be designed in such a way that the Air Conditioning & Ventilation Air requirements are kept to minimum. The VFD Manufacturer shall furnish the data regarding heat load, air flow requirements during the detailed engineering.	
10.04.00	Air cooled VFDs shall be provided with cooling fans mounted integral to the VFD/ enclosure. The VFD shall include air-flow pressure switches and temperature detectors to monitor	
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 B-23 VARIABLE FREQUENCY DRIVES
PAGE 4 OF 10		

CLAUSE NO.	TECHNICAL REQUIREMENTS	
	proper operation of the air cooling system. If the fan fails, the system must generate the alarm/trip for the fan failure.	
11.00.00	VFD TRANSFORMER:	
11.01.00	Type: Out door, Mineral oil filled ONAN type or Indoor natural air-cooled Dry type, Three phase unit, rectifier/converter duty type transformer.	
11.02.00	Transformer shall be suitable for operation with non-sinusoidal wave shape and DC components under normal and abnormal conditions of the system without exceeding the temperature.	
11.03.00	Suitable Design Margin as per applicable standards shall be taken for purpose of sizing of the transformer.	
11.04.00	All other components, technical parameters shall be as per applicable IEC/IS.	
12.00.00	POWER CONVERTER:	
12.01.00	The static power converter shall consist of a line side converter for operation as a rectifier and a load side power converter for operation as a fully controller inverter. Power converter shall be fast switching, most efficient and low loss type.	
12.02.00	The converter shall be co-ordinated with the transformers. The converter shall be able to withstand a three phase short circuit current until interrupted by normal breaker operation.	
12.03.00	Adequate short circuit and over voltage protection shall be provided for the converter and inverter system.	
12.04.00	All power converter devices shall include protective devices, snubber networks and dv/dt networks as required.	
12.05.00	The current rating of the converter's semi-conductor components shall not be less than 120% of the nominal current flowing through the elements at full load of the VFD through the whole speed range. If the parallel connection of semiconductor is applied, the above current rating shall not be less than 140% of the above values.	
12.06.00	All power diodes shall be of silicon type with minimum VBO rating at 2.5 times the rated operating voltage.	
12.07.00	The power converter circuit shall be designed so that motor can be powered at its full nameplate rating continuously without exceeding its rated temperature rise nor reducing its service factor due to harmonic currents generated by the inverter operation. The conversion devices and associated heat sinks shall be assembled such that individual devices can be replaced without requiring the use of any special precautions / tools.	
12.08.00	The cooling system of the electronic components, if provided, shall be monitored and necessary alarms shall be provided to prevent any consequential damage to the power control devices.	
13.00.00	OUTPUT FILTER (AS APPLICABLE):	
13.01.00	Output/ du/dt filter shall be provided, if required. It shall be an integral part of the VFD system and included within the VFD enclosure. It shall inherently protect motor from high voltage dv/dt stress.	
14.00.00	DC LINK CAPACITOR (AS APPLICABLE):	
14.01.00	Capacitor shall be of self-healing film or electrolytic type having high life time. The capacitor shall be an integral part of VFD system. DC link Capacitors shall have discharge resistors	
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 B-23 VARIABLE FREQUENCY DRIVES PAGE 5 OF 10

CLAUSE NO.	TECHNICAL REQUIREMENTS	
15.00.00	which shall be capable of reducing the residual charges to zero just after the capacitor is disconnected from the supply source. The capacitor shall be suitable for high ripple currents. ENCLOSURE	
15.01.00	Enclosure frames and load bearing members shall be fabricated using suitable mild steel structural sections or pressed and shaped cold-rolled sheet steel of thickness 2.0 mm. Frames shall be enclosed in cold-rolled sheet steel of thickness 1.6 mm. Doors and covers shall also be of cold rolled sheet steel of thickness 1.6 mm. Stiffeners shall be provided wherever necessary. The gland plate thickness shall be 3.0 mm for hot / cold-rolled sheet steel and 4.0 mm for non-magnetic material.	
15.02.00	The cable entry shall be from the bottom of the panel and a removable bolted un-drilled gland plate.	
15.03.00	All Panels shall be of dust-proof and vermin-proof construction and shall be provided with a degree of protection of IP: 4X as per IS/IEC 60947.	
15.04.00	Enclosures must be designed to avoid harmonic and inductive heating effects and to shield any outside equipment from interference, enclosing and shielding the complete to eliminate any radio frequency interference. The construction of the panel shall provide effective protection against electromagnetic emissions.	
15.05.00	Each panel shall be provided with illuminating lamp, space heater with switch fuse and variable setting thermostat.	
16.00.00	PAINTING Paint shade shall be as follows a) VFD transformer : RAL 9002 (Grey), legend in black letter b) Motors : RAL 5012 (Blue) c) VFD Panels : Front and rear panels in Grey (RAL9002). End panel sides in blue (RAL 5012) d) VFD reactor enclosure : RAL 5012 (Blue), legend in black letter	
17.00.00	BREAKER/CONTACTOR	
17.01.00	Type: Shall be SF6 or Vacuum type or air-break restrike free, stored energy operated and with electrical anti-pumping features.	
17.02.00	These shall be electrically operated, mechanically latched type & shall have protection against over load, all AC/DC transients and voltage surges etc. Electronic control module shall be electrically isolated.	
17.03.00	All other components, technical parameters shall be as per applicable IEC/IS.	
18.00.00	MOTORS	
18.01.00	VFD shall be used to drive three (3) phase squirrel cage inverter duty Induction motor with VPI insulation (Resin poor) suitable for VFD application. These motors shall be provided with insulated bearing on at least one side.	
18.02.00	Motors shall also meet the requirements mentioned in subsection for motors and relevant IS/IEC.	
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 B-23 VARIABLE FREQUENCY DRIVES PAGE 6 OF 10

CLAUSE NO.	TECHNICAL REQUIREMENTS	एनटीपीसी NTPC		
18.03.00	Motor shall be suitable for operation with a solid state power supply consisting of an adjustable frequency inverter for speed control & shall be suitable for the current waveforms produced by the power supply including the harmonics generated by the drive.			
18.04.00	Motor insulation shall be designed to accept the applied voltage waveform, within the Vpeak and dv/dt limits as per IEC-61800.			
18.05.00	Drive manufacturer shall coordinate with the motor manufacturer for proper selection of the motor for the given load application and the output characteristics of the drive.			
19.00.00	CABLES & CABLING			
19.01.00	All the power cable for the VFD System shall have sufficient current capacity and shall be suitably sized to meet the load demand on the motor.			
19.02.00	VFD Manufacturer shall submit cable sizing & selection criteria of drive cables including grounding/ earthing philosophy to address all the key issues such as EM Noise emissions, Common mode noise, voltage reflections, stray capacitances etc., for owner's review and approval.			
19.03.00	Cables shall be suitable for laying on racks, in ducts, trenches, conduits and underground buried installation with chances of flooding by water. The instrumentation and other control cables susceptible to interference shall be routed separately from the Power Cables.			
19.04.00	For other control/instrumentation Cables and other components, technical parameters shall be as per applicable IEC/IS/Mentioned Elsewhere in the specifications.			
20.00.00	CONTROL AND PERFORMANCE REQUIREMENTS			
20.01.00	The VFD to provide an automatic current limiting feature to control motor currents during startup and provide a "soft start" torque profile for the motor load combination. Current and torque limit adjustments shall be provided to limit the maximum VFD output current and the maximum torque produced by the motor.			
20.02.00	It shall be possible to vary the speed of the drive and control it in either Local or Remote mode. Local / Remote selection shall be done from VFD panel unless otherwise specified.			
20.03.00	Provision shall be kept for exchange of information between different VFD control system parameters thru PLC/DDCMIS.			
20.04.00	Drive shall be equipped with a front mounted operator console panel consisting of a backlit alphanumeric display and a keypad with keys for parameterization and adjusting parameter. Control panel shall be operable with password for changing the protection setting, safety interlock etc.			
20.05.00	Operator console/Main Control Card shall have facility / port to connect external hardware such as Lap-Top etc. Console shall have facility for upload and download of all parameter settings from one drive to another drive for start up and operation.			
20.06.00	User-friendly licensed software for operation and fault diagnostic shall be loaded in the drive system panel before commissioning.			
21.00.00	PROTECTION FEATURES			
21.01.00	The system offered shall incorporate adequate protection features, properly coordinated for the drive control and for motor including following:			
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 B-23 VARIABLE FREQUENCY DRIVES	PAGE 7 OF 10

CLAUSE NO.	TECHNICAL REQUIREMENTS		
	i) Converter transformer: short circuit, over current, earth fault & winding temperature high protection. ii) Incoming and outgoing line surge protection. iii) Under / over voltage protection iv) Phase loss, phase reversal, overload, negative phase sequence, locked rotor protection. v) Instantaneous Over current & Earth fault protection vi) Converter/Inverter module failure indication. vii) Over frequency/speed protection. viii) Ventilation failure indication & alarm. ix) Over temperature of VFD x) Bearing temperature protection. xi) System earth fault protection. xii) Speed reference loss protection.		
21.02.00	Under VFD Bypass Mode (if applicable) all the electrical protections related to the Motor shall remain applicable.		
22.00.00	CONTROL FEATURES		
22.01.00	Following controls shall be provided as a part of the Operator Control Panel or through separate switches on the front panel door. i) Start / stop (in local/remote mode) ii) Speed control (Raise / lower) iii) Acknowledge/Accept/ Test Push Button for annunciation iv) Auto / Manual / Test Mode select v) Emergency stop vi) Trip-Remote Breaker		
22.02.00	DIAGNOSTIC FEATURES		
22.02.01	The VFD shall include a microprocessor/PLC based digital diagnostic system which monitors its own control functions and displays faults and operating conditions.		
22.02.02	Fault diagnostic shall be built into the system to supervise the operation and failure of the system. The information regarding failure of any of the system including shut down of the system shall be available. It shall be possible to retrieve the record of events prior to tripping of the system or de-energization. Auxiliary supply to the system components or to the		
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 B-23 VARIABLE FREQUENCY DRIVES PAGE 8 OF 10

CLAUSE NO.	TECHNICAL REQUIREMENTS		
	electronics (firmware) for the diagnostics / display shall be taken care of by the manufacturer for this purpose.		
22.03.00	SERVICEABILITY / MAINTAINABILITY		
22.03.01	Front Access: VFD system should be designed for front access only. Manufacturer shall state in his proposal if rear access is provided.		
22.03.02	Power Component Accessibility: All power components in the converter sections shall be designed for rack-out accessibility for ease of maintenance and to minimize repair downtime.		
22.03.03	Marking / Labeling: Sleeve type wire marker tags or other acceptable means of permanent identification shall be applied to power and control wiring. Individual labels shall be provided for all major components of the VFD system.		
23.00.00	STORAGE AND PRESERVATION		
23.01.00	The Contractor shall be responsible for the storage and preservation of all the equipments to be supplied under the VFD System, till the time of successful installation and commissioning. The equipment should be suitable for storage for long periods before installation. Contractor should take adequate measures to ensure that no damage happens to the VFD System due to storage and preservation. Vendor shall submit powering requirement (if any) during storage.		
24.00.00	TESTS		
24.01.00	ROUTINE TESTS All acceptance and routine tests as per the specification and standard IEC -61800-2 and IEC 61800-4 shall be carried out.		
24.02.00	TYPE TESTS The Contractor shall submit for Employer'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. 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 under this contract free of cost to the Employer and submit the reports for approval.		
24.02.01	LIST OF TYPE TESTS a) VFD panels (For LV VFD) i. Rated Current/ Output ii. Temperature rise test iii. Surge withstand capability test iv. Noise level test v. Power Loss Determination Test vi. Power factor measurement.		
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 B-23 VARIABLE FREQUENCY DRIVES PAGE 9 OF 10

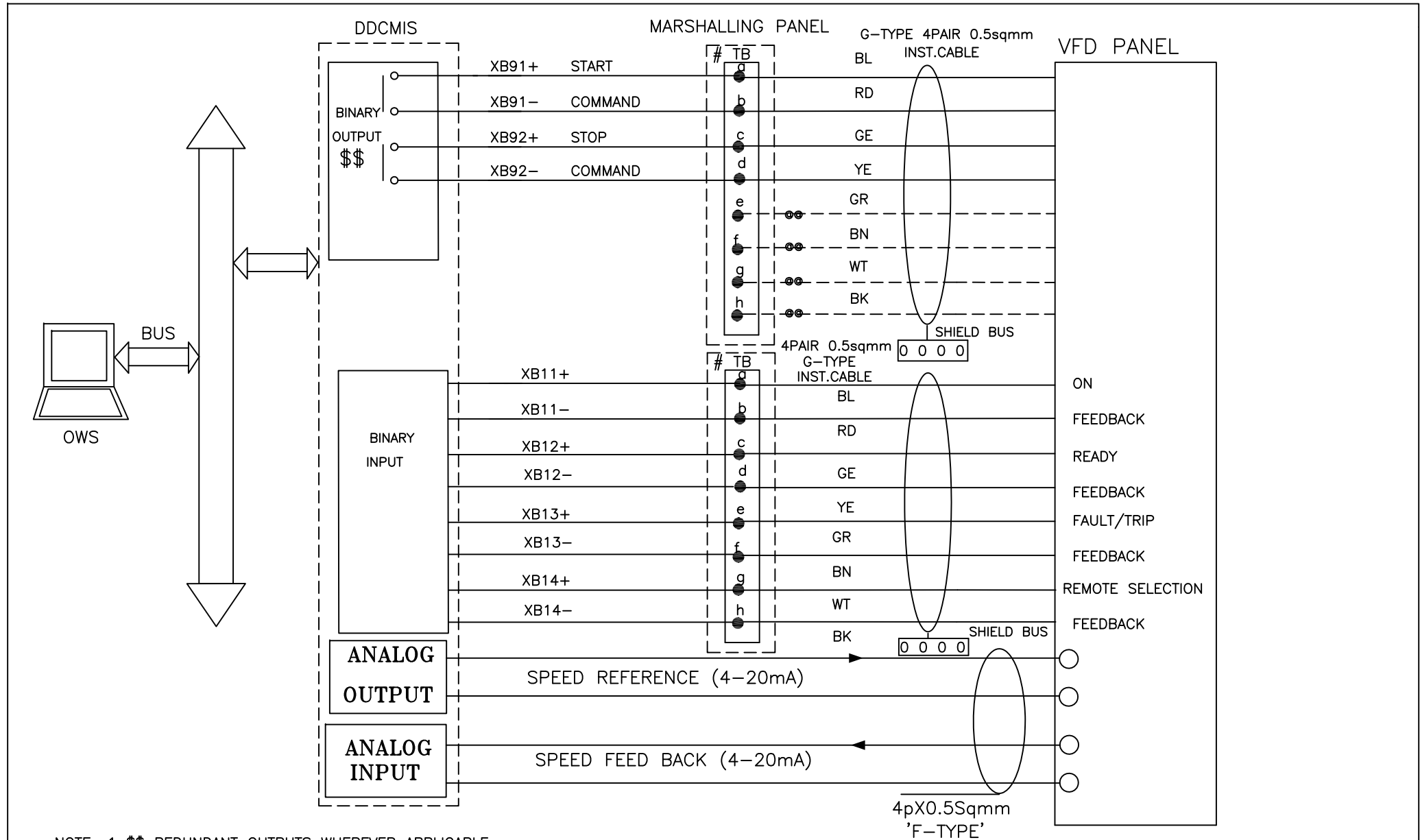


**C&I SPECIFICATION FOR
EFFLUENT TREATMENT PLANT**

SECTION: C
SUB SECTION: C&I

**SIGNL EXCHANGE BETWEEN DRIVES &
DCS**

DDCMIS INTERFACE WITH VFD PANEL



NOTE:-1 \$\$ REDUNDANT OUTPUTS WHEREVER APPLICABLE

NOTE:-2 # 8 LEVEL TERMINAL BLOCK

NOTE:-3 @@ IN EACH DDCMIS POST, UNUSED TB'S ARE USED FOR SPARE CORE TERMINATION.

NOTE:-4 OTHER VFD SIGNALS WILL BE CONSIDERED AS PER IO LIST.

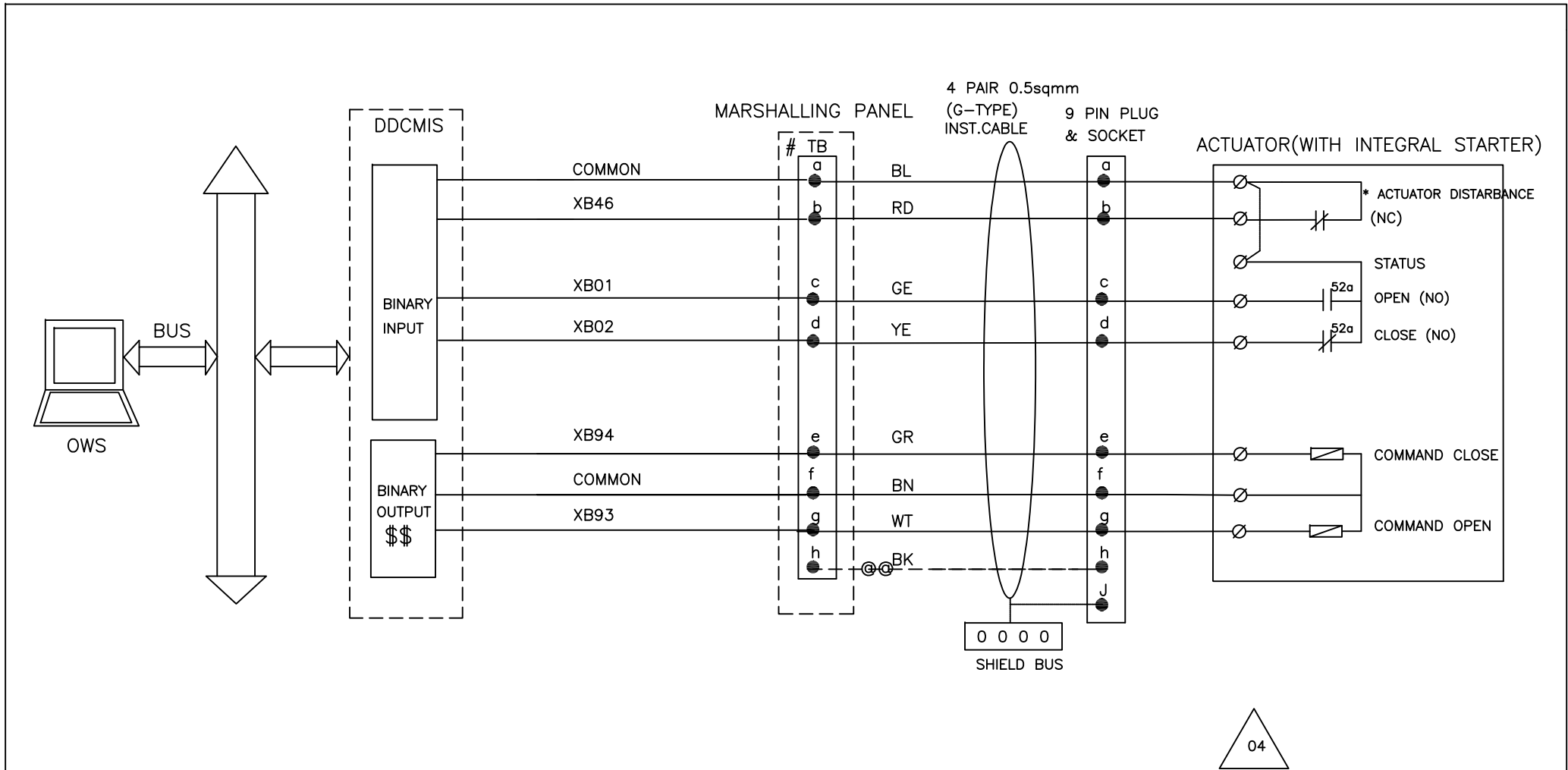
3X800 MW NTPC PATRATU STPP
PHASE-I

DDCMIS INTERFACE WITH VFD OF AC SYSTEM(VFD-AC)

DRG.NO. 9585-001-405-PVI-B-152B

SHT 13 OF 34

DDCMIS INTERFACE WITH BID/MOV/MOD



NOTE:-1 \$\$ REDUNDANT OUTPUTS WHEREVER APPLICABLE

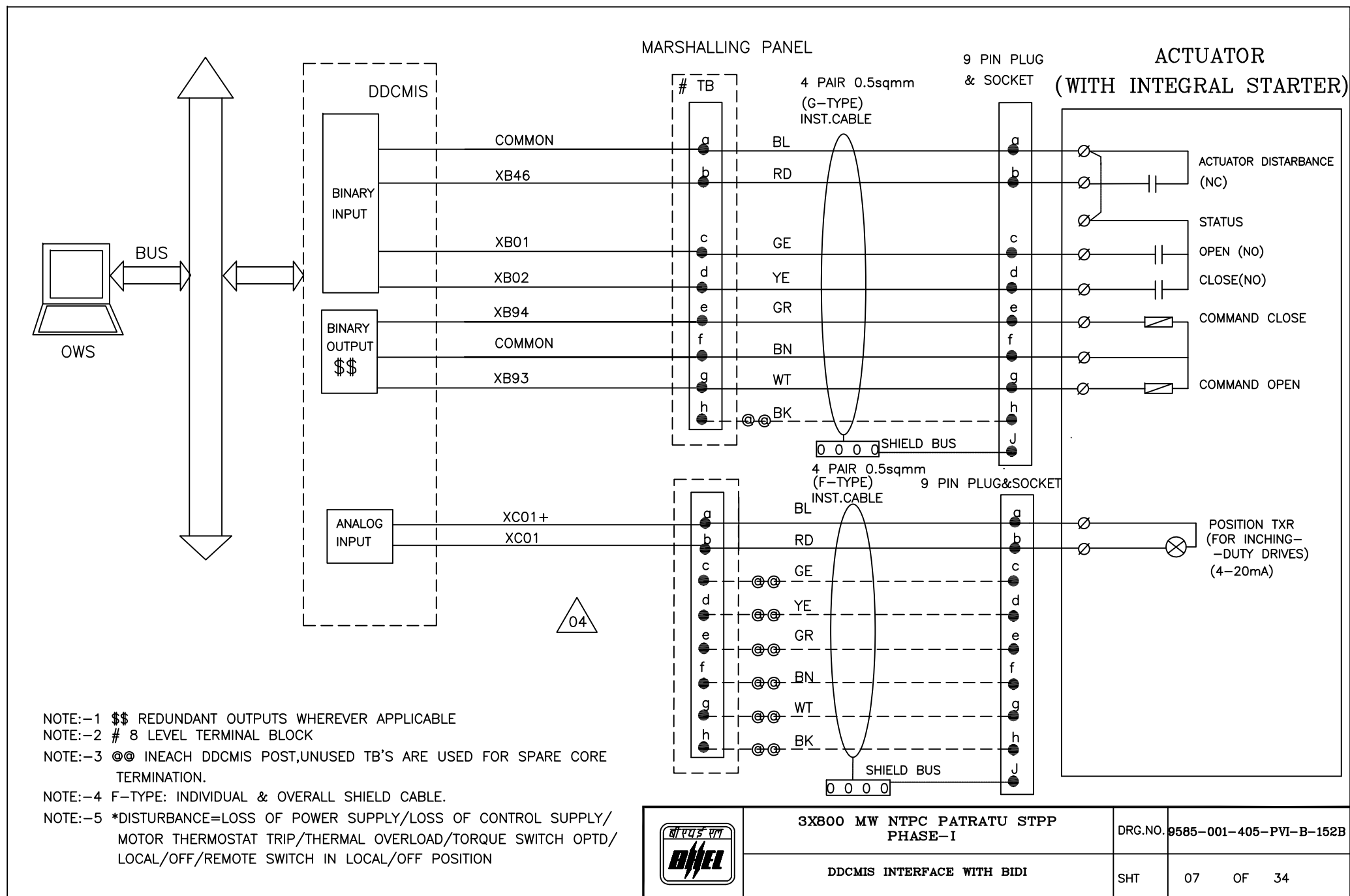
NOTE:-2 # 8 LEVEL TERMINAL BLOCK

NOTE:-3 @@ INEACH DDCMIS POST,UNUSED TB'S ARE USED FOR SPARE CORE TERMINATION.

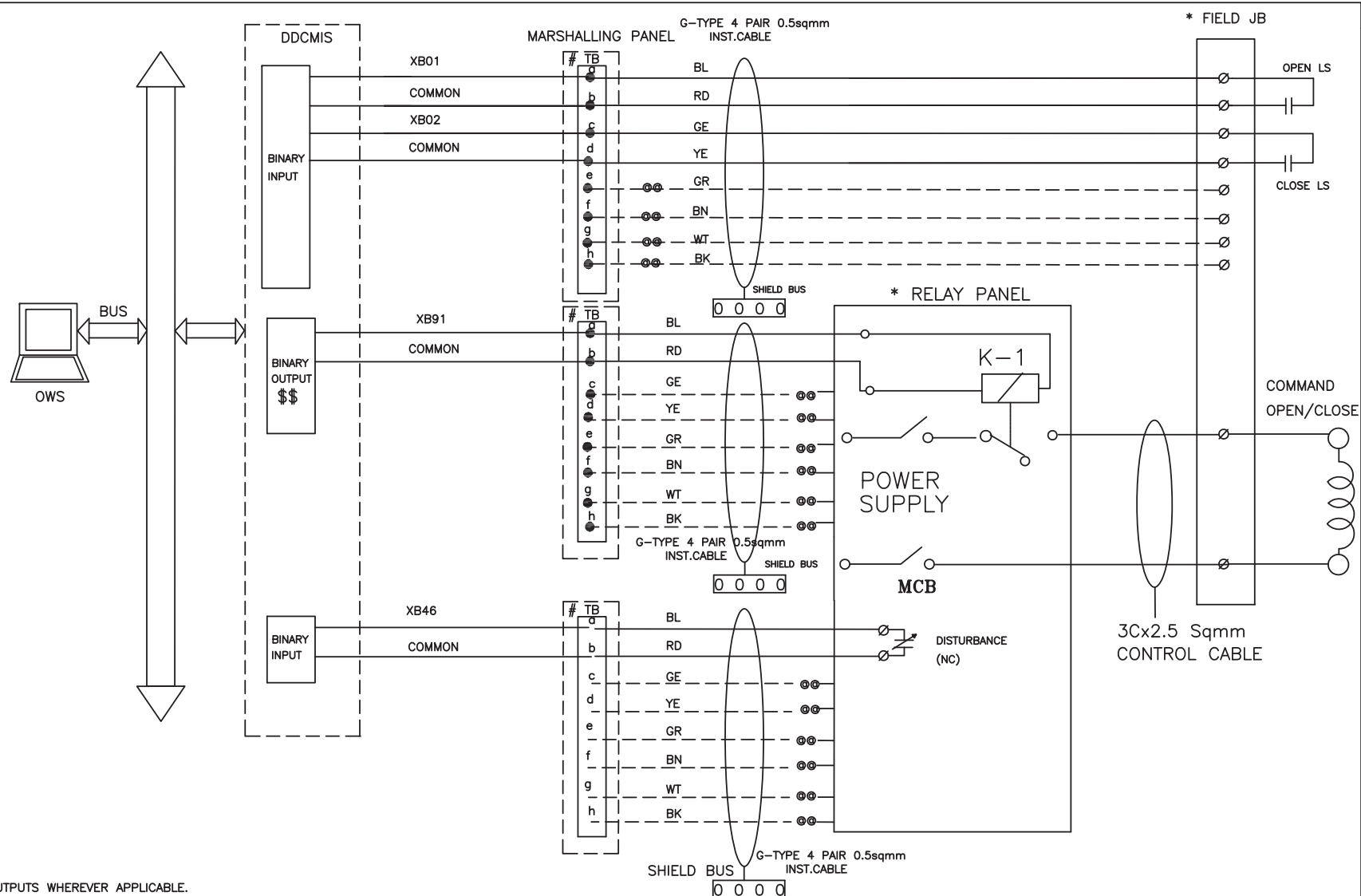
NOTE:-4 * DISTURBANCE=LOSS OF POWER SUPPLY(1PHASE/3PHASE)/LOSS OF CONTROL SUPPLY/MOTOR THERMOSTAT TRIP/THERMAL OVER LOAD/TORQUE SWITCH OPERATED, LOCAL/OFF/REMOTE SWITCH IN LOCAL/OFF POSITION

	3X800 MW NTPC PATRATU STPP PHASE-I	DRG.NO.	9585-001-405-PVI-B-152B
	DDCMIS INTERFACE WITH BID	SHT	06 OF 26

DDCMIS INTERFACE WITH BIDI/MODI/MOVI



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

3X800 MW NTPC PATRATU STPP
PHASE-I

DRG.NO.

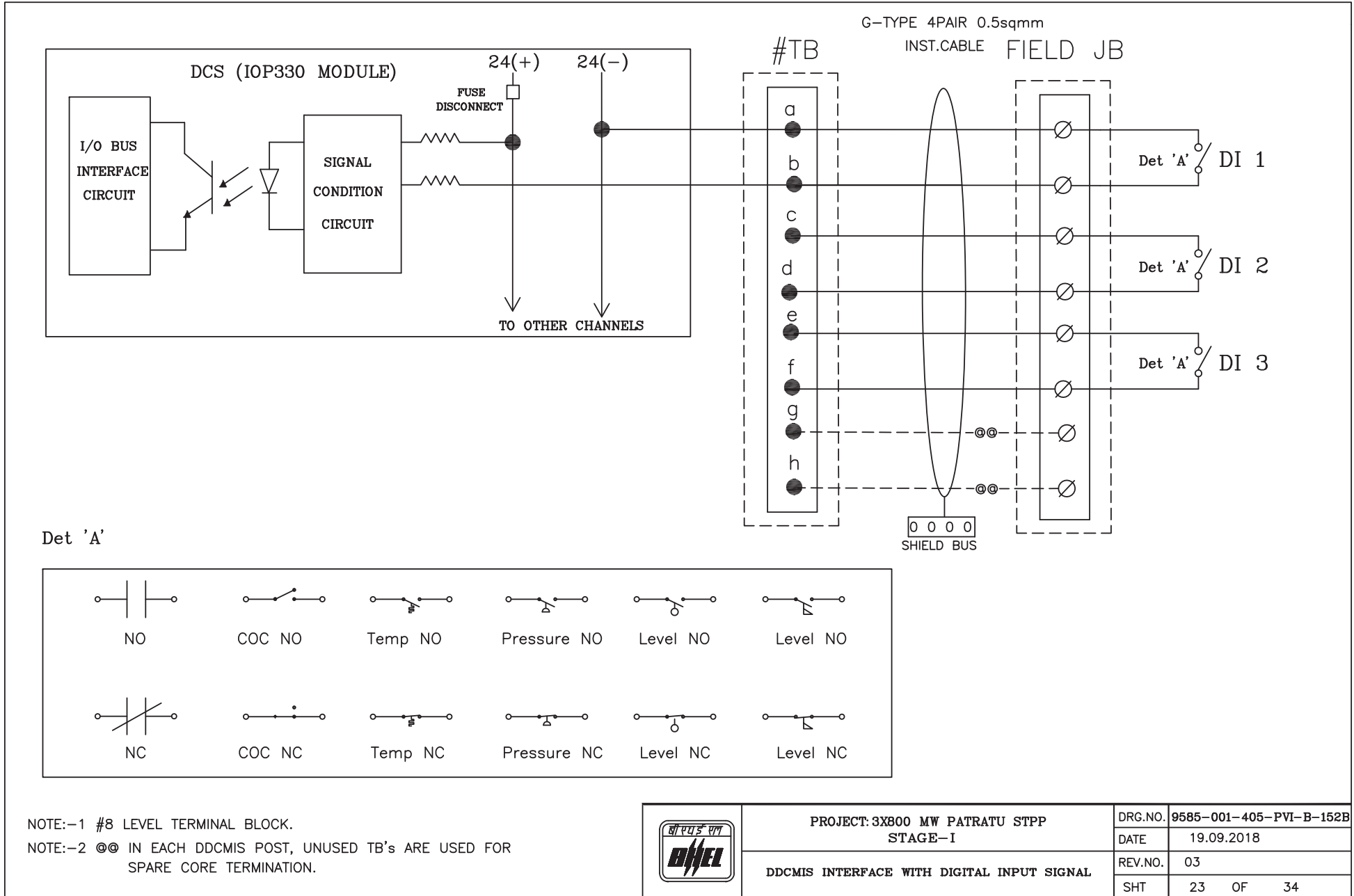
9585-001-405-PVI-B-152B

DDCMIS INTERFACE WITH SOV/O/L(WITH FEEDBACKS)

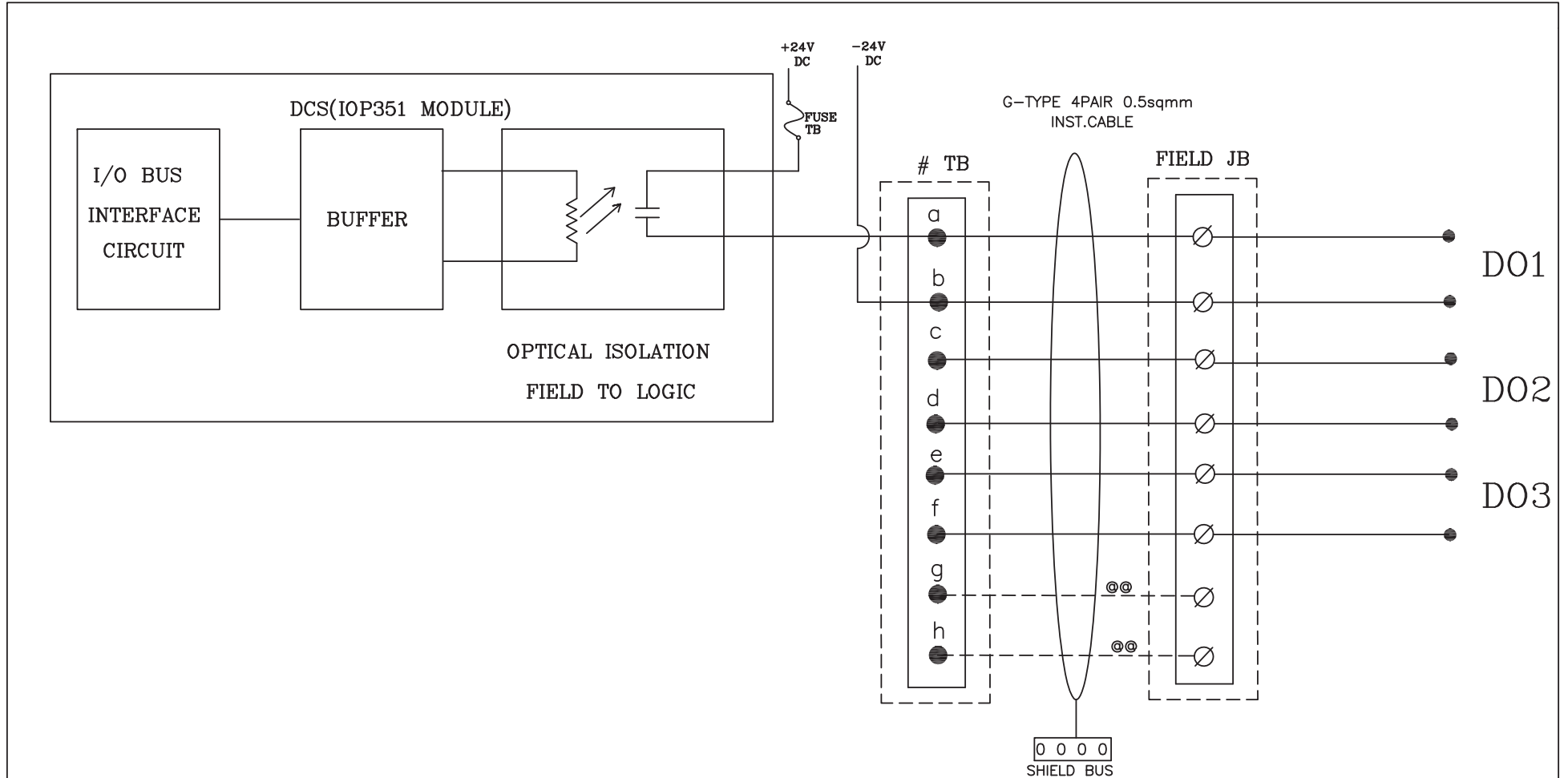
SHT

12 OF 34

DDCMIS INTERFACE WITH DIGITAL INPUT SIGNAL



DDCMIS INTERFACE WITH DIGITAL OUTPUT SIGNAL



NOTE:-1 #8 LEVEL TERMINAL BLOCK.

NOTE:-2 @ @ IN EACH DDCMIS POST, UNUSED TB's ARE USED FOR SPARE CORE TERMINATION.



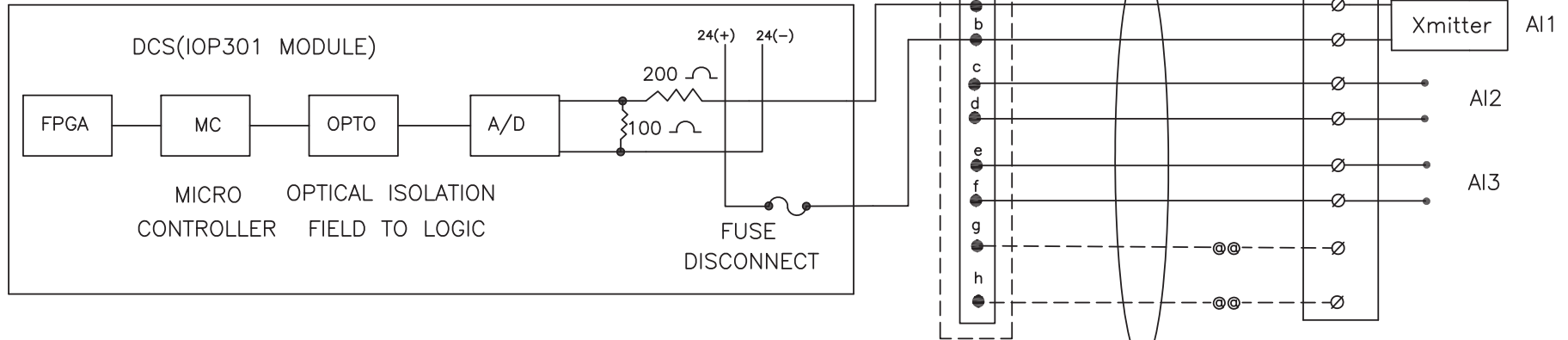
PROJECT: 3X800 MW PATRATU STPP
STAGE-I

DDCMIS INTERFACE WITH DIGITAL OUTPUT SIGNAL

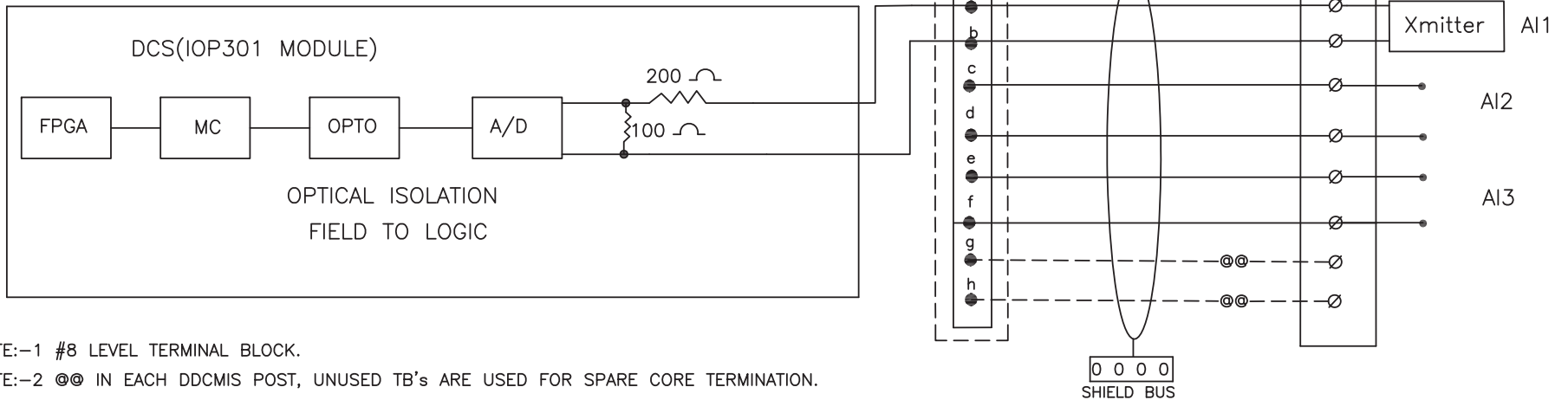
DRG.NO.	9585-001-405-PVI-B-152B
DATE	19.09.2018
REV.NO.	03
SHT	24 OF 34

DDCMIS INTERFACE WITH ANALOG INPUT SIGNAL

AI INTERFACE(4–20mA POWERED BY SYSTEM)



AI INTERFACE(4–20mA POWERED EXTERNALLY)



NOTE:-1 #8 LEVEL TERMINAL BLOCK.

NOTE:-2 @ @ IN EACH DDCMIS POST, UNUSED TB's ARE USED FOR SPARE CORE TERMINATION.

NOTE:-3 F-TYPE: INDIVIDUAL & OVERALL SHIELD CABLE.



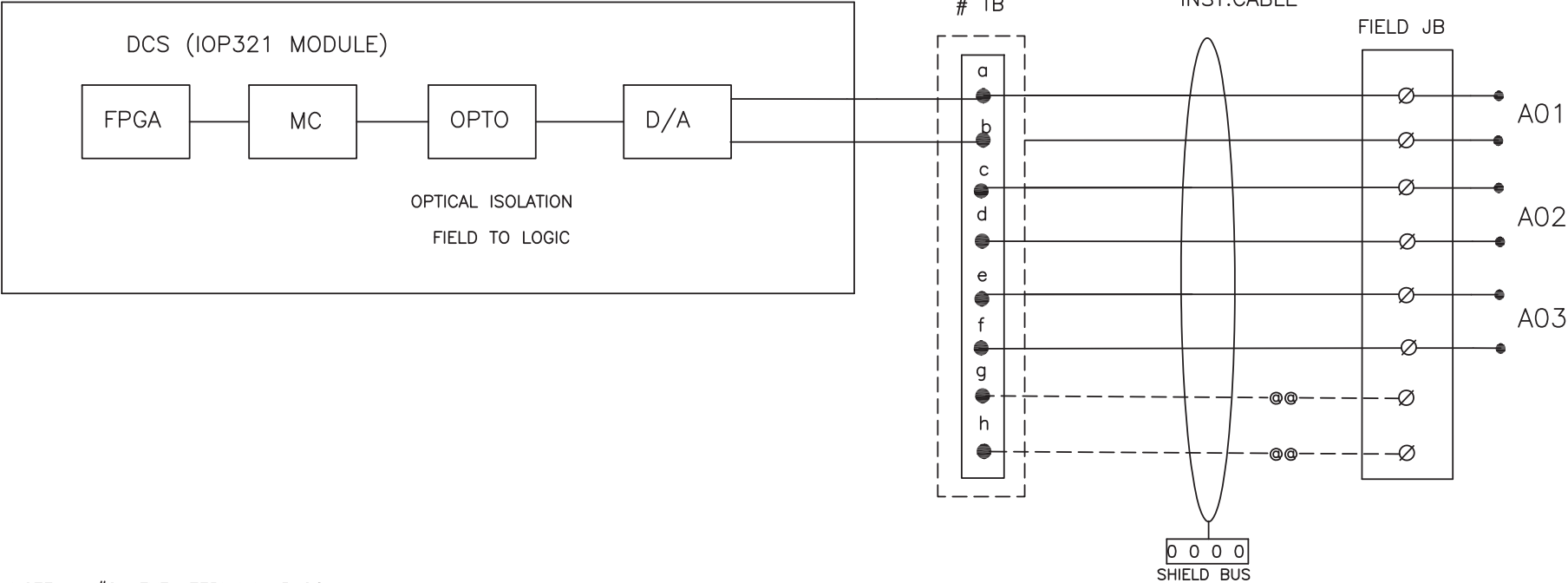
PROJECT: 2X800 MW PATRATU STTP
STAGE-I

DDCMIS INTERFACE WITH ANALOG INPUT SIGNAL

DRG.NO.	9585-001-405-PVI-B-152B
DATE	19.09.2018
REV.NO.	03
SHT	25 OF 34

DDCMIS INTERFACE WITH ANALOG OUTPUT SIGNAL

AO INTERFACE



- NOTE:-1 #8 LEVEL TERMINAL BLOCK.
 NOTE:-2 @@ IN EACH DDCMIS POST, UNUSED TB's ARE USED FOR SPARE CORE TERMINATION.
 NOTE:-3 F-TYPE: INDIVIDUAL & OVERALL SHIELD CABLE.

	PROJECT: 3X800 MW PATRATU STPP STAGE-I		DRG.NO.	9585-001-405-PVI-B-152B
	DDCMIS INTERFACE WITH ANALOG OUTPUT SIGNAL		DATE	19.09.2018
			REV.NO.	03
			SHT	26 OF 34

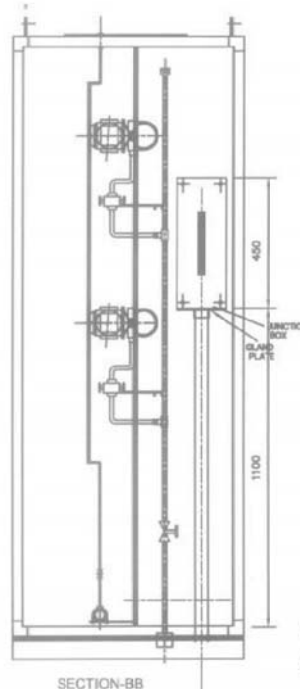
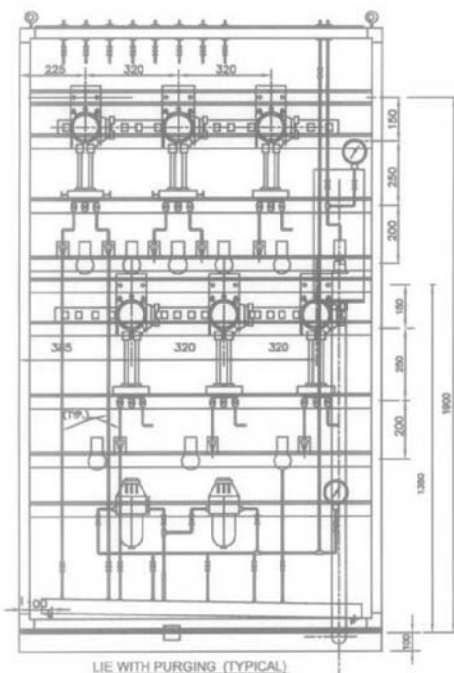
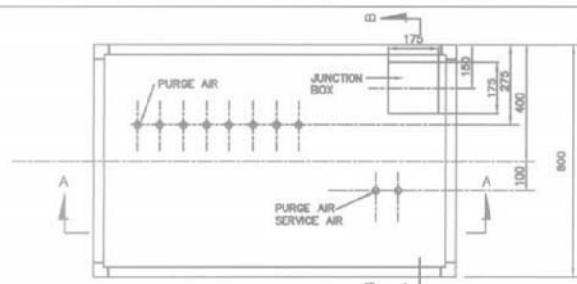


**C&I SPECIFICATION FOR
EFFLUENT TREATMENT PLANT**

SECTION: C
SUB SECTION: C&I

**DRIVE & INSTRUMENT INTERFACE
DIAGRAM**

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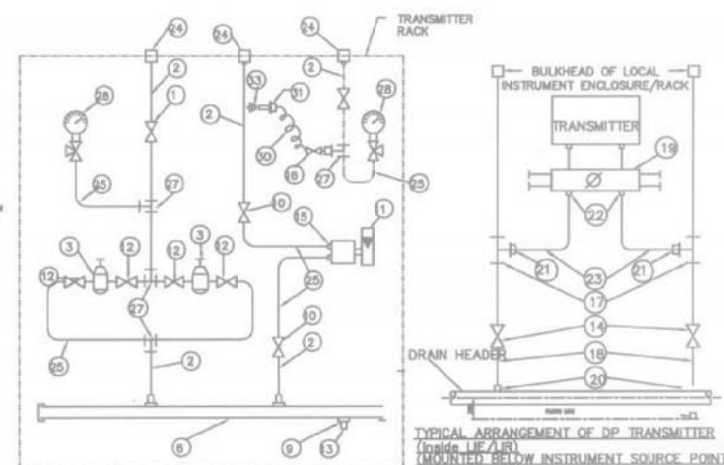


LIST OF MATERIALS

ITEM NO.	DESCRIPTION
1.	ISOLATION VALVE(gate/globe). SS.
2.	SEAMLESS SS PIPE.
3.	AIR FILTER REGULATOR.
6.	INST. AIR HEADER SS.
10.	COMP. NEEDLE VALVE SS.
11.	AIR PURGE SET.
12.	COMP VALVE SS.
13.	PLUG SS.
15.	TUBE SS CONNECTOR.
16.	TUBE COMP. EQUAL TEE UNION.
24.	BULKHEAD--SS SUITABLE FOR GI PIPE CONNECTION
25.	SEAMLESS TUBE SS.
27.	BRANCH TEE SS.
28.	PR. GAUGE.
30.	NYLON FLEX. HOSE BRAIDED WITH SS WIRE.
31.	HOSE BARBED CONN. SS.
33.	QUICK DISCONNECT SS (PURGE AIR CONNECTION TO INSTRUMENT SOURCE END).

LIST OF MATERIALS

ITEM NO.	DESCRIPTION
14.	SW GLOBE VALVE.
17.	SW EQUAL TEE
18.	S.S. NIPPLE
19.	5 VALVE MANIFOLD
20.	SW HALF COUPLER C
21.	PIPE x TUBE UNION
22.	SUITABLE ADAPTER
23.	SS TUBE



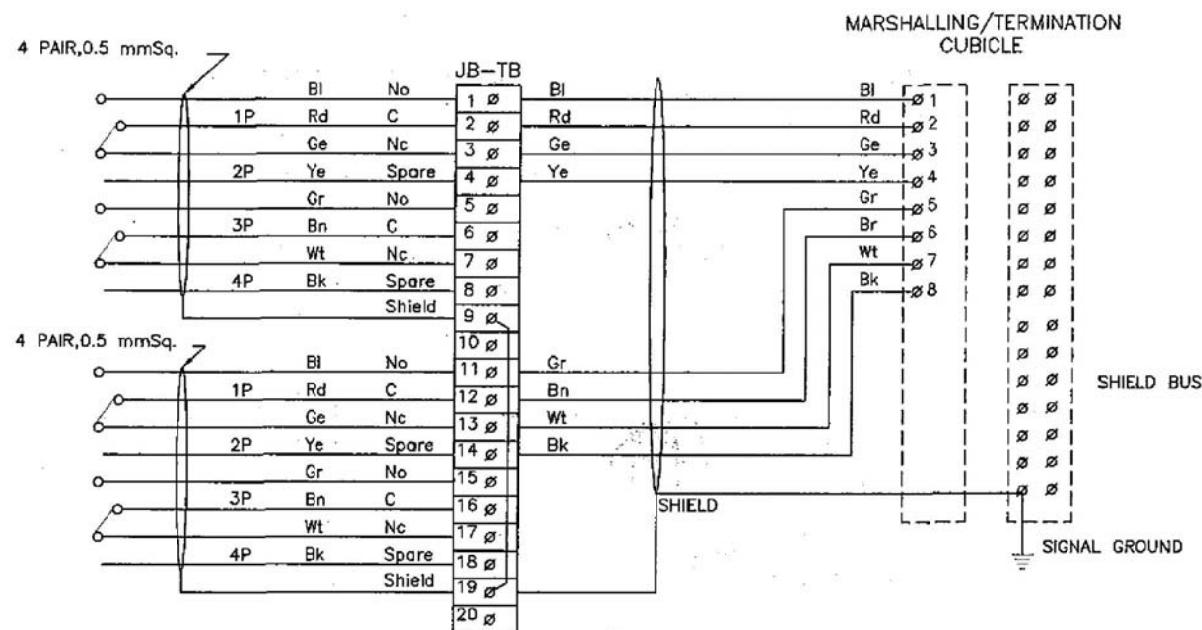
TYPICAL PURGE AIR CONNECTION INSIDE THE INST. ENCLOSURE
(APPLICABLE FOR MILL, AIR & FLUE GAS SERVICE INSTRUMENTS
REQUIRING PURGE AIR)
(Drain Header of each LIE/LIR shall be
connected to nearest plant drain)

FOR TENDER PURPOSE ONLY

												PROJECT		TYPICAL THERMAL POWER PROJECT (TURNKEY EPC PACKAGE)	
												TITLE		TYPICAL GA OF LOCAL INSTRUMENT ENCLOSURE, PURGING SCHEME, DP TRANSMITTER	
A	FIRST ISSUE										02.02.11				
REVNO	DESCRIPTION		DRAWN	DESIGN	CHD.	M	E	C	GM	APPC	DATE	SIZE	SCALE	DRG. NO.	REV. NO.
						CLEARED BY					A3	N.T.S.	0000-999-POI-A-036		A



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NTPC

एन टी पी सी लिमिटेड
NTPC LIMITED
(A GOVERNMENT OF INDIA ENTERPRISE)
ENGINEERING DIVISION

PROJECT

TYPICAL THERMAL POWER PROJECT

TITLE

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

A FIRST ISSUE

REV. NO.

DESCRIPTION

DRAWN DESIGN CHKD.

M

E

C

C&I

ARCH.

APPD

DATE

29.04.08

SIZE

A3

SCALE

NTS

DRG. NO.

0000-999-POI-A-065

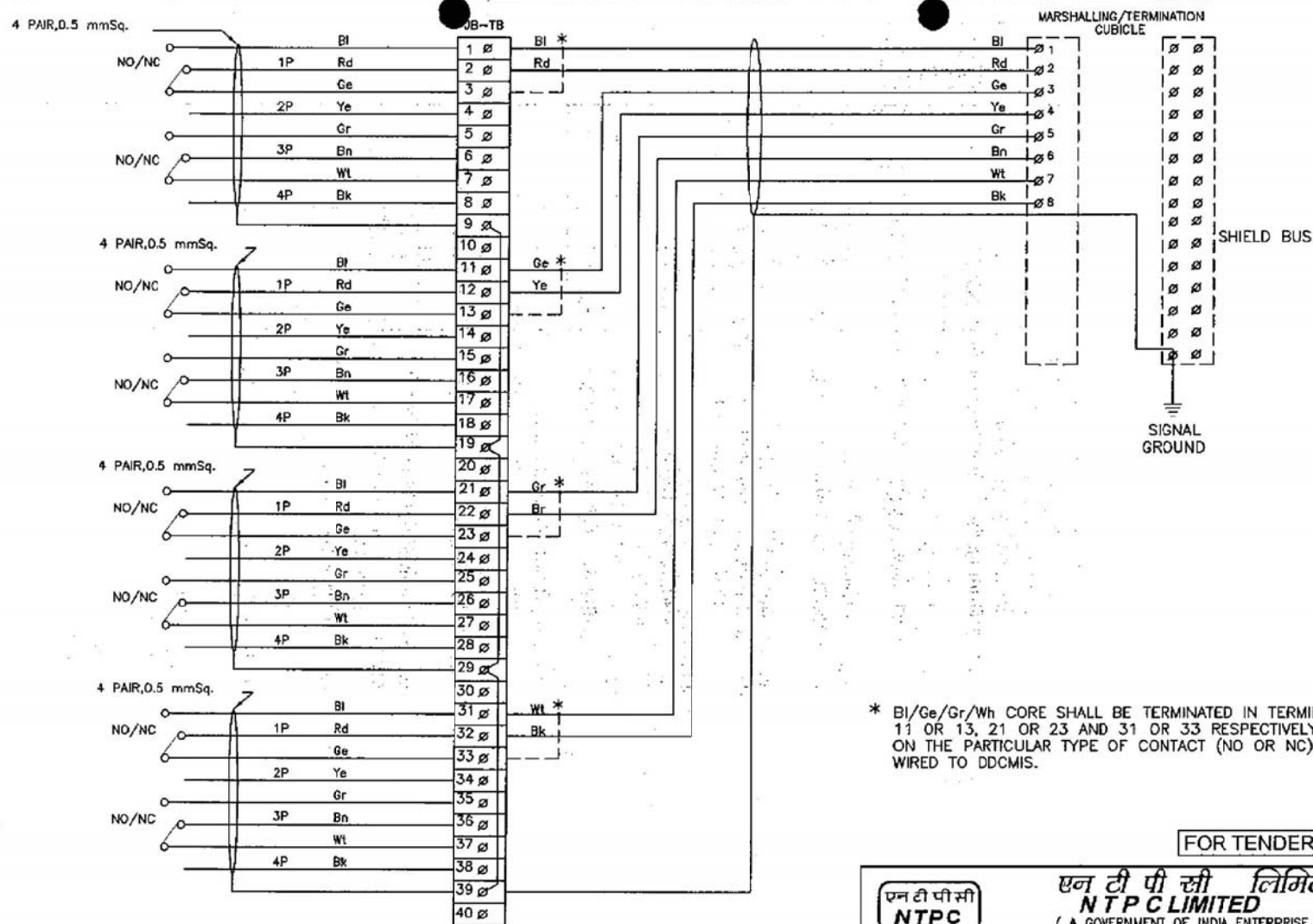
REV. NO.

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SH 01 OF 14

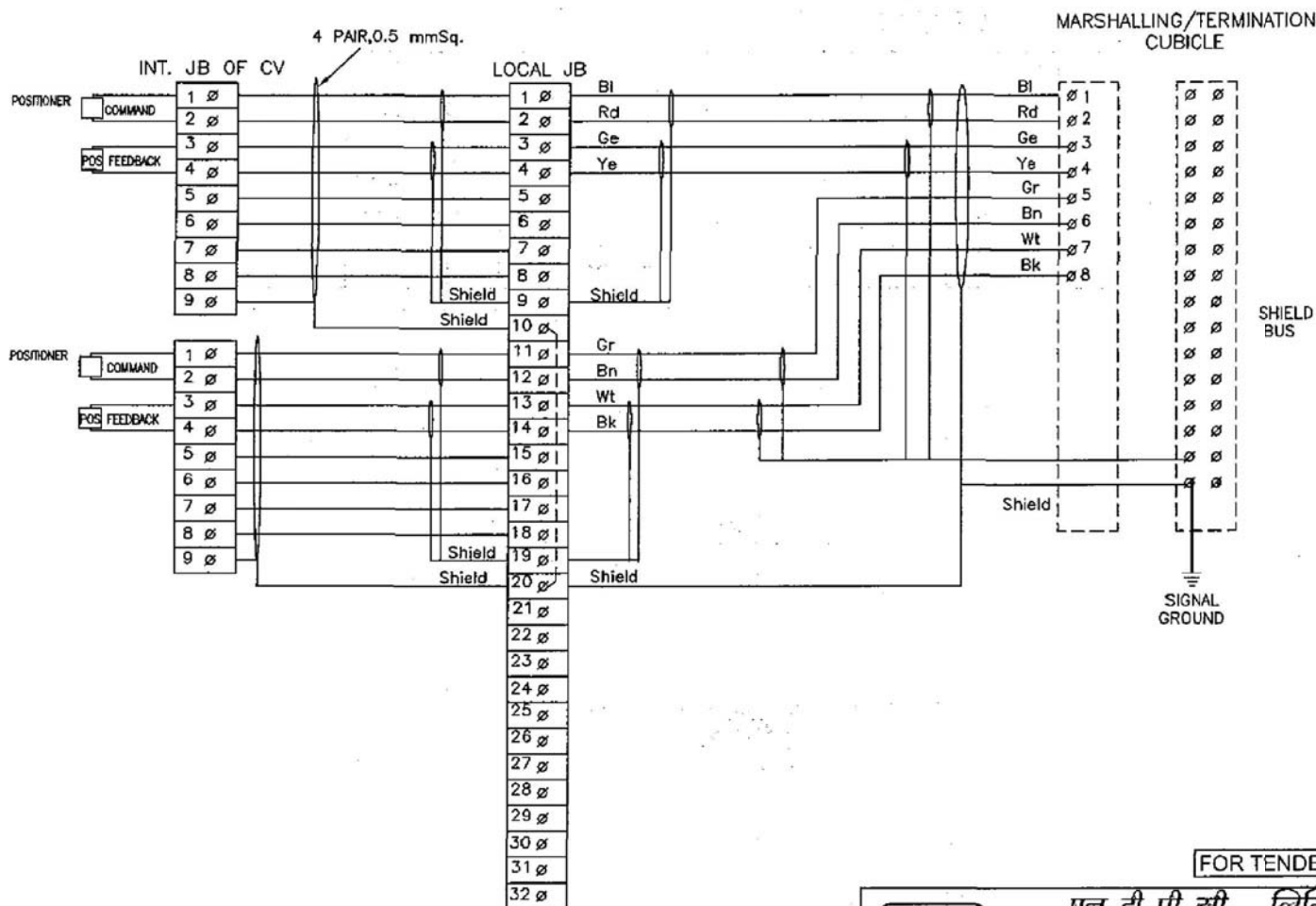
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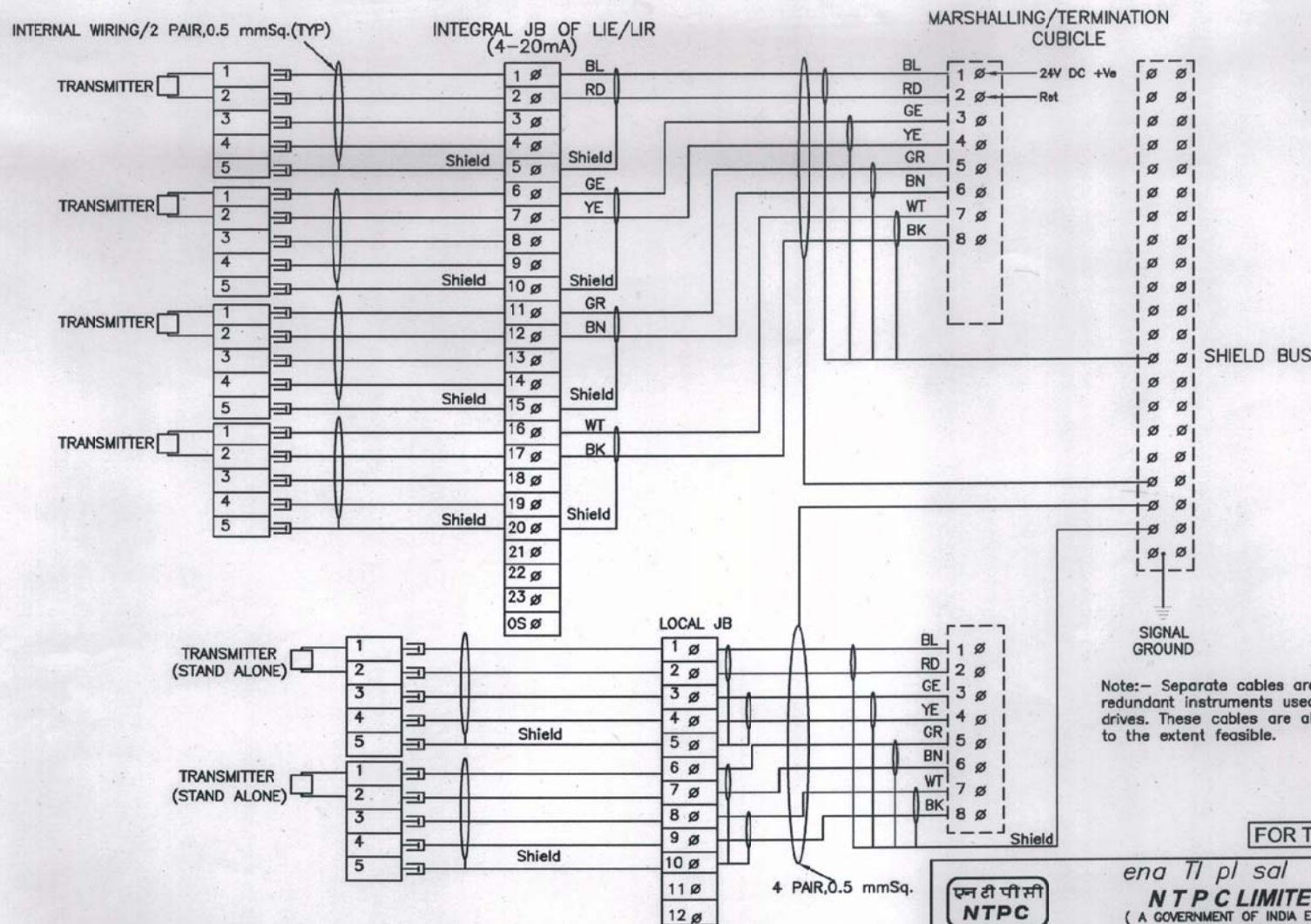
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PROJECT		TYPICAL THERMAL POWER PROJECT	
TITLE		INTERFACING OF FIELD INSTRUMENTS SWITCH TERMINATION DETAILS NO/NC	
REV. NO.	DESCRIPTION	SIZE	SCALE
A	FIRST ISSUE	A3	NTS
DRAWN		DRG. NO.	
DESIGN		0000-999-POI-A-065	
CHKD.		REV. NO.	
M		A	
E			
C			
C&I			
ARCH.			
APPD			
DATE		29.04.08	
CLEARED BY.		SH 02 OF 14	



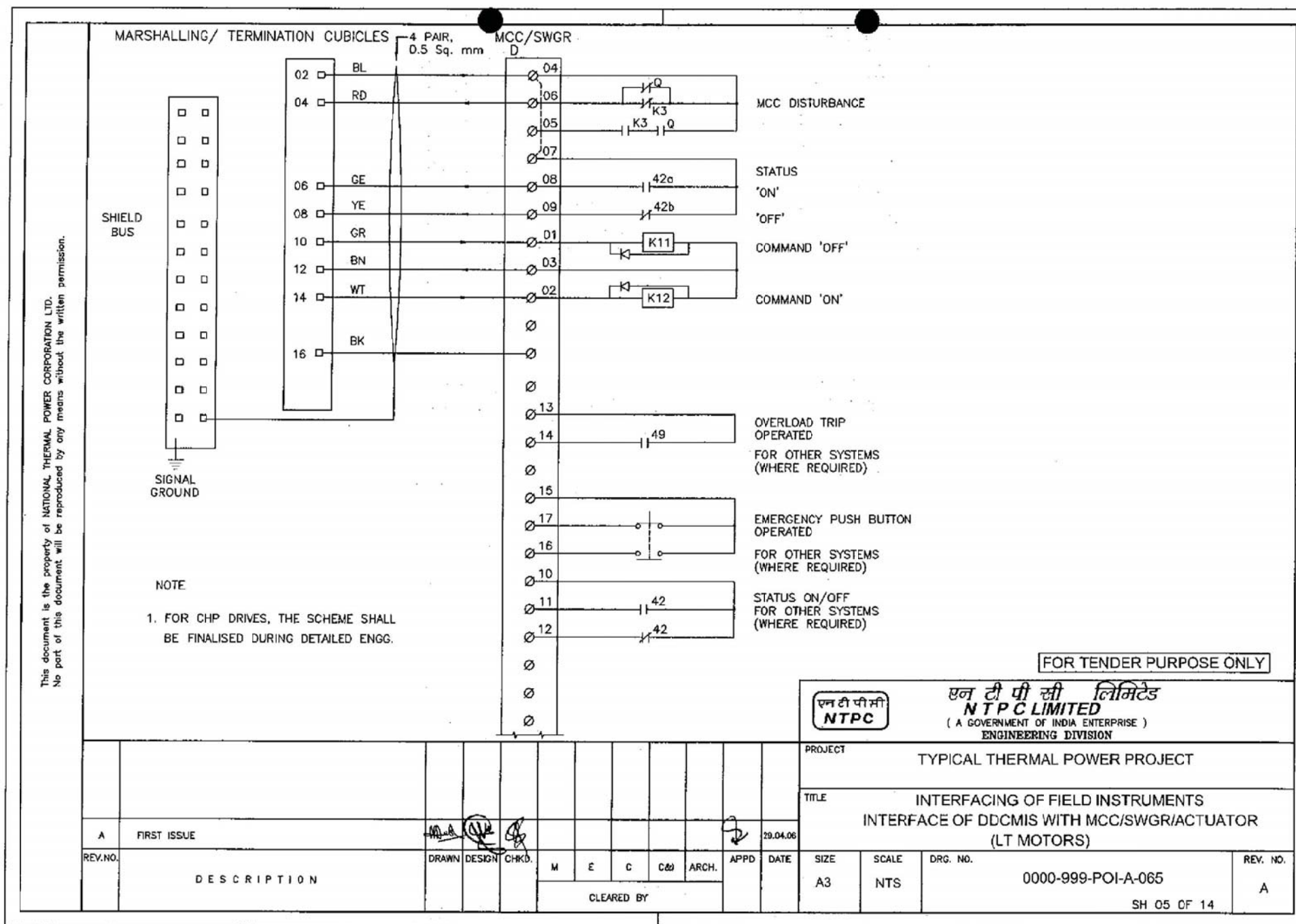
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PROJECT													TYPICAL THERMAL POWER PROJECT												
TITLE													INTERFACING OF FIELD INSTRUMENTS CONTROL VALVE												
A FIRST ISSUE													29.04.06												
REV.NO.													DESCRIPTION												
DRAWN													DESIGN												
CHKD.													M E C C&I ARCH. APPD. DATE												
Cleared By													Size A3 Scale NTS DRG. NO. 0000-999-POI-A-065 REV. NO. A												
SH 03 OF 14																									

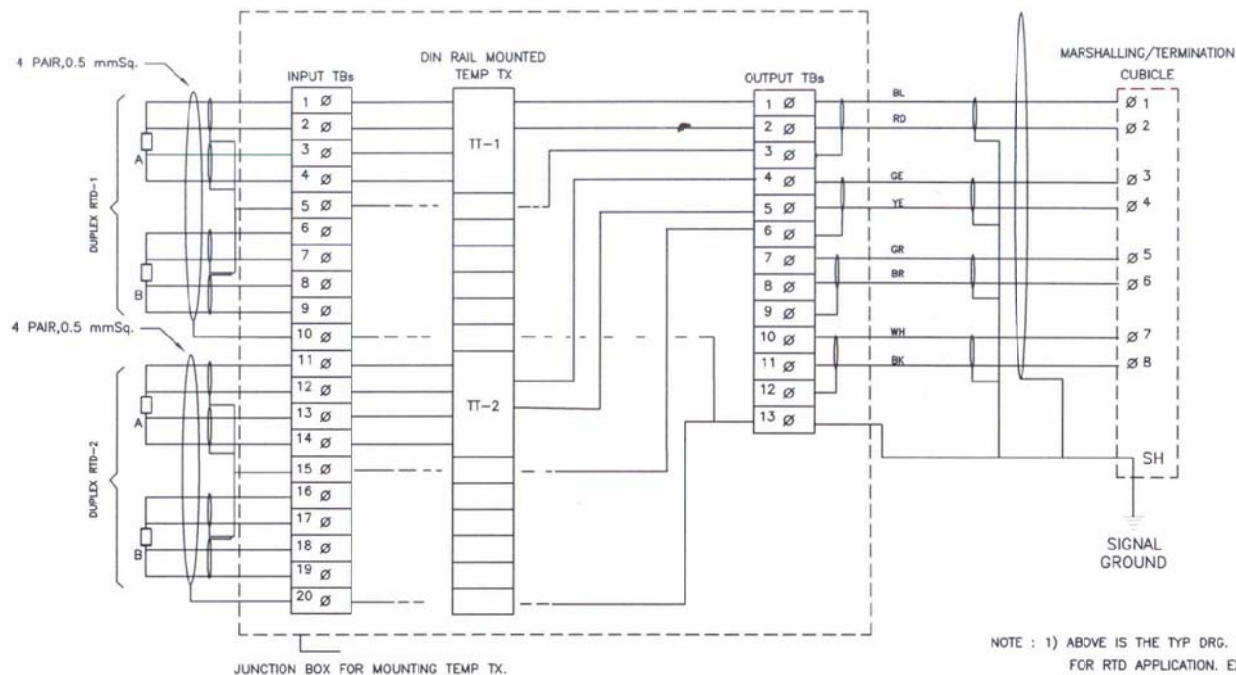
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C	NOTE REGARDING CABLE IS ADDED.										10.12.13	PROJECT	TYPICAL THERMAL POWER PROJECT			REV. NO.
B	INTERNAL WIRING FOR LIE/LIR MOUNTED SHOWN WIRING OF STAND ALONE TXTR SHOWN										10.12.06	TITLE	INTERFACING OF FIELD INSTRUMENTS 4-20mA			
A	FIRST ISSUE										12.1.05					
REV.NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	E	C	C&I	ARCH.	APPD	DATE	SIZE	SCALE	DRG. NO.	REV. NO.	
												A3	NTS	0000-999-POI-A-065	c	
CLEARED BY															SH 04 OF 14	



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- 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



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ENGINEERING DIVISION

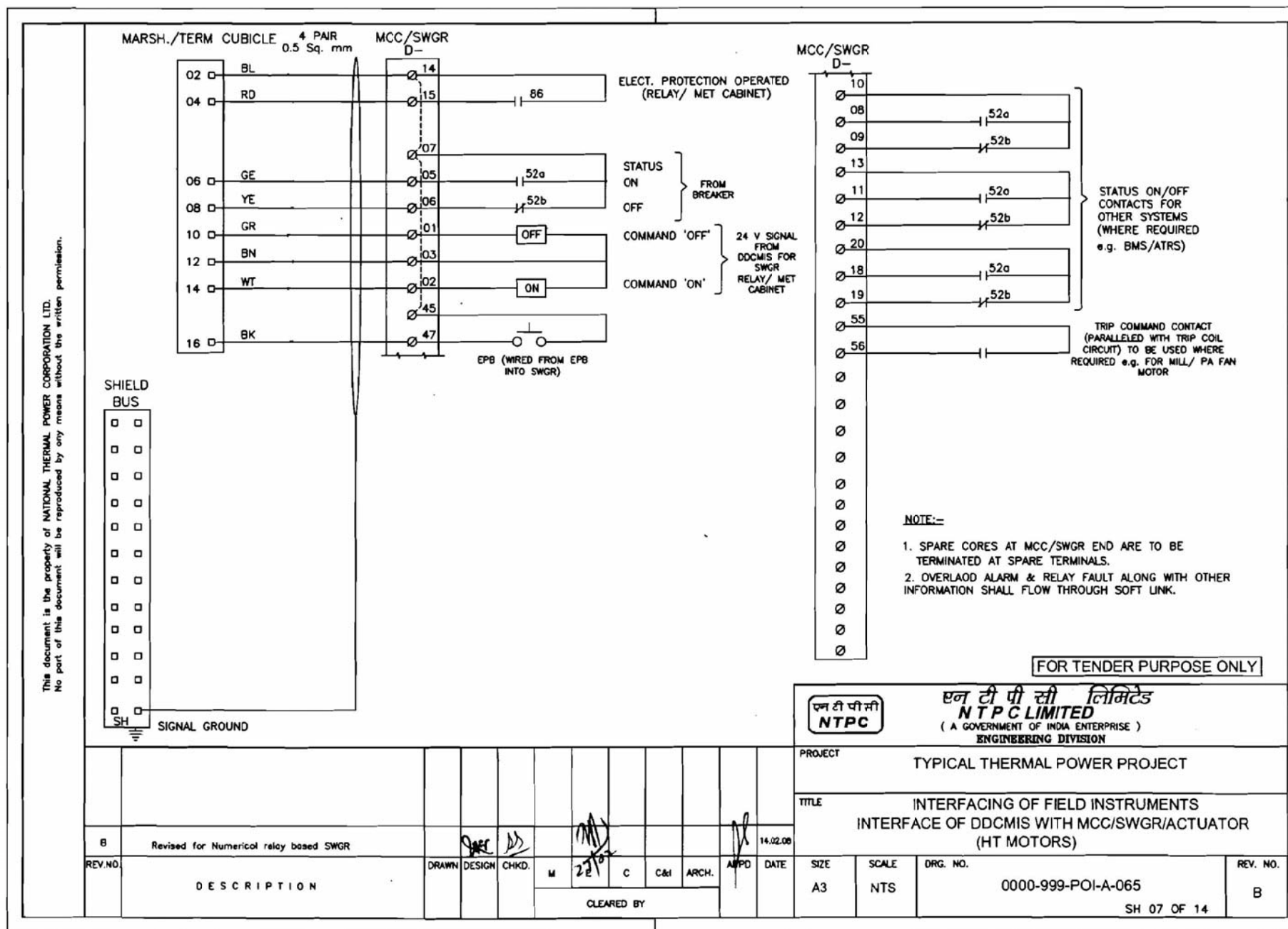
PROJECT TYPICAL THERMAL POWER PROJECT

TITLE INTERFACING OF FIELD INSTRUMENTS
TYPICAL RTD CONNECTION WITH TEMP TRANSMITTERS INJBs

A	FIRST ISSUE	DRAWN	DESIGN	CHKD.	M	E	C	C&I	ARCH.	APPD	DATE	29.04.06
REV.NO.	DESCRIPTION											

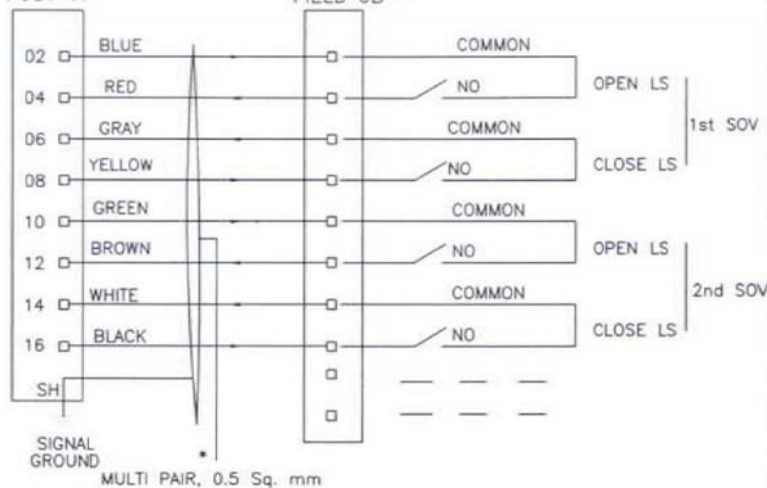
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SIZE A3	SCALE NTS	DRG. NO. 0000-999-POI-A-065	REV. NO. C
SH 06 OF 14			



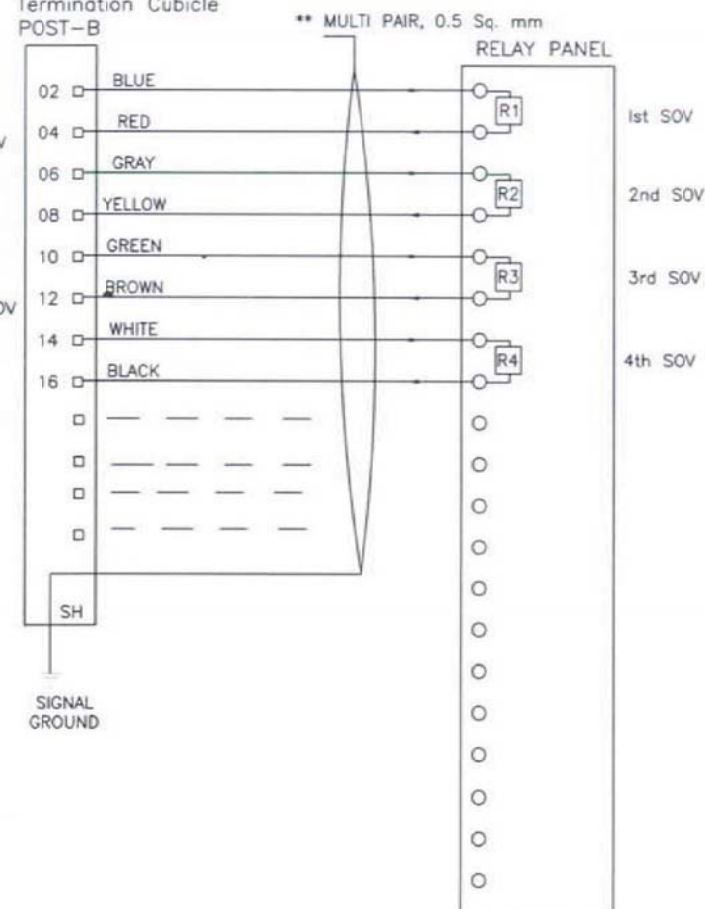
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Marshalling/ Termination Cubicle
POST-A FIELD JB *



- 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.

Marshalling/ Termination Cubicle
POST-B



एन टी पी सी
NTPC नैशनल थर्मल पावर कारपोरेशन लिमिटेड
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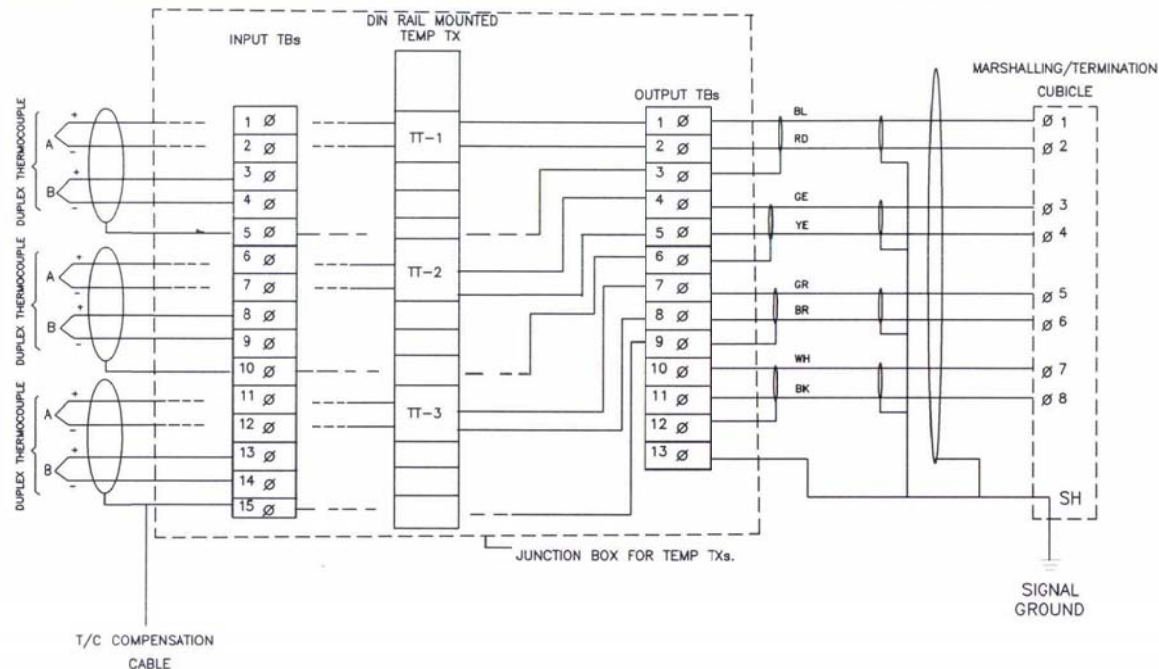
PROJECT TYPICAL THERMAL POWER PROJECT

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

REV. NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	E	C	C&I	ARCH.	APPD	DATE	SIZE	SCALE	DRG. NO.	REV. NO.
B	FIRST ISSUE										30.10.02	A3	NTS	0000-999-POI-A-065	C
Cleared By															

SH 08 OF 14

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- 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.

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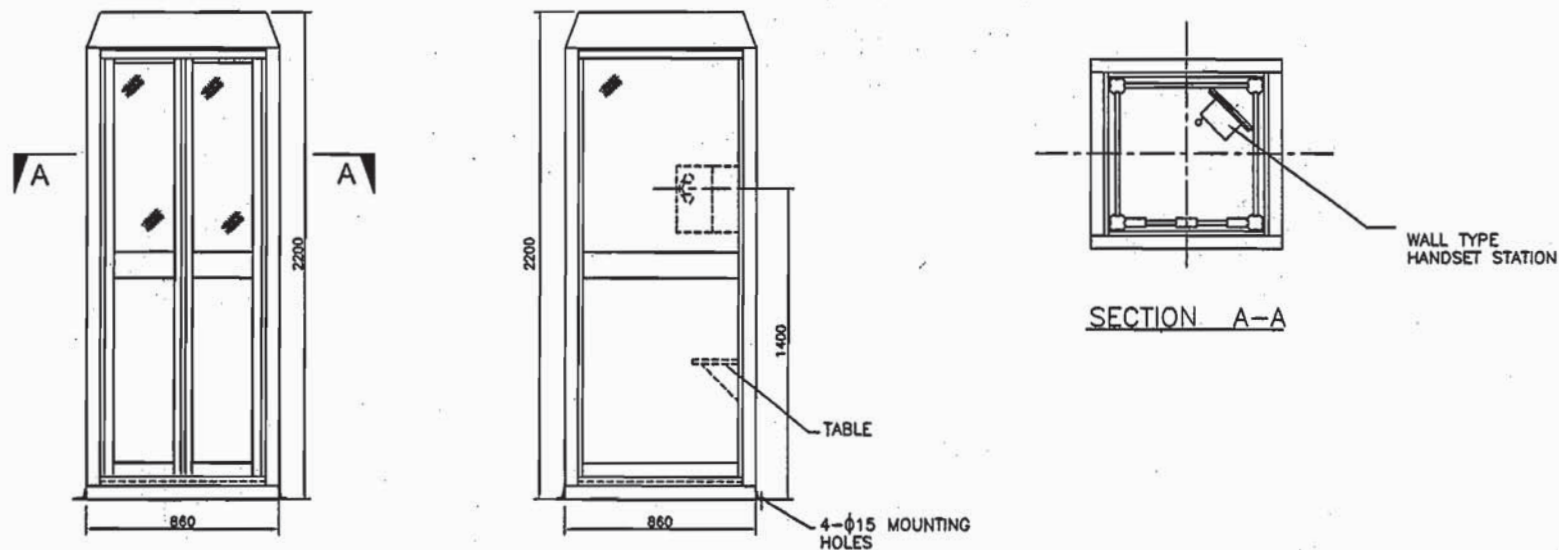
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ENGINEERING DIVISION

PROJECT TYPICAL THERMAL POWER PROJECT

TITLE INTERFACING OF FIELD INSTRUMENTS
TYPICAL T/C CONNECTION WITH TEMP TXs IN JBs

REV.NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	E	C	C&I	ARCH.	APPD	DATE	SIZE	SCALE	DRG. NO.	REV. NO.
												A3	NTS		
A	FIRST ISSUE										29.04.06			0000-999-POI-A-065	C
CLEARED BY												SH 11 OF 14			

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NOTES

1. LOCATIONS SHALL BE FINALISED DURING DETAILED ENGINEERING.

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PROJECT		TYPICAL THERMAL POWER PROJECT	
TITLE		ACOUSTIC HOOD OUT LINE	
REV. NO.	DESCRIPTION	DRWN	DESIGN
A	FIRST ISSUE	CHKD.	
		M	E
		C	C&I
		ARCH.	APPD
		DATE	29.04.06
SIZE	SCALE	DRG. NO.	REV. NO.
A3	N.T.S.	0000-999-POI-A-070	A



**C&I SPECIFICATION FOR
EFFLUENT TREATMENT PLANT**

SECTION: C
SUB SECTION: C&I

**INSTRUMENTATION CABLE
INTERCONNECTION AND TERMINATION
PHILOSOPHY**

|

CLAUSE NO.	TECHNICAL REQUIREMENTS				एनटीपीसी NTPC																																																
3.07.00																																																					
4.00.00																																																					
5.00.00																																																					
INSTRUMENTATION CABLE INTERCONNECTION AND TERMINATION PHILOSOPHY																																																					
The cable interconnection philosophy to be adopted shall be such that extensive grouping of signals by large scale use of field mounted Group Junction Boxes (JBs) at strategic locations (where large concentration of signals are available, e.g. valves limit & torque switches, switchgear) is done and consequently cable with higher number of pairs are extensively used. The details of termination to be followed are mentioned in the given Table A.																																																					
TABLE A: CABLE TERMINATION TO BE FOLLOWED																																																					
<table><tr><th colspan="2">Application</th><th colspan="2">Type Of Termination</th><th rowspan="2">Type Of Cable</th></tr><tr><th>FROM (A)</th><th>TO (B)</th><th>END A</th><th>END B</th></tr><tr><td>Valves/dampers drives (Integral Junction box)</td><td>Marshalling / Marshalling – cum Termination Cubicle / local group JB</td><td>Plug in connector</td><td>Post mount cage clamp type.</td><td>G</td></tr><tr><td>Transmitters, Process Actuated switches mounted in LIE/LIR</td><td>Integral Junction box of LIE/LIR</td><td>Plug in connector</td><td>Cage clamp (Rail mount) type.</td><td>F,G</td></tr><tr><td>RTD heads</td><td>Local junction box</td><td>Plug in connector</td><td>Cage clamp (Rail mount) type.</td><td>F</td></tr><tr><td>Thermocouple</td><td>Local junction box / CJC box (if applicable)</td><td>Plug in connector</td><td>Cage clamp (Rail mount) type.</td><td>A, B, C*</td></tr><tr><td>Other Field mounted Instrument</td><td>Local JB / Group JB</td><td>Plug in connector</td><td>Cage clamp (Rail mount) type.</td><td>F,G</td></tr><tr><td>RTD</td><td>Temperature transmitter</td><td>Plug in connector</td><td>Screwed, Cage clamp type</td><td>F</td></tr><tr><td>Thermocouple</td><td>Temperature transmitter</td><td>Plug in connector</td><td>Screwed, Cage clamp type</td><td>A, B, C*</td></tr><tr><td>Local Junction box, Temperature Transmitter, Int. Junction box of LIE/ LIR/ MCC/SWGR</td><td>Group JB</td><td>Cage clamp (Rail mount) type.</td><td>Cage clamp (Rail mount) type.</td><td>F,G</td></tr></table>					Application		Type Of Termination		Type Of Cable	FROM (A)	TO (B)	END A	END B	Valves/dampers drives (Integral Junction box)	Marshalling / Marshalling – cum Termination Cubicle / local group JB	Plug in connector	Post mount cage clamp type.	G	Transmitters, Process Actuated switches mounted in LIE/LIR	Integral Junction box of LIE/LIR	Plug in connector	Cage clamp (Rail mount) type.	F,G	RTD heads	Local junction box	Plug in connector	Cage clamp (Rail mount) type.	F	Thermocouple	Local junction box / CJC box (if applicable)	Plug in connector	Cage clamp (Rail mount) type.	A, B, C*	Other Field mounted Instrument	Local JB / Group JB	Plug in connector	Cage clamp (Rail mount) type.	F,G	RTD	Temperature transmitter	Plug in connector	Screwed, Cage clamp type	F	Thermocouple	Temperature transmitter	Plug in connector	Screwed, Cage clamp type	A, B, C*	Local Junction box, Temperature Transmitter, Int. Junction box of LIE/ LIR/ MCC/SWGR	Group JB	Cage clamp (Rail mount) type.	Cage clamp (Rail mount) type.	F,G
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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-07 INSTRUMENTATION CABLES																																																	
PAGE 7 OF 13																																																					

CLAUSE NO.	TECHNICAL REQUIREMENTS 				
	Application		Type Of Termination		Type Of Cable
	FROM (A)	TO (B)	END A	END B	
	Local Junction box, Temperature Transmitter, Int. Junction box of LIE/ LIR/ Group JB / MCC/SWGR	Marshalling / Marshalling – cum Termination Cubicle	Cage clamp (Rail mount) type.	Cage clamp (Post mounted) type.	F,G
	Marshalling cubicle/ Termination Cabinet	Electronic system cabinet	Cage clamp (Post mounted) type.	Plug-in connector / other system as per Mfr.'s Standard	Internal wiring
	Marshalling/ Termination System Cabinets	UCD mounted equipments	Cage clamp (Post mounted) type.	Plug in connector / Cage clamp type (rail mounted).	F,G (with plug-in connect or at one end)
	DDCMIS/PLC cabinets	PC, Printers etc.	Plug in connector	Plug in connector	Mfr.'s Standard
	Notes 1 Normally 10% spare cores shall be provided when the numbers of pairs of cables are more than four pairs, except for pre-fabricated cables which shall be as per manufacturer's standard. 2 For analog signals, individual pair shielding & overall shielding & for Binary signals, only overall shielding of instrumentation cables shall be provided. 3 * For high temperature applications only. 4 . For connection between field/JB and DDCMIS marshalling cabinet minimum 4 pair instrumentation cable shall be used. 5 All the spare cores of instrumentation cable have to be terminated in Marshalling cabinets/ DCS panel end. 6 For Cable type and cable termination scheme for the instruments/ equipment that are connected to Steam Turbine and Generator (STG) control system defined at Part A, sub section IIC, clause no. 2.03.01 (a) (ii) above and hydrogen generation plant auxiliaries system, Contractor's standard and proven practice is also acceptable. However, for termination of instrumentation cable at marshalling cabinets/DCS panel end, cage-clamp termination shall be offered. For power and control cable termination, Contractor's standard and proven practice would be acceptable				
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-07 INSTRUMENTATION CABLES	PAGE 8 OF 13

CLAUSE NO.	TECHNICAL REQUIREMENTS		
6.00.00	TERMINAL BLOCKS		
6.01.00	All terminal blocks shall be rail mounted/post mounted, cage clamp type with high quality non-flammable insulating material of melamine suitable for working temperature of 105 deg. C. The terminal blocks in field mounted junction boxes, temperature transmitters, instrument enclosures/racks, etc., shall be suitable for cage clamp connections. The terminal blocks in Control Equipment Room logic/termination/marshalling cubicles shall be suitable for post mounted cage clamp connection at the field input end. The exact type of terminal blocks to be provided by the Bidder and the technical details of the same including width etc. shall be subject to Employer's approval.		
6.02.00	All the terminal blocks shall be provided complete with all required accessories including assembly rail, locking pin and section, end brackets, partitions, small partitions, transparent covers, support brackets, distance sleeves, warning label, marking, etc.		
6.03.00	The marking on terminal strips shall correspond to the terminal numbering on wiring diagrams. At least 20% spare unused terminals shall be provided everywhere including local junction boxes, instrument racks/enclosures, termination/marshalling cabinets, etc. All terminal blocks shall be numbered for identification and grouped according to the function. Engraved labels shall be provided on the terminal blocks.		
6.04.00	For terminating each process actuated switches, drive actuators, control valves, Thermocouple, RTD, etc. in Local Junction Boxes, etc, refer Drg no. 0000-999-POI-A-065.		
6.05.00	The terminal blocks shall be arranged with at least 100 mm clearance between two sets of terminal blocks and between terminal blocks and junction box walls.		
7.00.00	INTERNAL PANELS/ SYSTEM CABINETS WIRING		
7.01.00	Internal panel/cabinet wiring shall be of multi-stranded copper conductor with FRLS PVC insulation without shield and outer sheath meeting the requirements of VDE 0815.		
7.02.00	All internal wires shall be provided with tag and identification nos. etched on tightly fitted ferules at both ends. All wires directly connected to trip devices shall be distinguished by one additional red colour ferrule.		
7.03.00	All external connection shall be made with one wire per termination point. Wires shall not be tapped or spliced between terminal points.		
7.04.00	All floor slots of desk/panels/cabinets used for cable entrance shall be provided with removable gasketed gland plates and sealing material. Split type grommets shall be used for prefabricated cables.		
7.05.00	All the special tools as may be required for solder less connections shall be provided by Bidder.		
7.06.00	Wire sizes to be utilised for internal wiring.		
	(i)	Current (4-20 mA), low voltage signals (48V); Ammeter/Voltmeter circuit, control switches etc. for electrical system.	0.5 Sq.mm.
	(ii)	Power supply and internal illumination.	2.5Sq.mm. minimum (shall be as per load requirement.)
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-07 INSTRUMENTATION CABLES
			PAGE 9 OF 13

CLAUSE NO.	TECHNICAL REQUIREMENTS												
8.00.00	INSTRUMENTATION CABLE INSTALLATION AND ROUTING												
8.01.00	All cables assigned to a particular duct/conduit shall be grouped and pulled in simultaneously using cable grips and suitable lubricants. Cables removed from one duct/conduit shall not be reused without approval of Employer.												
8.02.00	Cables shall be segregated as per IEEE Std.-422. In vertically stacked trays, the higher voltage cable shall be in higher position and instrumentation cable shall be in bottom tier of the tray stack. The distance between instrumentation cables and those of other system shall be as follows: <table><tr><td>From 11 kV/6.6 kV/3.3 kV tray system</td><td>-</td><td>914 mm</td></tr><tr><td>From 415V tray system</td><td>-</td><td>610 mm</td></tr><tr><td>From control cable tray system</td><td>-</td><td>305 mm</td></tr></table>				From 11 kV/6.6 kV/3.3 kV tray system	-	914 mm	From 415V tray system	-	610 mm	From control cable tray system	-	305 mm
From 11 kV/6.6 kV/3.3 kV tray system	-	914 mm											
From 415V tray system	-	610 mm											
From control cable tray system	-	305 mm											
8.03.00	Cables shall terminate in the enclosure through cable glands. All cable glands shall be properly gasketed. Sealing (to prevent ingress of dust entry and propagation of fire) shall be provided for all floor slots used for cable entrance. Compression cable glands (double for armoured and single for other cables) shall be provided.												
8.04.00	Not in use												
8.05.00	The cables emanating from redundant equipment/devices shall be routed through different paths. The above segregation of cables & wiring for redundant equipments/devices shall be in accordance with IEEE-Std-422.												
9.00.00	CABLE LAYING AND ACCESSORIES												
9.01.00	CABLE LAYING												
	1	Cables shall be laid strictly in line with cable schedule.											
	2	Identification tags for cables.											
		Indelible tags to be provided at all terminations, on both sides of wall or floor crossing, on each conduit/duct/pipe entry/exit, and at every 20 m in cable trench/tray.											
	3	Cable tray numbering and marking.											
		To be provided at every 10m and at each end of cable way & branch connection.											
	4	No jointing is permissible for Instrumentation cables. For other cables Jointing for more than 250 Meters run of cable shall be permitted.											
	5	Buried cable protection											
		With concrete slabs; Route markers at every 20 Meters along the route & at every bend.											
	6	Road Crossings											
		Cables to pass through buried high density PE pipes encased in PCC. At least 300											
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-07 INSTRUMENTATION CABLES	PAGE 10 OF 13									

CLAUSE NO.	TECHNICAL REQUIREMENTS			
	mm clearance shall be provided between - HT power & LT power cables, - LT power & LT control/instrumentation cables, Spacing between cables of same voltage grade shall be in accordance with the derating criteria adopted for cable sizing. 7 Segregation (physical isolation to prevent fire jumping) - a All cable associated with the unit shall be segregated from cables of other Units. - b Interplant cables of station auxiliaries and unit critical drives shall be segregated in such a way that not more than half of the drives are lost in case of single incident of fire. 8 Cable clamping All cables laid on trays shall be neatly dressed up & suitably clamped/tied to the tray. For cables in trefoil formation, trefoil clamps shall be provided. 9 Optical fiber cables (OFCs) : Outside Building Area - to be laid necessarily inside GI conduit with support from cable tray/Trestle structure Inside Building Area – to be laid on separate cable sub-trays While buried- in separate buried trench approx.1.0 meter depth, to be laid in 2” rodent proof HDPE conduits covered with sand, brick, laid breadth-wise and soil along the pipe line route by contractor; While crossing roads - to be laid in GI/ rodent proof HDPE conduits with sand filling at bottom and sand, soil filling at top with cement concrete; While crossing canals/river- to be laid in rodent proof HDPE conduits within hume pipe. 10 Laying of Network Cable (UTP/STP) : Out side Building Area- to be laid necessarily inside GI conduits with support from cable tray / Trestle structure. Inside Building Area- to be laid necessarily inside GI conduits on separate cable sub-trays.			
9.02.00	Bidder shall supply and install all cable accessories and fittings like Light Interface Units, Surge suppressors, Opto isolators, Interface Converters, Fibre Optic Card Cage, Fibre Optic Line Driver, Repeater / Modem (for Optical Fibre Cables), cable glands, grommets, lugs, termination kits etc. on as required basis.			
9.03.00	Cables, which terminate in cabinets of draw out sections shall have sufficient cable coiled in the bottom of the cabinet to permit full withdrawal of draw out sections without disconnecting the cables. When prefabricated cables with factory connectors on both ends are longer than required, the excess cable shall be coiled in the bottom of one or both termination cabinets.			
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-07 INSTRUMENTATION CABLES	PAGE 11 OF 13

CLAUSE NO.	TECHNICAL REQUIREMENTS			
9.04.00	The Bidder shall be responsible for proper grounding of all equipment under this package. Further, proper termination of cable shields shall be verified and the grounding of the same shall be coordinated so as to achieve grounding of all instrumentation cable shields at same potential. This shall be completed prior to system tests.			
9.05.00	The Contractor shall take full care while laying / installing cables as recommended by cable manufacturers regarding pulling tensions and cable bends. Cables damaged in any way during installation shall be replaced at the expense of the Contractor.			
10.00.00	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 7035			
11.00.00	CONDUITS			
11.01.00	Conduits shall be generally used for interconnecting cables from field instruments to Local JB's. All rigid conduits, couplings and elbows shall be hot dipped galvanised rigid mild steel in accordance with IS: 9537 Part-I (1980) and Part-II (1981). The conduit interior and exterior surfaces shall have continuous zinc coating with an overcoat of transparent enamel lacker or zinc chromate. Flexible conduit shall be heat resistant lead coated galvanized steel with , water leak, fire and rust proof protected <i>for the areas of Mills,Drum, Main Steam, RH steam Air Heaters and Furnace, BFPDT's</i> . <i>And for remaining applications, water leak, fire and rust proof flexible GI conduits shall be provided.</i> The temperature rating of flexible conduit shall be suitable for actual application.			
11.02.00	All rigid conduit fittings shall conform to the requirements of IS: 2667, 1976. Galvanized steel fitting shall be used with steel conduit. All flexible conduit fittings shall be liquid tight, galvanized steel. The end fittings shall be compatible with the flexible conduit supplied.			
11.03.00	Conduit sealing, explosion proof, dust proof and other types of special fittings shall be provided as required by these specifications and shall be consistent with the area and equipment with which they are installed. Fittings installed outdoors and in damp locations shall be sealed and gasketed. Hazardous area fittings and conduits sealing shall conform			
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-07 INSTRUMENTATION CABLES	PAGE 12 OF 13

CLAUSE NO.	TECHNICAL REQUIREMENTS	एनटीपीसी NTPC	
11.04.00	with NEC requirements for the area classification. Contractor shall provide double locknuts on all conduit terminations not provided with threaded hubs and couplings. Water tight conduit unions and rain tight conduit hubs shall be utilised for all the application which shall be exposed to weather. Moisture pockets shall be eliminated from conduits.		
11.05.00	Conduits shall be securely fastened to all boxes and cabinets.		
12.00.00	CABLE SUB-TRAY & SUPPORT		
12.01.00	The cable sub-trays and the supporting system, to be generally used between Local/Group JBs and the main cable trays and the same shall be furnished and installed by the Contractor. It is the assembly of sections and associated fittings forming a rigid structural system used to support the cable from the equipment or instrument enclosure upto the main cable trays (trunk route).		
12.02.00	The covers on the cable sub-trays shall be used for protection of cables in areas where damage may occur from falling objects, welding spark, corrosive environment, etc. & shall be electrically continuous and solidly grounded.		
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-07 INSTRUMENTATION CABLES
			PAGE 13 OF 13



**C&I SPECIFICATION FOR
EFFLUENT TREATMENT PLANT**

SECTION: C
SUB SECTION: C&I

QUALITY ASSURANCE-INSTRUMENTS



SUB-SECTION–E-61

MEASURING INSTRUMENTS
(PRIMARY & SECONDARY)

EPC PACKAGE FOR
PATRATU SUPER THERMAL POWER STATION EXPANSION
PHASE–I (3X 800MW)

TECHNICAL SPECIFICATION
SECTION-VI, PART-B
BID DOC NO.:CS-9585-001-2

1098305/2022/PS-PEM-MAX

CLAUSE NO.

QUALITY ASSURANCE



MEASURING INSTRUMENTS (PRIMARY AND SECONDARY)									
ITEMS	TESTS								
	Dimensions (R)	Make, Model, Type, Rating (R)	Process / Electrical connection (R)	Calibration (R)	Test as per standard (R)	Insulation Resistance (R)	IBR Certification (if applicable) (R)	Hydro Test (R)	Material Test certificate ®
1. PR Gauge (IS-3624)	Y	Y	Y	Y	Y				
2. Temp. Gauge (BS-5235)	Y	Y	Y	Y	Y				
3. Pr./D.P.Switch (BS-6134)	Y	Y	Y	Y	Y	Y			
4. Electronic Transmitter (IEC-770)	Y	Y	Y	Y	Y	Y			
5. Temp. Switch	Y	Y	Y	Y	Y	Y			
6. Recorder (IS-9319/ANSI C-39.4)	Y	Y	Y	Y	Y	Y			
7. Vertical indicators	Y	Y	Y	Y		Y			
8. Digital Indicators	Y	Y	Y	Y		Y			
9. Integrators	Y	Y	Y	Y					
10. Electrical Metering Instrument (IS-1248)	Y	Y	Y	Y	Y	Y			
11. Transducer (IEC-688)	Y	Y	Y	Y	Y	Y			
12. Thermocouples (IEC – 754 / ANSI-MC-96.1)	Y	Y	Y	Y	Y	Y			
13. RTD (IEC-751)	Y	Y	Y	Y	Y	Y			
14. Thermowell	Y		Y				Y	Y	Y
R-Routine Test A- Acceptance Test Y – Test applicable									
: Note: 1) Detailed procedure of Environmental Stress Screening shall be as per Quality Assurance Programme in General Technical Conditions. Requirement of test and procedure (if required) finalized during QP finalization									
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.									

EPC PACKAGE FOR
PATRATU SUPER THERMAL POWER
STATION EXPANSION PHASE-I (3X 800MW)

TECHNICAL SPECIFICATION
SECTION-VI, PART-B
BID DOC NO.:CS-9585-001-2

SUB-SECTION-E-61
MEASURING INSTRUMENTS
(PRIMARY & SECONDARY)

Page 1 of 1



SUB-SECTION–E-61A

MEASURING INSTRUMENTS
(PRIMARY & SECONDARY)

EPC PACKAGE FOR
PATRATU SUPER THERMAL POWER STATION EXPANSION
PHASE–I (3X 800MW)

TECHNICAL SPECIFICATION
SECTION-VI, PART-B
BID DOC NO.:CS-9585-001-2

1098305/2022/PS-PEM-MAX

95/2022/PS-HEM-MAX		QUALITY ASSURANCE										एनटीपीसी NTPC																																																																																																																																																																																									
CLAUSE NO.																																																																																																																																																																																																					
MEASURING INSTRUMENTS (PRIMARY AND SECONDARY) <table><tr><th>TESTS</th><th rowspan="2">ITEMS</th><th>Dimensions (R)</th><th>Make, Model, Type, Rating (R)</th><th>Process / Electrical connection (R)</th><th>Calibration (R)</th><th>Test as per standard(R)</th><th>Insulation Resistance (R)</th><th>IBR Certification (if applicable)(R)</th><th>Hydro Test(R)</th><th>Material Test certificate ®</th></tr><tr><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th></tr><tr><td>1. PR Gauge (IS-3624)</td><td>Y</td><td>Y</td><td>Y</td><td>Y</td><td>Y</td><td></td><td></td><td></td><td></td></tr><tr><td>2. Temp. Gauge (BS-5235)</td><td>Y</td><td>Y</td><td>Y</td><td>Y</td><td>Y</td><td></td><td></td><td></td><td></td></tr><tr><td>3. Pr./D.P.Switch(BS-6134)</td><td>Y</td><td>Y</td><td>Y</td><td>Y</td><td>Y</td><td>Y</td><td></td><td></td><td></td></tr><tr><td>4. Electronic Transmitter(IEC-770)</td><td>Y</td><td>Y</td><td>Y</td><td>Y</td><td>Y</td><td>Y</td><td></td><td></td><td></td></tr><tr><td>5. Temp. Switch</td><td>Y</td><td>Y</td><td>Y</td><td>Y</td><td>Y</td><td>Y</td><td></td><td></td><td></td></tr><tr><td>6. Recorder(IS-9319/ANSI C-39.4)</td><td>Y</td><td>Y</td><td>Y</td><td>Y</td><td>Y</td><td>Y</td><td></td><td></td><td></td></tr><tr><td>7. Vertical indicators</td><td>Y</td><td>Y</td><td>Y</td><td>Y</td><td></td><td>Y</td><td></td><td></td><td></td></tr><tr><td>8. Digital Indicators</td><td>Y</td><td>Y</td><td>Y</td><td>Y</td><td></td><td>Y</td><td></td><td></td><td></td></tr><tr><td>9. Integrators</td><td>Y</td><td>Y</td><td>Y</td><td>Y</td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>10. Electrical Metering Instrument (IS-1248)</td><td>Y</td><td>Y</td><td>Y</td><td>Y</td><td>Y</td><td>Y</td><td></td><td></td><td></td></tr><tr><td>11. Transducer (IEC-688)</td><td>Y</td><td>Y</td><td>Y</td><td>Y</td><td>Y</td><td>Y</td><td></td><td></td><td></td></tr><tr><td>12. Thermocouples (ANSI-MC-96.1)</td><td>Y</td><td>Y</td><td>Y</td><td>Y</td><td>Y</td><td>Y</td><td></td><td></td><td></td></tr><tr><td>13. RTD(IEC-751)</td><td>Y</td><td>Y</td><td>Y</td><td>Y</td><td>Y</td><td>Y</td><td></td><td></td><td></td></tr><tr><td>14. Thermowell</td><td>Y</td><td></td><td>Y</td><td></td><td></td><td></td><td>Y</td><td>Y</td><td>Y</td></tr><tr><td colspan="11">R-Routine Test A- Acceptance Test Y – Test applicable</td></tr><tr><td colspan="11">:</td></tr></table>		TESTS	ITEMS	Dimensions (R)	Make, Model, Type, Rating (R)	Process / Electrical connection (R)	Calibration (R)	Test as per standard(R)	Insulation Resistance (R)	IBR Certification (if applicable)(R)	Hydro Test(R)	Material Test certificate ®										1. PR Gauge (IS-3624)	Y	Y	Y	Y	Y					2. Temp. Gauge (BS-5235)	Y	Y	Y	Y	Y					3. Pr./D.P.Switch(BS-6134)	Y	Y	Y	Y	Y	Y				4. Electronic Transmitter(IEC-770)	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											:																								
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EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO.:CS-9585-001-2				SUB-SECTION-E-61A MEASURING INSTRUMENTS (PRIMARY & SECONDARY)				Page 1 of 2																																																																																																																																																																																											

5/2022/IPS-HEM-MAX		QUALITY ASSURANCE												एनटीपीसी NTPC	
CLAUSE NO.															
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.															

EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)	TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO.:CS-9585-001-2	SUB-SECTION-E-61A MEASURING INSTRUMENTS (PRIMARY & SECONDARY)	Page 2 of 2

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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
Note: 1) Detailed procedure of Environmental Stress Screening test shall be as per Quality Assurance Programme in General Technical Conditions. Requirement of test and procedure finalized during QP finalization 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													



SUB-SECTION – IIIC-10

TYPE TEST REQUIREMENTS

EPC PACKAGE FOR
PATRATU SUPER THERMAL POWER STATION EXPANSION
PHASE –I (3X 800MW)

TECHNICAL SPECIFICATION
SECTION-VI
BID DOC. NO.: CS:9585-001-2

CLAUSE NO.	TECHNICAL REQUIREMENTS			
1.00.00	TYPE TEST REQUIREMENTS			
1.01.00	General Requirements			
1.01.01	The Contractor shall furnish the type test reports of all type tests as per relevant standards and codes as well as other specific tests indicated in this specification. If the bidder proposes a different standard/code from that indicated at table 3.00.00, same is acceptable provided the equivalence of the proposed standard is established by the bidder. A list of such tests are given for various equipment in table titled 'TYPE TEST REQUIREMENT FOR C&I SYSTEMS' at the end of this chapter and under the item Special Requirement for Solid State Equipments/Systems. For the balance equipment instrument, type tests may be conducted as per manufactures standard or if required by relevant standard. (a) Out of the tests listed, the Bidder/ sub-vendor/ manufacturer is required to conduct certain type tests specifically for this contract (and witnessed by Employer or his authorized representative) even if the same had been conducted earlier, as clearly indicated subsequently against such tests. (b) For the rest, submission of type test results and certificate shall be acceptable provided. i. The same has been carried out by the Bidder/ sub-vendor on exactly the same model /rating of equipment. ii. There has been no change in the components from the offered equipment & tested equipment. iii. The test has been carried out as per the latest standards alongwith amendments as on the date of Bid opening. (c) In case the approved equipment is different from the one on which the type test had been conducted earlier or any of the above grounds, then the tests have to be repeated and the cost of such tests shall be borne by the Bidder/ sub-vendor within the quoted price and no extra cost will be payable by the Employer on this account.			
1.01.02	As mentioned against certain items, the test certificates for some of the items shall be reviewed and approved by the main Bidder or his authorized representative and the balance have to be approved by the Employer.			
1.01.03	The schedule of conduction of type tests/ submission of reports shall be submitted and finalized during pre-award discussion.			
1.01.04	For the type tests to be conducted, Contractor shall submit detailed test procedure for approval by Employer. This shall clearly specify test setup, instruments to be used, procedure, acceptance norms (wherever applicable), recording of different parameters, interval of recording precautions to be taken etc. for the tests to be carried out.			
1.01.05	The Bidder shall indicate in the relevant BPS schedule, the cost of the type test for each item only for which type tests are to be conducted specifically for this project. The cost shall only be payable after conduction of the respective type test in presence of authorize representative of Employer. If a test is waived off, then the cost shall not be payable.			
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 1 OF 9

CLAUSE NO.	TECHNICAL REQUIREMENTS			
2.00.00	SPECIAL REQUIREMENT FOR SOLID STATE EQUIPMENTS/ SYSTEMS			
2.01.00	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-IIIC-10 TYPE TEST REQUIREMENTS	PAGE 2 OF 9

CLAUSE NO.	TECHNICAL REQUIREMENTS							एनटीपीसी 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																												
	* 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>Electromagneti c 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	Electromagneti c field immunity	EN 61000-4-3 No orr equivalent	Yes	Degree of Protection	IS-13947 or No equivalent	Yes
Surge Withstand Capability(SWC)	ANSI 37.90.1, No IEEE-472,EN 61000-4-12	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-IIIC-10 TYPE TEST REQUIREMENTS	PAGE 6 OF 9																								

CLAUSE NO.	TECHNICAL REQUIREMENTS						एनटीपीसी NTPC
	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 standard (col 4)	per 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 21 Conductivity Type Level Switch 22 Local Gauges 23 Process actuated Switches 24 Control Valves 25 PLCs 26 Flow Nozzle Orifice plates Degree of protection test Degree of protection test Degree of protection test CV test As per standard (Col 4) Calibration of of of ISA 75.02& 75.11 IEC 1131 ASME PTC BS 1042 No No No No No No acceptable) No No No No Yes ## 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.					
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

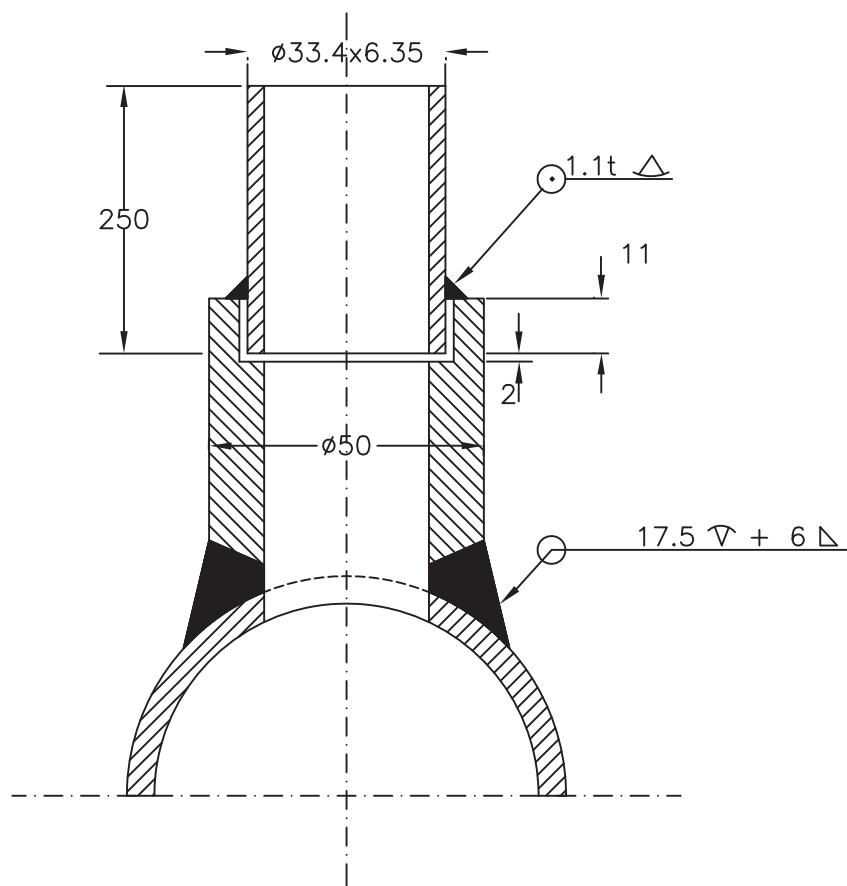


C&I SPECIFICATION FOR EFFLUENT TREATMENT PLANT

SECTION: C
SUB SECTION: C&I

INSTRUMENT STUB DETAILS

|



NOTE :

1. MATERIAL OF THE BOSS AND NIPPLE SHALL BE THE SAME AS THE PIPE INTO WHICH IT IS WELDED AND CONFORM TO ANSI B16.11.
2. THE LENGTH OF NIPPLE SHALL BE 250 MM.
3. ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE INDICATED
4. EDGE HOLE MUST BE CLEAN AND SQUARE OR ROUNDED SLIGHTLY (1/64" RADIUS) FREE FROM BURRS, WIRE EDGES OR OTHER IRREGULARITIES
5. STUB LENGTH SHALL BE 64mm UPTO 250Nb PIPE, 45mm ABOVE 200Nb PIPE SIZE.



TITLE :
**INSTRUMENT STUB DETAILS
 FOR PRESSURE MEASUREMENT**

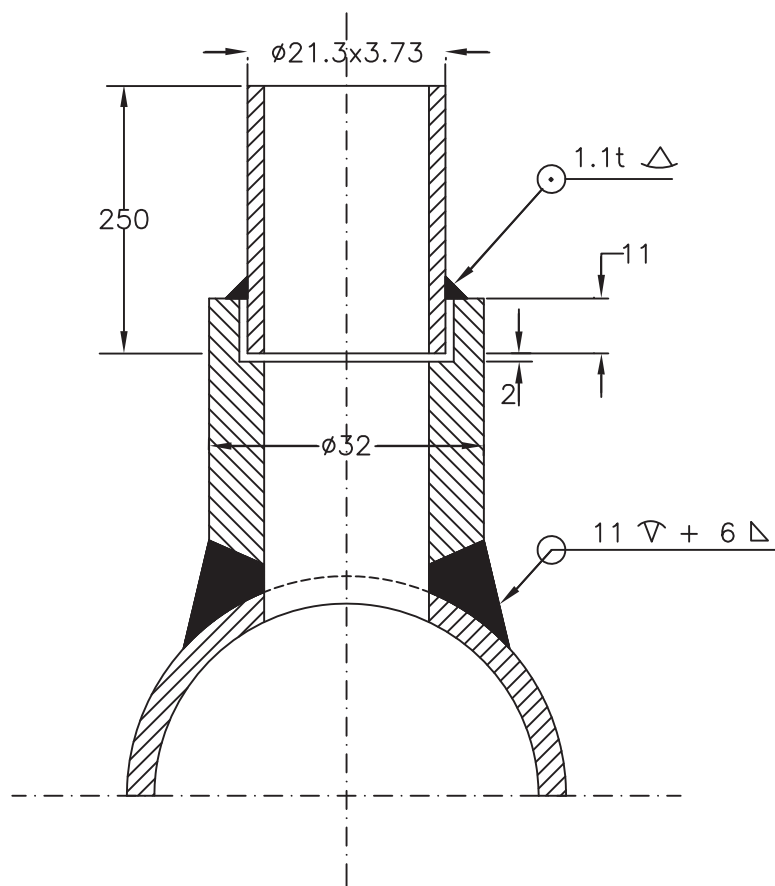
(APPLICABLE FOR TEMP < 500 DegC, CLASS 6000#)

DRG. NO.

PE-DG-434-145-I101

REV. 00

SH. 03 OF 08 SHS.



NOTE :

1. MATERIAL OF THE BOSS AND NIPPLE SHALL BE THE SAME AS THE PIPE INTO WHICH IT IS WELDED AND CONFORM TO ANSI B16.11.
2. THE LENGTH OF NIPPLE SHALL BE 250 MM.
3. ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE INDICATED
4. EDGE HOLE MUST BE CLEAN AND SQUARE OR ROUNDED SLIGHTLY (1/64" RADIUS) FREE FROM BURRS, WIRE EDGES OR OTHER IRREGULARITIES
5. STUB LENGTH SHALL BE 64mm UPTO 250Nb PIPE, 45mm ABOVE 200Nb PIPE SIZE.



TITLE :
INSTRUMENT STUB DETAILS
FOR PRESSURE MEASUREMENT

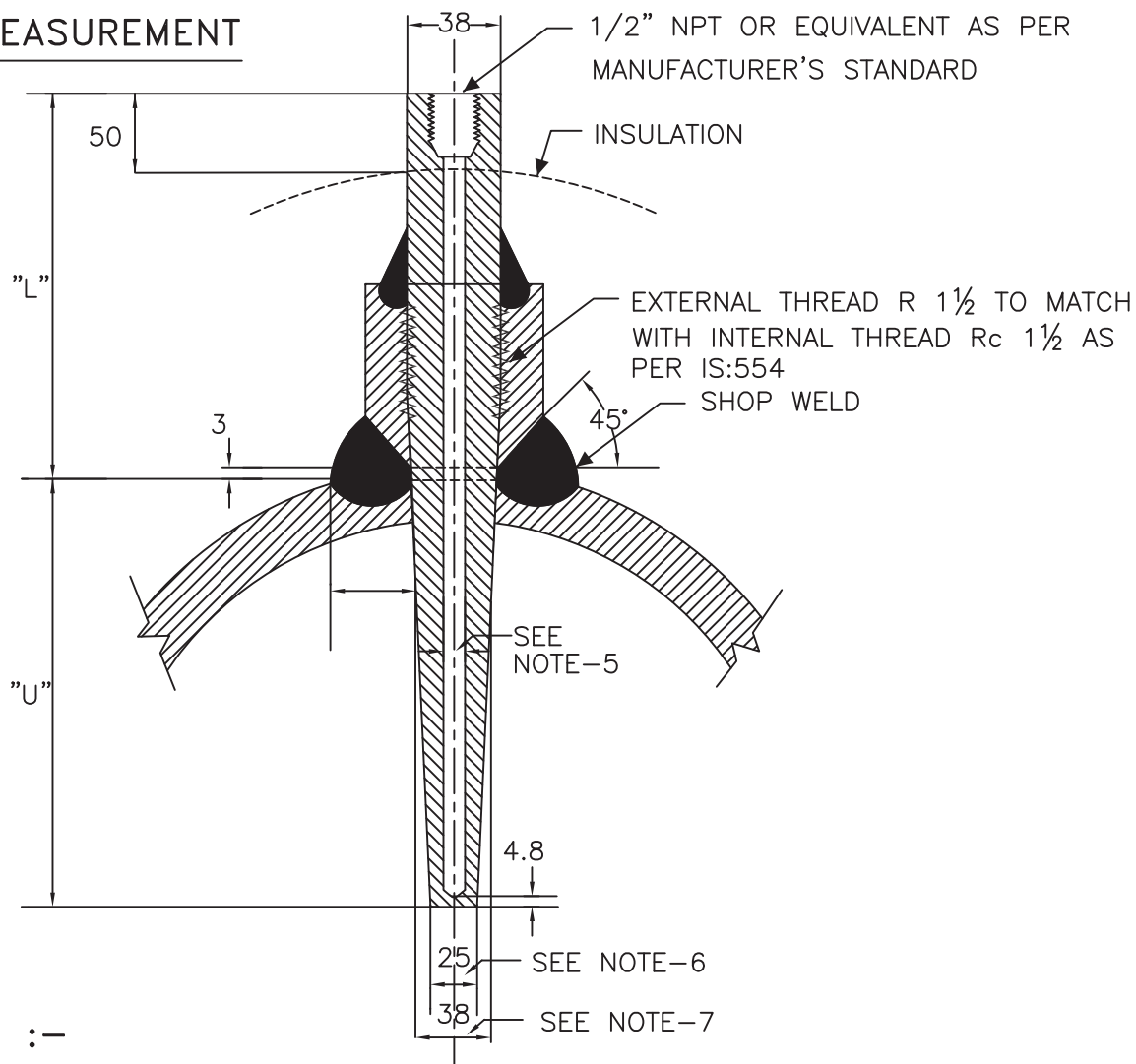
(SYSTEM PRESS UPTO 40Kg/Cm2, TEMP< 400 Deg C)SH. 04 OF 08 SHS.

DRG. NO.

PE-DG-434-145-1101

REV. 00

SH. 04 OF 08 SHS.

TEMP. MEASUREMENT**NOTES :-**

1. THIS TYPE OF TEMPERATURE BOSS SHALL BE USED FOR THE PROCESS PRESS EQUAL/ ABOVE 40 KG/CM2(g) AND FOR PROCESS TEMP.>400 DEG C EVEN IF THE PROCESS PRESSURE IS LESS THAN 40 KG/CM2(g).
2. THE MATERIAL OF THE BOSS SHALL BE SIMILAR TO PIPING MATERIAL.
3. MATERIAL OF THE THERMOWELL SHALL BE OF 316SS.
4. THERMOWELL SHALL BE DRILLED BAR STOCK TYPE.
5. INTERNAL BORE OF THE THERMOWELL SHOULD BE SELECTED BASED ON THE NORMAL SIZE OF THE SENSING ELEMENT AS PER ASME PTC-19.3.
6. THE BOTTOM DIAMETER OF THE THERMOWELL TYPICALLY SHOWN HERE SHALL BE SUBJECT TO VARIATION BASED ON THE INTERNAL BORE OF THERMOWELL AND THICKNESS OF THERMOWELL MATERIAL TO WITHSTAND THE PROCESS PRESS AND TEMP AS PER ASME PTC-19.3.
7. THERMOWELL SHALL BE SUITABLE TO MATCH THE STUB DIMENSIONS AS PER Rc 1½.
8. THE 'U' & 'L' DIMENSIONS SHALL BE SELECTED BASED ON PARTICULAR APPLICATION.
9. ORIENTATION OF STUB ON VERTICAL/ HORIZONTAL PIPES SHALL BE 90° TO THE CENTRE LINE OF THE PIPES, FOR PIPE SIZE LARGER THAN 4". HEIGHT OF STUB SHALL BE 64mm FOR PIPE OD < 200Nb AND 45mm FOR PIPE OD ≤ 200Nb.
10. ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE INDICATED.



TITLE :

DRG. NO.

INSTRUMENT STUB DETAILS (TEMP)
 (APPLICABLE FOR PIPE SIZE ABOVE 4")

PE-DG-434-145-I101

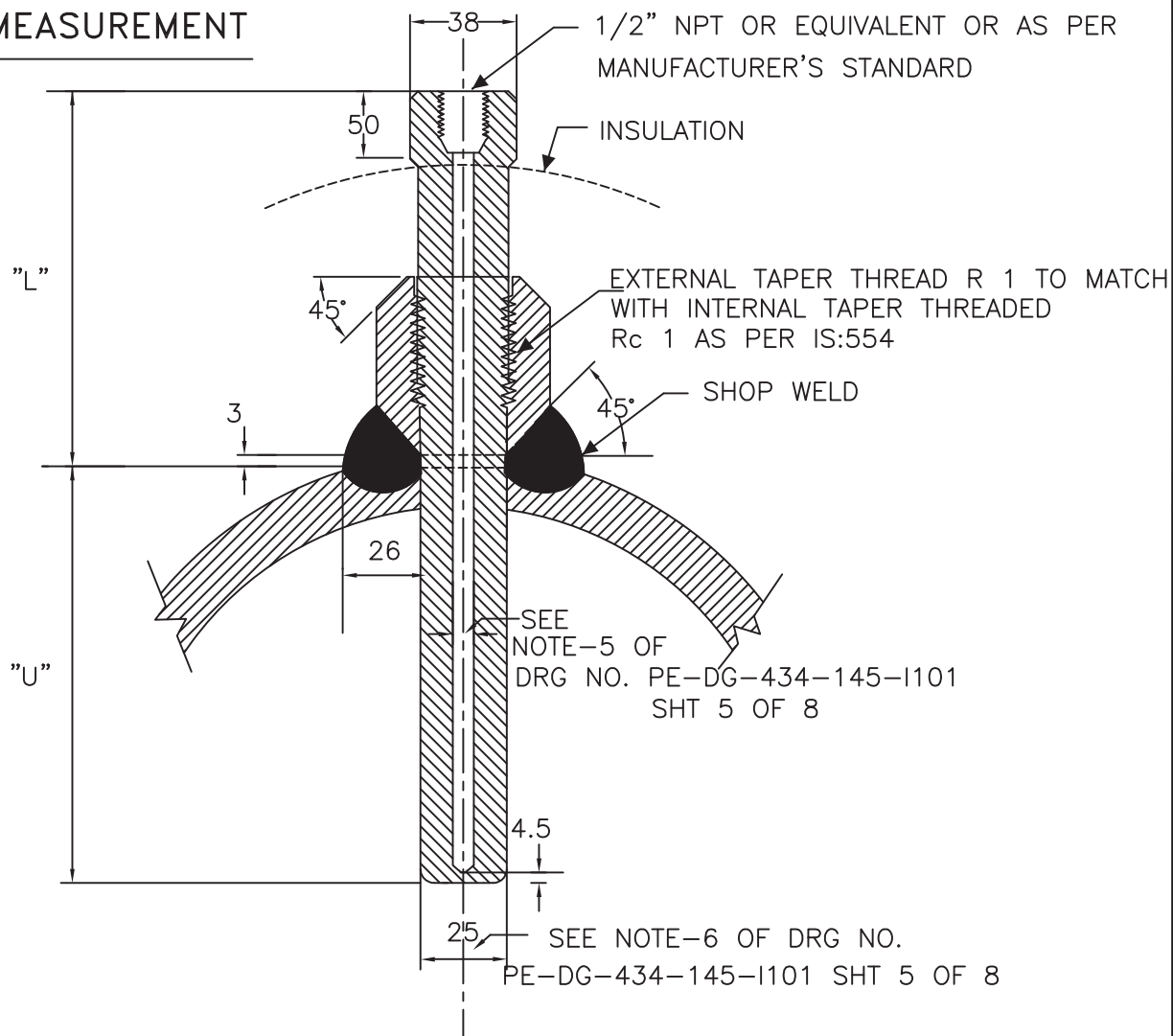
[PROCESS PRESS EQUAL/> 40 Kg/Cm2 (g)

REV. 00

PROCESS PRESS < 40 Kg/Cm2 (g), TEMP.EQUAL/>400 DEG C]

SH. 05 OF 08 SHS.

TEMP. MEASUREMENT



NOTES :-

1. THIS TYPE OF TEMPERATURE BOSS IS APPLICABLE FOR THE PROCESS PRESS/ TEMP. BELOW 40 KG/CM²(g)/400°C.
2. SEE NOTES-2 TO 9 IN SHT. 5 OF 8 OF THIS DRG.
3. ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE INDICATED.



TITLE :

INST. STUB DETAILS (TEMP)

(APPLICABLE FOR PIPE SIZE ABOVE 4")

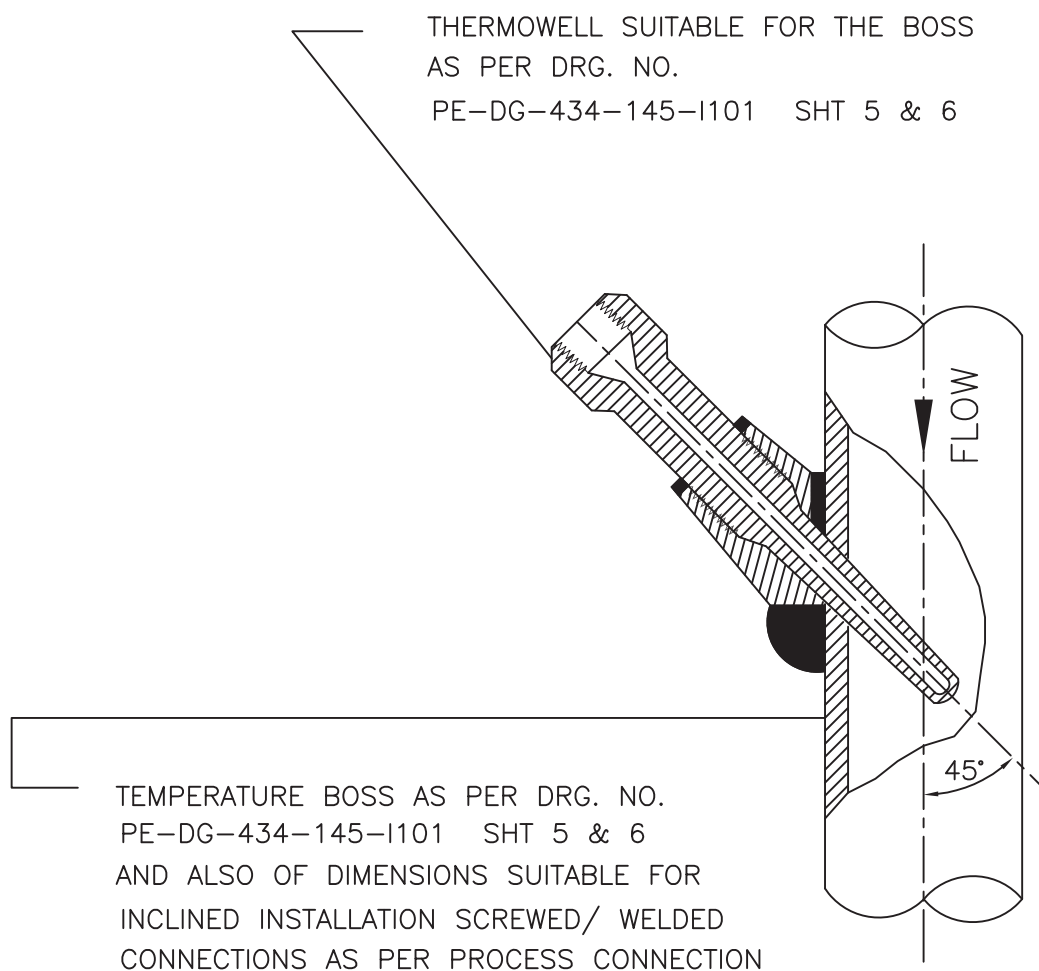
[PROCESS PRESS < 40 Kg/Cm² (g), TEMP < 400 °C]

DRG. NO.

PE-DG-434-145-I101

REV. 00

SH. 06 OF 08 SHS.



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 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 INSTALLED THERMOWELL).



TITLE :

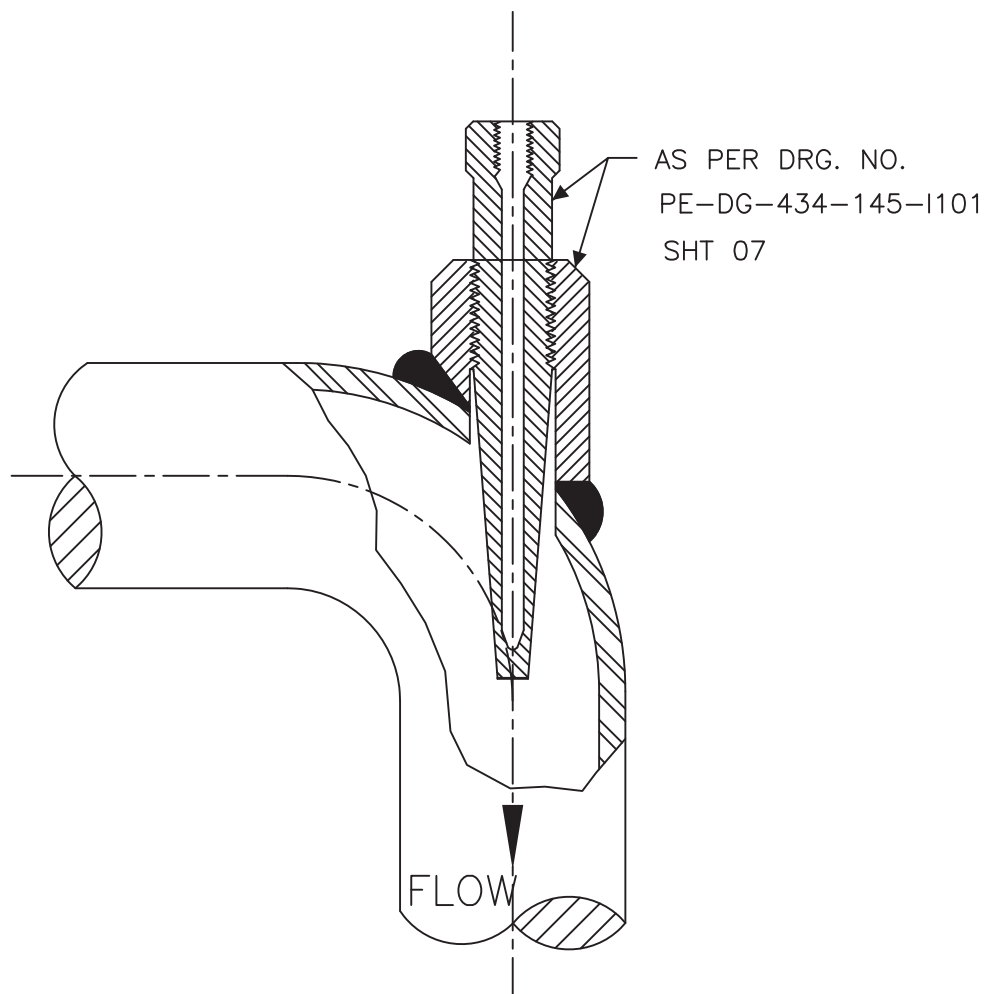
THERMOWELL INSTALLATION

DRG. NO.

PE-DG-434-145-I101

REV. 00

SH. 07 OF 08 SHS.



NOTES :-

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



TITLE :

THERMOWELL INSTALLATION
(IN BEND PIPES)

DRG. NO.

PE-DG-434-145-I101

REV. 00

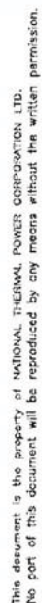
SH. 08 OF 08 SHS.



**C&I SPECIFICATION FOR
EFFLUENT TREATMENT PLANT**

SECTION: C
SUB SECTION: C&I

INSTRUMENT INSTALLATION DRAWING



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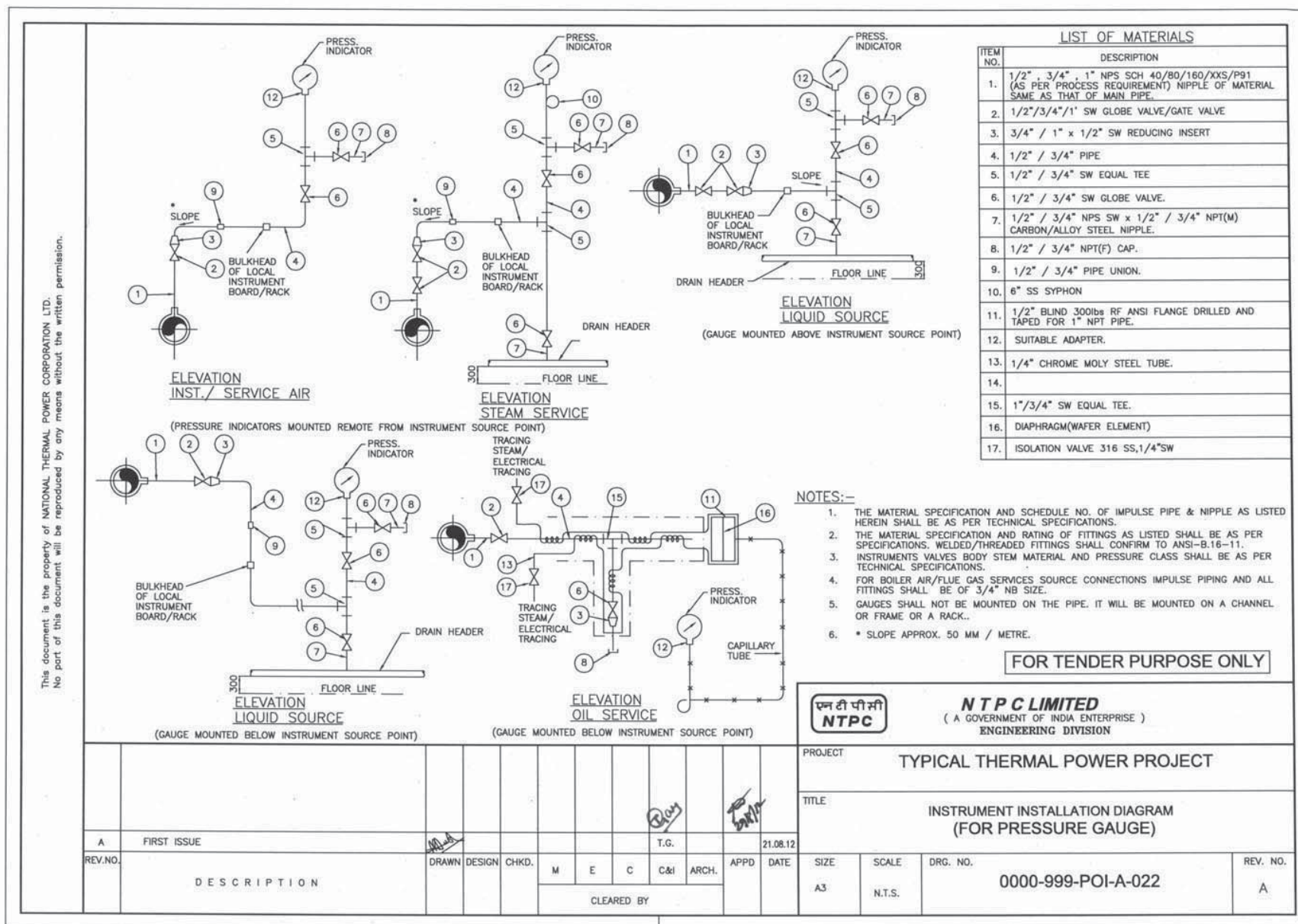
GROUNDING FOR EACH ROW OF PANELS (TYPICAL)

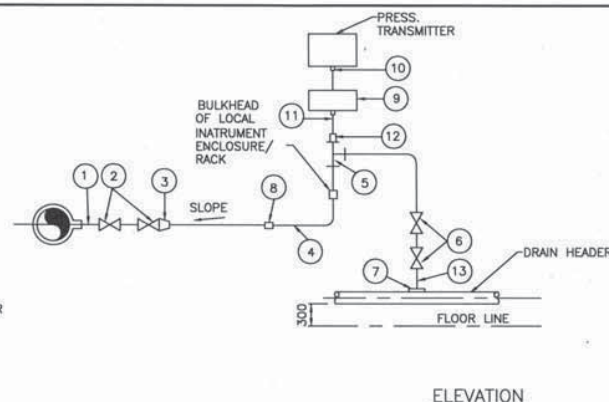
NOTES:-

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

एन टी पी सी NTPC NTPC LIMITED (A GOVERNMENT OF INDIA ENTERPRISE) ENGINEERING DIVISION															
PROJECT TYPICAL THERMAL POWER PROJECT TITLE INSTRUMENTATION CABLING DIAGRAM GROUNDING SCHEME FOR CABINETS / PANELS / POWER SUPPLY															
REV. NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	E	C	CM	ARCH.	APPD	DATE	SIZE	SCALE	DRG. NO.	REV. NO.
A	FIRST ISSUE										21.08.12	A3	N.T.S.	0000-999-POI-A-019A	A
CLEARED BY SH-2 OF 2															

FOR TENDER PURPOSE ONLY

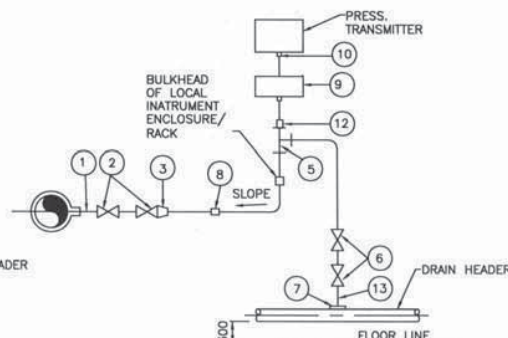




ITEM NO.	DESCRIPTION
1.	1/2" / 3/4" 1" NPS SCH. 80/160/XXS/P91 NIPPLE OF MATERIAL SAME AS THAT OF MAIN PIPE.
2.	3/4" / 1" SW GLOBE VALVE.
3.	3/4" / 1" to 1/2" REDUCING INSERT
4.	1/2" NPS PIPE
5.	1/2" SW EQUAL TEE
6.	1/2" SW GLOBE VALVE
7.	1/2" NPS SCH. 80/160 SWx1/2" CS/AS COUPLER
8.	1/2" PIPE UNION
9.	2/3 VALVE MANIFOLD (FOR DETAIL SEE DRAWING NO.0000-102-POI-A-023.
10.	SUITABLE ADAPTER
11.	SS TUBE
12.	1/2" PIPE x 1/2" TUBE UNION
13.	1/2" NPS SCH. 80/160 SWx1/2" NPT(M) CS/AS NIPPLE

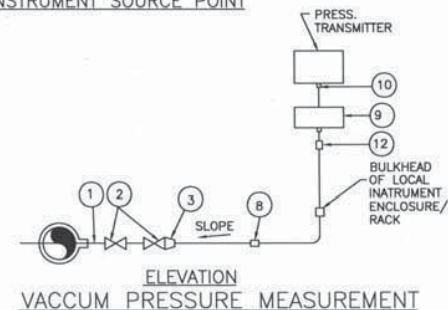
TRANSMITTER MOUNTED ABOVE INSTRUMENT SOURCE POINT

LIQUID PRESSURE MEASUREMENT



ELEVATION
TRANSMITTER MOUNTED ABOVE
INSTRUMENT SOURCE POINT

STEAM PRESSURE MEASUREMENT



VACCUUM PRESSURE MEASUREMENT

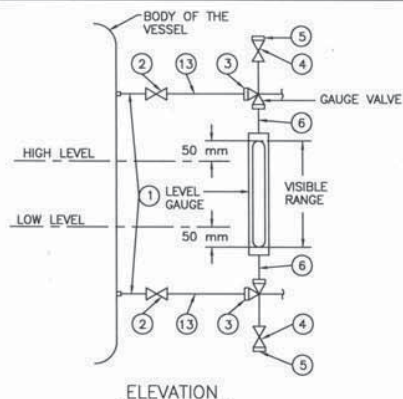
NOTES:—

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.

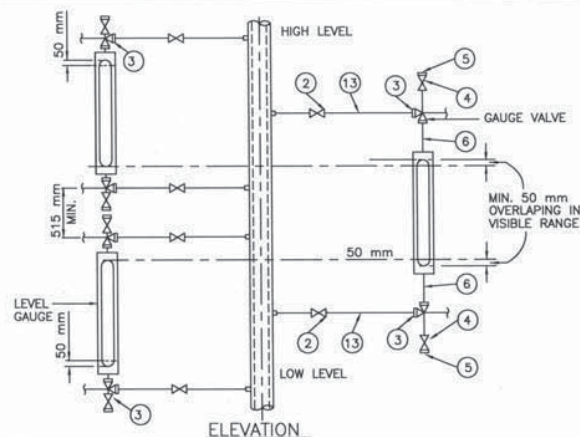
FOR TENDER PURPOSE ONLY

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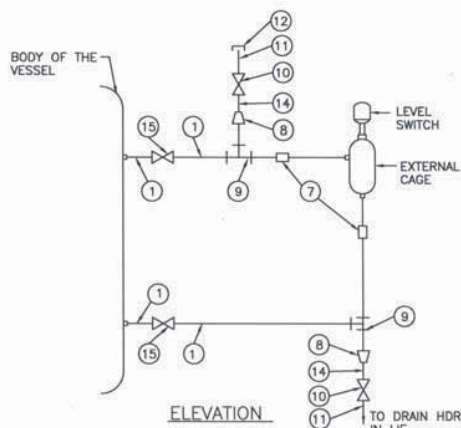
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ELEVATION
LOCAL LEVEL INDICATION USING GAUGE GLASS



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



ELEVATION
FLOAT OR DISPLACER OPERATED EXTERNAL CAGE TYPE LEVEL SWITCH INSTALLATION

LIST OF MATERIALS	
ITEM NO.	DESCRIPTION
1.	3/4" x 1" NPS SCH.40/80/160/P91 (AS PER PROCESS REQUIREMENT) CARBON /ALLOY STEEL PIPE.
2.	3/4" SW GLOBE VALVE.
3.	3/4" SW UNION.
4.	3/4" NPT GLOBE VALVE.
5.	3/4" NPT (M) CAP.
6.	3/4" NPT (F) UNION CONNECTION.
7.	1" SW EQUAL UNION.
8.	1" x 1/2" SW REDUCING INSERT.
9.	1" SW EQUAL TEE.
10.	1/2" SW GLOBE VALVE.
11.	1/2" NPS SWx1/2" NPT(M) CS/AS NIPPLE.
12.	1/2" NPT (F) CAP.
13.	3/4"x1/2" NPS SCH.40/80 CS/AS PIPE.
14.	1/2" NPS SCH.80/160 CS/AS NIPPLE.
15.	1" SW GLOBE VALVE.

NOTES:-

1. FOR LEVEL GAUGE 3/4" AND FOR LEVEL SWITCH 1" PROCESS CONNECTION SHALL BE PROVIDED.
2. NOTES UNDER DRG. NO. 0000-999-POI-A-023 (WHICHEVER ARE RELEVANT).

FOR TENDER PURPOSE ONLY



NTPC LIMITED
(A GOVERNMENT OF INDIA ENTERPRISE)
ENGINEERING DIVISION

PROJECT **TYPICAL THERMAL POWER PROJECT**

TITLE **INSTRUMENT INSTALLATION DIAGRAM
(LEVEL GAUGE & SWITCHES)**

SIZE A3	SCALE N.T.S.	DRG. NO. 0000-999-POI-A-031	REV. NO. A

REV. NO. **A** FIRST ISSUE

DESCRIPTION

DRAWN	DESIGN	CHKD.	M	E	C	C&I	ARCH.	APPD	DATE
									21.08.12
CLEARED BY									



SUB-SECTION – IIIC - 06

PROCESS CONNECTION

AND PIPING

EPC PACKAGE FOR
PATRATU SUPER THERMAL POWER STATION EXPANSION
PHASE –I (3X 800MW)

TECHNICAL SPECIFICATION
SECTION-VI
BID DOC. NO.: CS:9585-001-2

CLAUSE NO.	TECHNICAL REQUIREMENTS			एनटीपीसी NTPC								
	PROCESS CONNECTION AND PIPING											
1.00.00	PROCESS CONNECTION PIPING											
1.01.00	The Contractor shall provide, install and test all required material for completeness of Impulse Piping System and Air Piping System as per the requirements of this Sub-Section on as required basis for the connection of all instruments and control equipments of entire plant.											
1.01.01	IMPULSE PIPING, TUBING, FITTINGS, VALVES AND VALVE MANIFOLDS											
1.01.02	All impulse pipes shall be of seamless type conforming to ANSI B36.10 for schedule numbers. The size of impulse pipe shall be ½” for Steam & Water Application and ¾” for Air & Flue Gas applications. The rating of material of impulse pipes, tubes, fittings, valves and their installation thereof shall conform to the latest edition of standards as per following table: <table><tr><td>Impulse Pipes, Tubes (Material, Rating)</td><td>ANSI B31.1, ANSI B31.1a, ANSI/ISA 77.70</td></tr><tr><td>Valves (Material, Pr. Class, Size)</td><td>ASTM A182/ASTM A105 as per ASME 16.34</td></tr><tr><td>Fittings (Size, Rating, Material)</td><td>ANSI B31.1, ANSI B31.1a, ASME B16.11-2009</td></tr><tr><td>Installation Schemes</td><td>BS 6739-2009, ANSI/ISA 77.70</td></tr></table> Stainless steel tube shall be provided inside enclosures & racks from tee connection to valve manifold and then to instrument. The source shut-off (primary process root valve) and blow down valve shall be of 1/2 inch size globe valve type for all applications except for air and flue gas service wherein no source shut-off valves are to be provided. Two root valves are to be used wherever pressure is more than 40 Kg/cm² or Temp>280 °C. The end connections of valves shall be of socket welded type. Typical installation scheme of DP Transmitter (inside LIE/LIR) mounted below instrument source point is indicated in Drg. No. 0000-999-POI-A-036. Same scheme with necessary changes shall be applied for other instruments.				Impulse Pipes, Tubes (Material, Rating)	ANSI B31.1, ANSI B31.1a, ANSI/ISA 77.70	Valves (Material, Pr. Class, Size)	ASTM A182/ASTM A105 as per ASME 16.34	Fittings (Size, Rating, Material)	ANSI B31.1, ANSI B31.1a, ASME B16.11-2009	Installation Schemes	BS 6739-2009, ANSI/ISA 77.70
Impulse Pipes, Tubes (Material, Rating)	ANSI B31.1, ANSI B31.1a, ANSI/ISA 77.70											
Valves (Material, Pr. Class, Size)	ASTM A182/ASTM A105 as per ASME 16.34											
Fittings (Size, Rating, Material)	ANSI B31.1, ANSI B31.1a, ASME B16.11-2009											
Installation Schemes	BS 6739-2009, ANSI/ISA 77.70											
1.01.03	The valve manifolds of 316 SS with pressure rating suitable for intended application shall be provided as given below: <table><tr><th>Manifold</th><th>Application/Masurement</th></tr><tr><td>2 Valve</td><td>Pressure measurements using pressure transmitters/pressure switches</td></tr><tr><td>3 Valve</td><td>Pressure measurements using differential pressure transmitter/ switches</td></tr><tr><td>5 Valve</td><td>Differential Pressure, Flow and Level Measurements</td></tr></table> For Pr./D.P gauges, two-way globe/gate valve shall be provided on each impulse line to the instrument in Fluid/Air & Flue Gas applications respectively .				Manifold	Application/Masurement	2 Valve	Pressure measurements using pressure transmitters/pressure switches	3 Valve	Pressure measurements using differential pressure transmitter/ switches	5 Valve	Differential Pressure, Flow and Level Measurements
Manifold	Application/Masurement											
2 Valve	Pressure measurements using pressure transmitters/pressure switches											
3 Valve	Pressure measurements using differential pressure transmitter/ switches											
5 Valve	Differential Pressure, Flow and Level Measurements											
2.00.00	AIR SUPPLY PIPING											
2.01.01	All pneumatic piping, fittings, valves, air filter cum regulator, purge rotameter and other accessories required for instrument air for the various pneumatic devices/ instruments shall be provided. This will include as a minimum air supply to pneumatically operated control valves, actuators, instruments, continuous and intermittent purging requirements etc.											
2.02.00	Instrument air and Service air supply shall be provided for continuous and intermittent purging respectively for all transmitters of mill, dirty air and flue gas applications. Purging Scheme shall be as per Drg. No. 0000-999-POI-A-036.											
2.03.00	The Contractor shall also provide SS Tubing and associated fittings (screwed type) of suitable sizes for all pneumatic equipments/actuators (including supply air, signal air and output to actuators) conforming to ANSI 31.1 and 31.3 standard. All other air supply lines shall be of mild steel hot dipped galvanized inside and outside as per IS-1239, heavy duty											
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-06 PROCESS CONNECTION AND PIPING	PAGE 1 OF 3								

CLAUSE NO.	TECHNICAL REQUIREMENTS		
	with threaded ends. Fittings for air supply line shall be of forged carbon steel A234 Gr. WPB galvanized inside and outside, screwed as per ASA B2.1. Dimensions of fittings shall be as per ASA B16.11 of rating 3000 lbs. Air supply piping shall be adequately sloped to prevent accumulation of condensed water within the pipe. The air supply headers, sub-headers and branch pipes shall be supported properly by clamps or supports.		
2.04.00	The instrument/service air supply to each equipment/devices requiring air supply shall be provided by a well designed air distribution scheme comprising of 2" GI Pipe Header feeding 1" GI Pipe sub-header feeding ½" pipe at each equipment/device. Instrument air filters cum regulator set with mounting accessories shall be provided for each pneumatic device requiring air supply except for Ash Handling System wherein it shall be provided on instrument air header at each location.		
2.05.00	All the isolation valves in the air supply line shall be gate valves as per ASTM B62 inside screw rising stem, screwed female ends as per ASA B2.1. Valve bonnet shall be union type & trim material shall be stainless steel, body rating 150 pounds ASA. The valve sizes shall be ½ inch to 2 inch.		
2.06.00	Instrument air filters cum regulator set with mounting accessories shall be provided for pneumatic device requiring air supply. The filter regulators shall be suitable for 10-kg/ sq.cm max. Inlet pressure. The filter shall be of size 5 microns and of material sintered bronze. The air set shall have 2-inch size pressure gauge and built in filter housing blowdown valve. The end connection shall be as per the requirement to be finalized during detailed engineering.		
3.00.00	INSTALLATION AND ROUTING		
3.01.01	All instrument piping, tubing and its accessories shall be supported in a safe manner to prevent excessive vibrations and anchored sufficiently to prevent undue strain on connected equipment. Impulse piping shall be supported at an interval not exceeding 1.5 meters. The slope of the impulse pipe from the process connection to the instrument shall be as per ANSI/ISA 77.70 latest edition and BS 6739-2009. All impulse piping shall be installed to permit free movement due to thermal expansion. Wherever required expansion loops shall be provided. Condensate pots shall be provided for all level measurements in steam and water services, all flow measurement in steam services and for flow measurements in water services above 120 Deg. C. Colour coding of all impulse pipes shall be done by the Contractor in line with the colour coding being followed for the parent pipes.		
4.00.00	SHOP AND SITE TESTS		
4.01.01	The equipment and work performed as per this Sub-section shall be subject to shop and site test as per requirements of Sub-section-IIIE-04 (Quality Assurance & Inspection) other applicable clauses of this Sub-section and Employer approved quality assurance plan.		
4.01.02	Hydrostatic and Pneumatic leakage tests shall be performed on all pipes, tubing and systems and shall conform to ANSI B31.1.		
5.00.00	LOCAL INSTRUMENT ENCLOSURE AND RACKS All transmitters, switches etc. in Boiler Turbine Generator measurements (except for all fuel oil applications) shall be suitably grouped together and mounted inside (i) local instruments enclosures in case of open areas of the plant like boiler area, etc. and (ii) In local instrument racks in case of covered areas like Turbine/Generator area. The GA of LIE with purging indicated in the Drg. No. 0000-999-POI-A-036 is to be followed by contractor. The GA of LIR shall be similar to LIE except for front/rear doors and side panels.		
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-06 PROCESS CONNECTION AND PIPING
			PAGE 2 OF 3

CLAUSE NO.	TECHNICAL REQUIREMENTS			
5.01.00	The internal layout shall be such that the impulse piping/ blow down lines are accessible from back side of the enclosure / rack and the transmitters etc. are accessible from front side for easy maintenance. Bulkheads, especially designed to provide isolation from process line vibration shall be installed on instrument enclosures/racks to meet the process sensing line connection requirement. Vibration dampeners shall be installed for each enclosure / rack. The Degree of Protection of LIE and JB of LIE/LIR shall be IP-55. The instrument racks shall be free standing type constructed of suitable 3 mm thick channel frame of steel and shall be provided with a canopy to protect the equipment mounted in racks from falling objects, water etc. The canopy shall not be less than 3 mm thick steel, and extended beyond the ends of the rack. Enclosures/Racks shall be reinforced as required to ensure true surface and to provide adequate support for instruments and equipment mounted therein. Centre posts or any member which would reduce access shall not be provided. Contractor shall provide not more than three variants for LIE/LIR with respect to max. no. transmitters mounted in each LIE/LIR. ENCLOSURE / RACKS FOR DUAL I/P TEMPERATURE TRANSMITTERS All Dual Input temperature transmitters in Boiler Turbine Generator measurements shall be suitably grouped together and mounted inside (i) Enclosures in case of open areas of the plant like boiler area, etc. and (ii) Racks in case of covered areas like Turbine/Generator area. Integral JB shall be provided with each Enclosure and Rack. The internal layout shall be such that the transmitters are accessible from both front and back side of the enclosure / rack for easy maintenance. Enclosure/ Racks shall be of robust and rugged design. Vibration dampeners shall be installed for each enclosure / rack. The Degree of Protection of Enclosure and JB shall be IP-55. Enclosure and Racks shall be free standing type. Enclosures/Racks shall be reinforced as required to ensure true surface and to provide adequate support for instruments and equipment mounted therein. Contractor shall provide not more than five variants for Enclosure/ Rack with respect to max. no. transmitters mounted in each Enclosure/ Rack. However, the maximum number of Transmitters that can be grouped in one Enclosure/ Rack shall be decided during detail Engineering.			
	6.00.00	INSTALLATION OF OTHER INSTRUMENTS: For installation and routing of other field mounted instruments which are not covered in Cl. No. 5.00.00, please refer Cl. No 52.04.00(f) of Section-VI, Part-D, Erection Conditions of Contract (ECC) of Technical Specifications.		
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-06 PROCESS CONNECTION AND PIPING	PAGE 3 OF 3



**C&I SPECIFICATION FOR
EFFLUENT TREATMENT PLANT**

SECTION: C
SUB SECTION: C&I

KKS TAGGING PHILOSOPHY

3X800 MW PATRATU STPP : CHP ETP(CSSP)- DRIVE LIST

SL. NO.	ID	KKS_CODE	DESCRIPTION	DRIVE_TY PE
1	PT-D-001	GTF10AP001	CLRFR FD PMP-A	LTUD
2	PT-D-002	GTF10AP002	CLRFR FD PMP-B	LTUD
3	PT-D-003	GTF10AP003	CLRFR FD PMP-C	LTUD
4	PT-D-004	GTF10AP004	CLRFR FD PMP-D	LTUD
5	PT-D-005	GTF10AA001	CLRFR FD PMP-A DISCH VLV	BID
6	PT-D-006	GTF10AA002	CLRFR FD PMP-B DISCH VLV	BID
7	PT-D-007	GTF10AA003	CLRFR FD PMP-C DISCH VLV	BID
8	PT-D-008	GTF10AA004	CLRFR FD PMP-D DISCH VLV	BID
9	PT-D-009	GTF11AA001	CLRFR FD PMPS DISCH TO SC VLV	BID
10	PT-D-010	GTF12AA001	CLRFR FD PMPS DISCH TO CHP TNK VLV	BID
11	PT-D-011	GTF31AE001	RAKE ARM DRIVE FOR CLRFR – 1	LTUD
12	PT-D-012	GTF31AT001	IMPELLER DRIVE FOR CLRFR – 1	VFD-CSSP
13	PT-D-013	GTF31AA001	LIME DOS TO CLRFR-1	BIDI
14	PT-D-014	GTF32AE001	RAKE ARM DRIVE FOR CLRFR – 2	LTUD
15	PT-D-015	GTF32AT001	IMPELLER DRIVE FOR CLRFR – 2	VFD-CSSP
16	PT-D-016	GTF32AA001	LIME DOS TO CLRFR-2	BIDI
17	PT-D-017	GTF25AA001	CLRFR- 1 SLUDGE O/L VLV	BID
18	PT-D-018	GTF26AA001	CLRFR- 2 SLUDGE O/L VLV	BID
19	PT-D-019	GTF41AP001	SPRNTNT PMP-A	LTUD
20	PT-D-020	GTF41AP002	SPRNTNT PMP-B	LTUD
21	PT-D-021	GTF41AA001	SPRNTNT PMP-A DISCH VLV	BID
22	PT-D-022	GTF41AA002	SPRNTNT PMP-B DISCH VLV	BID
23	PT-D-023	GTF42AA001	DIST CHMBR TO STORM WTR DRN VLV	BID
24	PT-D-024	GTF50AP001	SLDG TRF PMP-A	LTUD
25	PT-D-025	GTF50AP002	SLDG TRF PMP-B	LTUD
26	PT-D-026	GTF50AP003	SLDG TRF PMP-C	LTUD
27	PT-D-027	GTF50AA001	SLDG TRF PMP-A DISCH VLV	BID
28	PT-D-028	GTF50AA002	SLDG TRF PMP-B DISCH VLV	BID
29	PT-D-029	GTF50AA003	SLDG TRF PMP-C DISCH VLV	BID
30	PT-D-030	GTF51AA001	SLDG TRF PMP RIEC VLV	BID
31	PT-D-031	GTF52AA001	SLDG TRF PMP DISCH TO SOLID CAKE VLV	BID
32	PT-D-032	GTF55AN001	SLDG PIT BLWR-A	LTUD
33	PT-D-033	GTF55AN001	SLDG PIT BLWR-B	LTUD
34	PT-D-034	GTF55AA001	SLDG PIT BLWR-A DISCH VLV	BID
35	PT-D-035	GTF55AA002	SLDG PIT BLWR-B DISCH VLV	BID
36	PT-D-036	GTF60AT001	SOLID CAKE DRIVE-A	VFD-CSSP
37	PT-D-037	GTF60AT001	SOLID CAKE DRIVE-B	VFD-CSSP
38	PT-D-038	GTE10AA001	LIME SLURRY TRNSFR PMP – A DISCH VLV	BID
39	PT-D-039	GTE10AA002	LIME SLURRY TRNSFR PMP – B DISCH VLV	BID
40	PT-D-040	GTE10AM001	LIME Slaking TANs AGITATOR – A	LTUD

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41	PT-D-041	GTE10AM002	LIME Slaking TANK AGITATOR – B	LTUD
42	PT-D-042	GTE10AM003	LIME Slaking TANK AGITATOR – C	LTUD
43	PT-D-043	GTE10AP001	LIME SLURRY TRNSFR PMP – A	LTUD
44	PT-D-044	GTE10AP002	LIME SLURRY TRNSFR PMP – B	LTUD
45	PT-D-045	GTE20AA001	LIME SOL DOS PMP – A DISCH VLV	BID
46	PT-D-046	GTE20AA002	LIME SOL DOS PMP – B DISCH VLV	BID
47	PT-D-047	GTE20AM001	LIME SOL DOS TANK AGITATOR – A	LTUD
48	PT-D-048	GTE20AM002	LIME SOL DOS TANK AGITATOR – B	LTUD
49	PT-D-049	GTE20AM003	LIME SOL DOS TANK AGITATOR – C	LTUD
50	PT-D-050	GTE20AP001	LIME SOL DOS PMP – A	LTUD
51	PT-D-051	GTE20AP002	LIME SOL DOS PMP – B	LTUD
52	PT-D-052	GTE30AA001	ALUM DOS PMP – A DISCH VLV	BID
53	PT-D-053	GTE30AA001	ALUM DOS PMP – B DISCH VLV	BID
54	PT-D-054	GTE30AA001	ALUM DOS PMPS CMN DISCH VLV	BID
55	PT-D-055	GTE30AM001	ALUM DOS PMPS TANK AGITATOR – A	LTUD
56	PT-D-056	GTE30AM002	ALUM DOS PMPS TANK AGITATOR – B	LTUD
57	PT-D-057	GTE30AM003	ALUM DOS PMPS TANK AGITATOR – C	LTUD
58	PT-D-058	GTE30AM004	ALUM DOS PMPS TANK AGITATOR – D	LTUD
59	PT-D-059	GTE30AP001	ALUM DOS PMP – A	LTUD
60	PT-D-060	GTE30AP002	ALUM DOS PMP – B	LTUD
61	PT-D-061	GTE40AA001	SYN FLOCC DOS PMP – A DISCH VLV	BID
62	PT-D-062	GTE40AA002	SYN FLOCC DOS PMP – B DISCH VLV	BID
63	PT-D-063	GTE40AM001	SYN FLOCC DOS TANK AGITATOR – A	LTUD
64	PT-D-064	GTE40AM002	SYN FLOCC DOS TANK AGITATOR – B	LTUD
65	PT-D-065	GTE40AM003	SYN FLOCC DOS TANK AGITATOR – C	LTUD
66	PT-D-066	GTE40AP001	SYN FLOCC DOS PMP – A	LTUD
67	PT-D-067	GTE40AP002	SYN FLOCC DOS PMP – B	LTUD
68	PT-D-068	UNASSIGNED	UNASSIGNED	BID
69	PT-D-069	UNASSIGNED	UNASSIGNED	BID
70	PT-D-070	UNASSIGNED	UNASSIGNED	BID
71	PT-D-071	UNASSIGNED	UNASSIGNED	BID
72	PT-D-072	UNASSIGNED	UNASSIGNED	BIDI
73	PT-D-073	UNASSIGNED	UNASSIGNED	BIDI
74	PT-D-074	UNASSIGNED	UNASSIGNED	BIDI
75	PT-D-075	UNASSIGNED	UNASSIGNED	LTUD
76	PT-D-076	UNASSIGNED	UNASSIGNED	LTUD
77	PT-D-077	UNASSIGNED	UNASSIGNED	LTUD
78	PT-D-078	UNASSIGNED	UNASSIGNED	SOLV
79	PT-D-079	UNASSIGNED	UNASSIGNED	SOLV
80	PT-D-080	UNASSIGNED	UNASSIGNED	VFD-CSSP

3X800 MW PATRATU STPP : CHP ETP(CSSP)- IO LIST						
SNo	ID	KKS_CODE	DESCRIPTION	STATUS	RECORD_TYPE	IO_TYPE
1	CSSP-P-001	GTF10CP001	CLRFR FD PMP COM DISCH PRESS	NA	AI	AI[4-20mA]
2	CSSP-P-002	GTF10CP002	CLRFR FD PMP COM DISCH PRESS	NA	AI	AI[4-20mA]
3	CSSP-P-003	GTF10CL001	CLRFR FD SUMP-1 LVL LT - 1	NA	AI	AI[4-20mA]
4	CSSP-P-004	GTF10CL002	CLRFR FD SUMP-1 LVL LT - 2	NA	AI	AI[4-20mA]
5	CSSP-P-005	GTF50CP001	SLDG TRF PMP COMM DISCH PRESS	NA	AI	AI[4-20mA]
6	CSSP-P-006	GTF50CP002	SLDG TRF PMP COMM DISCH PRESS	NA	AI	AI[4-20mA]
7	CSSP-P-007	GTF50CL001	SLDG PIT LVL LT - 1	NA	AI	AI[4-20mA]
8	CSSP-P-008	GTF50CL001	SLDG PIT LVL LT - 2	NA	AI	AI[4-20mA]
9	CSSP-P-009	GTF55CP001	SLDG PIT BLWR DISCH PRESS	NA	AI	AI[4-20mA]
10	CSSP-P-010	GTF55CP001	SLDG PIT BLWR DISCH PRESS	NA	AI	AI[4-20mA]
11	CSSP-P-011	GTF40CL001	DIST CHAMBER LVL LT - 1	NA	AI	AI[4-20mA]
12	CSSP-P-012	GTF40CL002	DIST CHAMBER LVL LT - 2	NA	AI	AI[4-20mA]
13	CSSP-P-013	GTF21CF001	DIST FLOW FROM STILLING CHMBE TO I/L CHMBR	NA	AI	AI[4-20mA]
14	CSSP-P-014	GTF21CF002	DIST FLOW FROM STILLING CHMBE TO I/L CHMBR	NA	AI	AI[4-20mA]
15	CSSP-P-015	GTF41CP001	SPRNTNT PMP COM DISCH PRESS	NA	AI	AI[4-20mA]
16	CSSP-P-016	GTF41CP002	SPRNTNT PMP COM DISCH PRESS	NA	AI	AI[4-20mA]
17	CSSP-P-017	GTF41CF001	SPRNTNT PMP COM DISCH FLOW	NA	AI	AI[4-20mA]
18	CSSP-P-018	GTE30AA201_XB01	ALUM DOS PMP - A SUC VLV - OPN	OPN_FB	DI	DI[DRY]
19	CSSP-P-019	GTE30AA201_XB02	ALUM DOS PMP - A SUC VLV - CLS	CLS_FB	DI	DI[DRY]
20	CSSP-P-020	GTE30AA202_XB01	ALUM DOS PMP - B SUC VLV - OPN	OPN_FB	DI	DI[DRY]
21	CSSP-P-021	GTE30AA202_XB02	ALUM DOS PMP - B SUC VLV - CLS	CLS_FB	DI	DI[DRY]
22	CSSP-P-022	GTE30AA203_XB01	ALUM DOS PMP - C SUC VLV - OPN	OPN_FB	DI	DI[DRY]
23	CSSP-P-023	GTE30AA203_XB02	ALUM DOS PMP - C SUC VLV - CLS	CLS_FB	DI	DI[DRY]
24	CSSP-P-024	GTE30AA204_XB01	ALUM DOS PMP - D SUC VLV - OPN	OPN_FB	DI	DI[DRY]
25	CSSP-P-025	GTE30AA204_XB02	ALUM DOS PMP - D SUC VLV - CLS	CLS_FB	DI	DI[DRY]
26	CSSP-P-026	GTE30CL101	ALUM SOL DOS TNK - A -LVL	NA	AI	AI[4-20mA]
27	CSSP-P-027	GTE30CL102	ALUM SOL DOS TNK - B -LVL	NA	AI	AI[4-20mA]
28	CSSP-P-028	GTE30CL103	ALUM SOL DOS TNK -C -LVL	NA	AI	AI[4-20mA]
29	CSSP-P-029	GTE30CL104	ALUM SOL DOS TNK -D -LVL	NA	AI	AI[4-20mA]
30	CSSP-P-030	GTE30CP101	ALUM DOS PMP COMM DISCH PRESS	NA	AI	AI[4-20mA]
31	CSSP-P-031	GTE30CP102	ALUM DOS PMP COMM DISCH PRESS	NA	AI	AI[4-20mA]
32	CSSP-P-032	GTE10AA201_XB01	LIME SLR TRFR PMP - A SUC VLV - OPN	OPN_FB	DI	DI[DRY]
33	CSSP-P-033	GTE10AA201_XB02	LIME SLR TRFR PMP - A SUC VLV - CLS	CLS_FB	DI	DI[DRY]
34	CSSP-P-034	GTE10AA202_XB01	LIME SLR TRFR PMP - B SUC VLV - OPN	OPN_FB	DI	DI[DRY]
35	CSSP-P-035	GTE10AA202_XB02	LIME SLR TRFR PMP - B SUC VLV - CLS	CLS_FB	DI	DI[DRY]
36	CSSP-P-036	GTE10CL101	LIME SLK DOS TNK - A - LVL	NA	AI	AI[4-20mA]
37	CSSP-P-037	GTE10CL102	LIME SLK DOS TNK - B- LVL	NA	AI	AI[4-20mA]
38	CSSP-P-038	GTE10CL103	LIME SLK DOS TNK - C - LVL	NA	AI	AI[4-20mA]
39	CSSP-P-039	GTE10CP101	LIME SLR TRFR PMP COMM DISCH PRESS	NA	AI	AI[4-20mA]
40	CSSP-P-040	GTE10CP102	LIME SLR TRFR PMP COMM DISCH PRESS	NA	AI	AI[4-20mA]
41	CSSP-P-041	GTE20AA201_XB01	LIME SOL DOS PMP - A SUC VLV - OPN	OPN_FB	DI	DI[DRY]
42	CSSP-P-042	GTE20AA201_XB02	LIME SOL DOS PMP - A SUC VLV - CLS	CLS_FB	DI	DI[DRY]
43	CSSP-P-043	GTE20AA202_XB01	LIME SOL DOS PMP - B SUC VLV - OPN	OPN_FB	DI	DI[DRY]
44	CSSP-P-044	GTE20AA202_XB02	LIME SOL DOS PMP - B SUC VLV - CLS	CLS_FB	DI	DI[DRY]
45	CSSP-P-045	GTE20AA203_XB01	LIME SOL DOS PMP - C SUC VLV - OPN	OPN_FB	DI	DI[DRY]
46	CSSP-P-046	GTE20AA203_XB02	LIME SOL DOS PMP - C SUC VLV - CLS	CLS_FB	DI	DI[DRY]
47	CSSP-P-047	GTE20CL101	LIME SOL DOS TNK - A - LVL	NA	AI	AI[4-20mA]
48	CSSP-P-048	GTE20CL102	LIME SOL DOS TNK - B- LVL	NA	AI	AI[4-20mA]
49	CSSP-P-049	GTE20CL103	LIME SOL DOS TNK - C - LVL	NA	AI	AI[4-20mA]
50	CSSP-P-050	GTE20CP101	LIME DOS PMP COM DISCH PRESS	NA	AI	AI[4-20mA]
51	CSSP-P-051	GTE20CP102	LIME DOS PMP COM DISCH PRESS	NA	AI	AI[4-20mA]
52	CSSP-P-052	GTE40AA201_XB01	SYN FLOCC DOS PMP - A SUC VLV - OPN	OPN_FB	DI	DI[DRY]
53	CSSP-P-053	GTE40AA201_XB02	SYN FLOCC DOS PMP - A SUC VLV - CLS	CLS_FB	DI	DI[DRY]
54	CSSP-P-054	GTE40AA202_XB01	SYN FLOCC DOS PMP - B SUC VLV - OPN	OPN_FB	DI	DI[DRY]
55	CSSP-P-055	GTE40AA202_XB02	SYN FLOCC DOS PMP - B SUC VLV - CLS	CLS_FB	DI	DI[DRY]
56	CSSP-P-056	GTE40AA203_XB01	SYN FLOCC DOS PMP - C SUC VLV - OPN	OPN_FB	DI	DI[DRY]
57	CSSP-P-057	GTE40AA203_XB02	SYN FLOCC DOS PMP - C SUC VLV - CLS	CLS_FB	DI	DI[DRY]

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58	CSSP-P-058	GTE40CL101	SYN FLOCC DOS TNK - A - LVL	NA	AI	AI[4-20mA]
59	CSSP-P-059	GTE40CL102	SYN FLOCC DOS TNK - B - LVL	NA	AI	AI[4-20mA]
60	CSSP-P-060	GTE40CL103	SYN FLOCC DOS TNK - C - LVL	NA	AI	AI[4-20mA]
61	CSSP-P-061	GTE40CP101	SYN FLOCC DOS PMP COM DISCH PRESS	NA	AI	AI[4-20mA]
62	CSSP-P-062	GTE40CP102	SYN FLOCC DOS PMP COM DISCH PRESS	NA	AI	AI[4-20mA]
63	CSSP-P-063	GTF21AA201_XB01	SC O/L TO PF - 1 SLC GATE - OPN	OPN_FB	DI	DI[DRY]
64	CSSP-P-064	GTF21AA201_XB02	SC O/L TO PF - 1 SLC GATE - CLS	CLS_FB	DI	DI[DRY]
65	CSSP-P-065	GTF22AA201_XB01	SC O/L TO PF - 2 SLC GATE - OPN	OPN_FB	DI	DI[DRY]
66	CSSP-P-066	GTF22AA201_XB02	SC O/L TO PF - 2 SLC GATE - CLS	CLS_FB	DI	DI[DRY]
67	CSSP-P-067	GTF31AA201_XB01	CLRFR - 1 O/L GATE - OPN	OPN_FB	DI	DI[DRY]
68	CSSP-P-068	GTF31AA201_XB02	CLRFR - 1 O/L GATE - CLS	CLS_FB	DI	DI[DRY]
69	CSSP-P-069	GTF32AA202_XB01	CLRFR - 2 O/L GATE - OPN	OPN_FB	DI	DI[DRY]
70	CSSP-P-070	GTF32AA202_XB02	CLRFR - 2 O/L GATE - CLS	CLS_FB	DI	DI[DRY]
71	CSSP-P-071	GTF31AA202_XB01	CLRFR O/L to DIST CHMBR GATE - OPN	OPN_FB	DI	DI[DRY]
72	CSSP-P-072	GTF31AA202_XB02	CLRFR O/L to DIST CHMBR GATE - CLS	CLS_FB	DI	DI[DRY]
73	CSSP-P-073		UNASSIGNED	NA	AI	AI[4-20mA] live
74	CSSP-P-074		UNASSIGNED	NA	AI	AI[4-20mA] live
75	CSSP-P-075		UNASSIGNED	NA	AI	AI[4-20mA]
76	CSSP-P-076		UNASSIGNED	NA	AI	AI[4-20mA]
77	CSSP-P-077		UNASSIGNED	NA	AI	AI[4-20mA]
78	CSSP-P-078		UNASSIGNED	NA	AI	AI[4-20mA]
79	CSSP-P-079		UNASSIGNED	NA	AI	AI[4-20mA]
80	CSSP-P-080		UNASSIGNED	NA	AI	AI[4-20mA]
81	CSSP-P-081		UNASSIGNED	NA	AI	AI[4-20mA]
82	CSSP-P-082		UNASSIGNED	NA	AI	AI[4-20mA]
83	CSSP-P-083		UNASSIGNED	NA	AI	AI[4-20mA]
84	CSSP-P-084		UNASSIGNED	CLS_FB	DI	DI[DRY]
85	CSSP-P-085		UNASSIGNED	CLS_FB	DI	DI[DRY]
86	CSSP-P-086		UNASSIGNED	CLS_FB	DI	DI[DRY]
87	CSSP-P-087		UNASSIGNED	CLS_FB	DI	DI[DRY]
88	CSSP-P-088		UNASSIGNED	CLS_FB	DI	DI[DRY]
89	CSSP-P-089		UNASSIGNED	CLS_FB	DI	DI[DRY]
90	CSSP-P-090		UNASSIGNED	CLS_FB	DI	DI[DRY]
91	CSSP-P-091		UNASSIGNED	CLS_FB	DI	DI[DRY]
92	CSSP-P-092		UNASSIGNED	CLS_FB	DI	DI[DRY]
93	CSSP-P-093		UNASSIGNED	CLS_FB	DI	DI[DRY]
94	CSSP-P-094		UNASSIGNED	CLS_FB	DI	DI[DRY]
95	CSSP-P-095		UNASSIGNED	CLS_FB	DI	DI[DRY]

ANNEXURE - 1**FORMAT FOR PROVENNESS CERTIFICATE**

Sl.No.	Item Description	Plant No.1
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

Signature of authorized signatory.....

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TITLE:

TECHNICAL SPECIFICATION FOR
COAL HANDLING PLANT
RUN-OFF WATER TREATMENT SYSTEM
3X800 MW PATRATU STPP EXT.PH-I

BHEL DOCUMENTS NO.: PE-TS-434-157-A001

VOLUME-II-B

SECTION-D

REV. NO. 00

DATE:

SECTION-D
(GENERAL TECHNICAL REQUIRMENT)



**GENERAL TECHNICAL REQUIREMENT
FOR THE PROJECT/PACKAGE**

**EPC PACKAGE FOR
PATRATU SUPER THERMAL POWER STATION
EXPANSION PHASE-I (3x800 MW)**

**TECHNICAL SPECIFICATION
SECTION-VI, PART-C
BID DOC NO: CS-9585-001-2**



GENERAL TECHNICAL REQUIREMENTS

PART - C

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**EPC PACKAGE FOR
PATRATU SUPER THERMAL POWER STATION
EXPANSION PHASE-I (3x800 MW)**

**TECHNICAL SPECIFICATION
SECTION-VI, PART-C
BID DOC NO: CS-9585-001-2**



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EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3x800 MW)	TECHNICAL SPECIFICATION SECTION-VI, PART-C BID DOC NO: CS-9585-001-2



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EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3x800 MW)	TECHNICAL SPECIFICATION SECTION-VI, PART-C BID DOC NO: CS-9585-001-2

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS		
1.00.00	INTRODUCTION This part covers technical requirements which will form an integral part of the Contract. The following provisions shall supplement all the detailed technical specifications and requirements brought out in Section-VI, the Technical Specification and the Technical Data Sheets.		
2.00.00	BRAND NAME Whenever a material or article is specified or described by the name of a particular brand, manufacturer or vendor, the specific item mentioned shall be understood to be indicative of the function and quality desired, and not restrictive; other manufacturer's products may be considered provided sufficient information is furnished to enable the Employer to determine that the products proposed are equivalent to those named.		
3.00.00	BASE OFFER & ALTERNATE PROPOSALS The Bidder's proposal shall be based upon the use of equipment and material complying fully with the requirements specified herein. It is recognized that the Contractor may have standardized on the use of certain components, materials, processes or procedures different than those specified herein. Alternate proposals offering similar equipment based on the manufacturer's standard practice will also be considered, provided the base offer is in line with technical specifications and such proposals meet the specified design standards and performance requirement and are acceptable to the Employer. Sufficient amount of information for justifying such proposals shall be furnished to Employer alongwith the bid to enable the Employer to determine the acceptability of these proposals.		
4.00.00	COMPLETENESS OF FACILITIES		
4.01.00	Bidders may note that this is a turnkey contract. Each of the plant shall be engineered and designed in accordance with the specification requirement. All engineering and associated services are required to ensure a completely engineered plant shall be provided.		
4.02.00	All equipments furnished by the Contractor shall be complete in every respect, with all mountings, fittings, fixtures and standard accessories normally provided with such equipment and/or those needed for erection, completion and safe operation of the equipment and for the safety of the operating personnel, as required by applicable codes, though they may not have been specifically detailed in the respective specifications, unless included in the list of exclusions. All same standard components/ parts of same equipment provided, shall be interchangeable with one another.		
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-C BID DOC. NO.:CS-9585-001-2	GENERAL TECHNICAL REQUIREMENTS PAGE 1 OF 111

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
4.03.00	For the C&I systems, the Contractor shall be required to provide regular information about future upgrades and migration paths to the Employer.			
5.00.00	CODES & STANDARDS			
5.01.00	In addition to the codes and standards specifically mentioned in the relevant technical specifications for the equipment / plant / system, all equipment parts, systems and works covered under this specification shall comply with all currently applicable statutory regulations and safety codes of the Republic of India as well as of the locality where they will be installed, including the following : a) Indian Electricity Act b) Indian Electricity Rules c) Indian Explosives Act d) Indian Factories Act and State Factories Act e) Indian Boiler Regulations (IBR) f) Regulations of the Central Pollution Control Board, India g) Regulations of the Ministry of Environment & Forest (MoEF), Government of India h) Pollution Control Regulations of Department of Environment, Government of India i) State Pollution Control Board. (j.) Rules for Electrical installation by Tariff Advisory Committee (TAC). (k.) Building and other construction workers (Regulation of Employment and Conditions of services) Act, 1996 (l.) Building and other construction workers (Regulation of Employment and Conditions of services) Central Rules, 1998 (m.) Explosive Rules, 1983 (n.) Petroleum Act, 1984 (o.) Petroleum Rules, 1976, (p.) Gas Cylinder Rules, 1981			
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5.02.00	(q.) Static and Mobile Pressure Vessels (Unified) Rules, 1981 (r.) Workmen's Compensation Act, 1923 (s.) Workmen's Compensation Rules, 1924 (t.) NTPC Safety Rules for Construction and Erection (u.) NTPC Safety Policy (v.) Any other statutory codes / standards / regulations, as may be applicable. Unless covered otherwise in the specifications, the latest editions (as applicable as on date of bid opening), of the codes and standards given below shall also apply : a) Bureau of Indian standards (BIS) b) Japanese Industrial Standards (JIS) c) American National Standards Institute (ANSI) d) American Society of Testing and Materials (ASTM) e) American Society of Mechanical Engineers (ASME) f) American Petroleum Institute (API) g) Standards of the Hydraulic Institute , U.S.A. h) International Organization for Standardization (ISO) i) Tubular Exchanger Manufacturer's Association (TEMA) j) American Welding Society (AWS) k) National Electrical Manufacturers Association (NEMA) l) National Fire Protection Association (NFPA) m) International Electro-Technical Commission (IEC) n) Expansion Joint Manufacturers Association (EJMA) o) Heat Exchange Institute (HEI) p) IEEE standard		
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5.03.00 5.04.00 5.05.00 5.06.00 5.07.00 5.08.00 6.00.00 6.01.00	q) JEC standard Other International/ National standards such as DIN, VDI, BS, GOST etc. shall also be accepted for only material codes and manufacturing standards, subject to the Employer's approval, for which the Bidder shall furnish, adequate information to justify that these standards are equivalent or superior to the standards mentioned above. In all such cases the Bidder shall furnish specifically the variations and deviations from the standards mentioned elsewhere in the specification together with the complete word to word translation of the standard that is normally not published in English. As regards highly standardised equipments such as Steam Turbine and Generator, National /International standards such as JIS, DIN, VDI, ISO, SEL, SEW, VDE, IEC & VGB shall also be considered as far as applicable for Design, Manufacturing and Testing of the respective equipment. However, for those of the above equipment not covered by these National / International standards, established and proven standards of manufacturers shall also be considered. In the event of any conflict between the codes and standards referred to in the above clauses and the requirement of this specification, the requirement of Technical Specification shall govern. Two (2) English language copies of all national and international codes and/or standards used in the design of the plant and equipment shall be provided by the Contractor to the Employer within two calendar months from the date of the Notification of Award. In case of any change in codes, standards & regulations between the date of bid opening and the date when vendors proceed with fabrication, the Employer shall have the option to incorporate the changed requirements or to retain the original standard. It shall be the responsibility of the Contractor to bring to the notice of the Employer such changes and advise Employer of the resulting effect. A detailed list of standards apart from those mentioned in the respective detailed specifications in other parts of Section-VI to which all equipment/systems/civil works should conform as indicated in this Part C and elsewhere in the specification. EQUIPMENT FUNCTIONAL GUARANTEE The functional guarantees of the equipment under the scope of the Contract is given in Section-VI Part - A & B of Technical Specifications. These guarantees shall supplement the general functional guarantee provisions covered under Defect liabilities Section-IV, General Conditions of Contract.		
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6.02.00	Liquidated damages for shortfall in meeting functional guarantee(s) during the performance and guarantee tests shall be assessed and recovered from the Contractor as specified elsewhere in this specification.			
7.00.00	DESIGN OF FACILITIES/ MAINTENANCE & AVAILABILITY CONSIDERATIONS			
7.01.00	DESIGN OF FACILITIES			
7.02.00	All the design procedures, systems and components proposed shall have already been adequately developed and shall have demonstrated good reliability under similar conditions elsewhere.			
	The Contractor shall be responsible for the selection and design of appropriate equipments to provide the best coordinated performance of the entire system. The basic requirements are detailed out in various clauses of the Technical Specifications. The design of various components, assemblies and subassemblies shall be done so that it facilitates easy field assembly and dismantling. All the rotating components shall be so selected that the natural frequency of the complete unit is not critical or close to the operating range of the unit.			
	MAINTENANCE AND AVILABILITY CONSIDERATIONS			
	Equipment/works offered shall be designed for high availability, low maintenance and ease of maintenance. The Bidder shall specifically state the design features incorporated to achieve high degree of reliability/ availability and ease of maintenance. The Bidder shall also furnish details of availability records in the reference plants stated in his experience list.			
	Bidder shall state in his offer the various maintenance intervals, spare parts and man-hour requirement during such operation. The intervals for each type of maintenance namely inspection of the furnace, inspection of the entire hot gas path and the minor and major overhauls shall be specified in terms of fired hours , clearly defining the spare parts and man-hour requirement for each stage.			
	Lifting devices i.e. hoists and chain pulley jacks ,etc. shall be provided by the contractor for handling of any equipment or any of its part having weight in excess of 500 Kgs during erection and maintenance activities.			
	Lifting devices like lifting tackles, slings, etc. to be connected to hook of the hoist / crane shall be provided by the contractor for lifting the equipment and accessories covered under the specification.			
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8.00.00	DOCUMENTS, DATA AND DRAWINGS TO BE FURNISHED BY CONTRACTOR			
8.01.00	Bidders may note that this is a turnkey contract. Each of the plant and equipment shall be fully integrated, engineered and designed to perform in accordance with the technical specification. All engineering and technical services required to ensure a completely engineered plant shall be provided in respect of mechanical, electrical and power systems, control & instrumentation, civil & structural works. The Contractor shall furnish engineering data /drawings in accordance with the schedule of information as specified in Technical Data Sheets and Technical Specification. A comprehensive engg and quality coordination procedure shall be finalized with the successful bidder covering salient features as described in this section of specifications.			
8.02.00	The number of copies/prints/CD-ROMs/manuals to be furnished for various types of document is given in Annexure-VI to this Part-C, Section-VI of the Technical Specification.			
8.03.00	The documentation that shall be provided by the Contractor is indicated in the various sections of specification. This documentation shall include but not be limited to the following:			
8.03.01	A) BASIC ENGINEERING DOCUMENTATION Prior to commencement of the detailed engineering work, the Contractor shall furnish a Plant Definition Manual within 12 weeks from the date of the Notification of Award. This manual shall contain the following as a minimum: i) System description of all the mechanical, electrical, control & instrumentation & civil systems. ii) Technology scan for each system / sub-system & equipment. iii) Selection of appropriate technology / schemes for various systems/ subsystems including techno-economic studies between various options. iv) Optimisation studies including thermal cycle optimisation. v) Sizing criteria of all the systems, sub-systems/ equipments/ structures/ equipment foundations alongwith all calculations justifying and identifying the sizing and the design margins.			
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	vi) Schemes and Process & Instrumentation diagrams for the various systems/ sub-system with functional write-ups. vii) Water Balance diagram. viii) Operation Philosophy and the control philosophy of the Main Plant and other plants. ix) General Layout plan of the power station incorporating all facilities in Bidder's as well as those in the Employer's scope. This drawing shall also be furnished in the form of CD-ROMs to the Employer for engineering of areas not included in bidder's scope. x) Basic layouts and cross sections of the main plant building (various floor elevations), boiler, fuel oil area, transformer yard, switchyard and other areas included in the scope of the bidder. xi) Documentation in respect of Quality Assurance System as listed out elsewhere in this specification. The successful bidder shall furnish within three (3) weeks from the date of Notification of Award, a list of contents of the Plant Definition Manual (PDMs) including techno-economic studies, which shall then be mutually discussed & finalised with the Employer. B) DETAILED ENGINEERING DOCUMENTS i) General layout plan of the station. ii) Layouts, general arrangements, elevations and cross-sections drawings for all the equipment and facilities of the plant. iii) Flow diagram, process and instrumentation diagrams along with write up and system description. iv) Start up curves for boiler and both turbines and boiler combined together as a unit for various start ups, viz. cold, warm and hot start up. v) Piping isometric, composite layout and fabrication drawings. vi) Piping engineering diagrams, pipe and fittings schedules, valve schedules, hanger and support schedules, insulation schedules.			
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	vii) Technical data sheets for all bought out and manufactured items. Contractor shall use the Employer's specifications as a base for placement of orders on their sub vendors. viii) Detailed design calculations for components, system, piping etc., wherever applicable including sizing calculations for all auxiliaries like mills, fans, BFPs, CEPs, Heaters/ Deaerators, Condensers, vacuum pumps etc. ix) Boiler pressure part schedule and sizing calculations. Boiler performance data and boiler design dossier. x) Transient, hydraulic and thermal stress analysis of piping and system wherever applicable & input and output data alongwith stress analysis isometrics showing nodes.. xi) Thermal cycle information (heat balance diagrams, boiler performance calculations, condenser and heat exchanger thermal calculations etc.). xii) Characteristic Curves/ Performance Correction Curves. Hydraulic & Mechanical design calculations for condensers & heaters. xiii) Comprehensive list of all terminal points which interface with Employer's facilities, giving details of location, terminal pressure, temperature, fluid handled & end connection details, forces, moments etc. xiv) Power supply single line diagram, block logics, control schematics, electrical schematics, etc. xv) Protection system diagrams and relay settings. xvi) Cables schedules and interconnection diagrams. xvii) Cable routing plan. xviii) Instrument schedule, measuring point list, I/O list, Interconnection & wiring diagram, functional write-ups, installation drawings for field mounted instruments, logic diagrams, control schematics, wiring and tubing diagrams of panels and enclosures etc. Drawings for open loop and close loop controls (both hardware and software). Motor list and valve schedule including type of actuator etc. xix) Alarm and annunciation/ Sequence of Event (SOE) list and alarms & trip set points.			
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8.03.02	xx) Sequence and protection interlock schemes. xxi) Type test reports, insulation co-ordination study report and power system stability study report. xxii) Control system configuration diagrams and card circuit diagrams and maintenance details. xxiii) Detailed DDCMIS system manuals. xxiv) Detailed flow chart for digital control system. xv) Mimic diagram layout, Assignment for other application engg. xxvi) Civil and Structural works drawings and documents for all structures, facilities, architectural works, foundations underground and overground works and super-structural works as included in the scope of the bidder civil calculation sheets including structural analysis and design alongwith output results. xxvii) Underground facilities, levelling ,sanitary, land scaping drawings. xxviii) Geotechnical investigation and site survey reports (if and as applicable). xxix) Model study reports wherever applicable. xxx) Functional & guarantee test procedures and test reports. xxxi) Documentation in respect of Quality Assurance System, and Documentation in respect of Commissioning, as listed out elsewhere in this specification. The Contractor's while sumitting the above documents/ drawings for approval/ reference as the case may be, shall mark on each copy of submission the reference letter alongwith the date vide which the submissions are made.			
	INSTRUCTION MANUALS The Contractor shall submit to the Employer, draft Instruction Manuals for all the equipments covered under the Contract by the end of one year from the date of his acceptance of the Letter of Award. The Instruction manuals shall contain full details required for erection, commissioning, operation and maintenance of each equipment. The manual shall be specifically compiled for this project. After finalisation and approval of the Employer the Instruction Manuals shall be submitted as indicated in Annexure-IV . The Contract shall not be considered to be completed			
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	for purposes of taking over until the final Instructions manuals have been supplied to the Employer. The Instruction Manuals shall comprise of the following. A) ERECTION MANUALS The erection manuals shall be submitted atleast three (3) months prior to the commencement of erection activities of particular equipment/system. The erection manual should contain the following as a minimum. a) Erection strategy. b) Sequence of erection. c) Erection instructions. d) Critical checks and permissible deviation/tolerances. e) List of tool, tackles, heavy equipments like cranes, dozers, etc. f) Bill of Materials g) Procedure for erection and General Safety procedures to followed during erection/installation. h) Procedure for initial checking after erection. i) Procedure for testing and acceptance norms. j) Procedure / Check list for pre-commissioning activities. k) Procedure / Check list for commissioning of the system. l) Safety precautions to be followed in electrical supply distribution during erection. B) OPERATION & MAINTENANCE MANUALS a) The manual shall be a two rim PVC bound stiff sided binder able to withstand constant usage or where a thicker type is required it shall have locking steel pins, the size of the manual shall not be larger than international size A3. The cover shall be printed with the Project Name, Services covered and Volume / Book number Each section of the manual shall be divided by a stiff divider of the same size as the holder. The dividers shall clearly state the section number and title. All written instructions within the manual not provided by the			
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	manufacturers shall be typewritten with a margin on the left hand side. b) The arrangement and contents of O & M manuals shall be as follows : 1) <u>Chapter 1 - Plant Description</u> : To contain the following sections specific to the equipment/system supplied (a) Description of operating principle of equipment / system with schematic drawing / layouts. (b) Functional description of associated accessories / controls. Control interlock protection write up. (c) Integrated operation of the equipment alongwith the intended system. (The is to be given by the supplier of the Main equipment by taking into account the operating instruction given by the associated suppliers). (d) Exploded view of the main equipment, associated accessories and auxiliaries with description. Schematic drawing of the equipment alongwith its accessories and auxiliaries. (e) Design data against which the plant performance will be compared. (f) Master list of equipments, Technical specification of the equipment/ system and approved data sheets. (g) Identification system adopted for the various components, (it will be of a simple process linked tagging system). (h) Master list of drawings (as built drawing - Drawings to be enclosed in a separate volume). 2) <u>Chapter 2.0 - Plant Operation</u>: To contain the following sections specific to the equipment supplied (a) Protection logics provided for the equipment alongwith brief philosophy behind the logic, Drawings etc. (b) Limiting values of all protection settings. (c) Various settings of annunciation/interlocks provided.			
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	(d) Startup and shut down procedure for equipment alongwith the associated systems in step mode. (e) Do's and Don'ts related to operation of the equipment. (f) Safety precautions to be take during normal operation. Emergency instruction on total power failure condition/lubrication failure/any other conditions. (g) Parameters to be monitored with normal value and limiting values. (h) Equipment isolating procedures. (i) Trouble shooting with causes and remedial measures. (j) Routine testing procedure to ascertain healthiness of the safety devices alongwith schedule of testing. (k) Routine Operational Checks, Recommended Logs and Records (l) Change over schedule if more than one auxiliary for the same purpose is given. (m) Preservation procedure on long shut down. (n) System/plant commissioning procedure. 3) <u>Chapter 3.0 - Plant Maintenance</u>- To contain the following sections specific to the equipment supplied. (a) Exploded view of each of the equipments. Drawings alongwith bill of materials including name, code no. & population. (b) Exploded view of the spare parts and critical components with dimensional drawings (In case of Electronic cards, the circuit diagram to be given) and spare parts catalogue for each equipment. (c) List of Special T/ P required for Overhauling /Trouble shooting including special testing equipment required for calibration etc. (d) Stepwise dismantling and assembly procedure clearly specifying the tools to be used, checks to be made, records to be maintained etc. Clearance to be maintained etc.			
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8.03.03	(e)	Preventive Maintenance schedules linked with running hours/calendar period alongwith checks to be carried out.			
	(f)	Overhauling schedules linked with running hours/calendar period alongwith checks to be done.			
	(g)	Long term maintenance schedules			
	(h)	Consumables list alongwith the estimated quantity required during normal running and during maintenance like Preventive Maintenance and Overhauling.			
	(i)	List of lubricants with their Indian equivalent, Lubrication Schedule including charts showing lubrication checking, testing and replacement procedure to be carried daily, weekly, monthly & at longer intervals to ensure trouble free operation and quantity required for complete replacement..			
	(j)	Tolerance for fitment of various components.			
	(k)	Details of sub vendors with their part no. in case of bought out items.			
	(l)	List of spare parts with their Part No, total population, life expediency & their interchangeability with already supplied spares to NTPC.			
	(m)	List of mandatory and recommended spare list along with manufacturing drawings, material specification & quality plan for fast moving consumable spares.			
	(n)	Lead time required for ordering of spares from the equipment supplier, instructions for storage and preservation of spares.			
8.03.03	(o)	General information on the equipment such as modification carried out in the equipment from its inception, equipment population in the country / foreign country and list of utilities where similar equipments have been supplied.			
	After finalization and approval of the Employer, the O & M Manuals shall be submitted as indicated in Annexure-VI. The Contract shall not be considered to be completed for purposes of taking over until the final Instructions manuals (both erection and O & M manuals have been supplied to the Employer.				
If after the commissioning and initial operation of the plant, the instruction manuals (Erection and /or O &M manuals) require modifications/additions/ changes, the same shall be incorporated and the updated final instruction manuals shall be submitted by					
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	the Contractor to the Employer for records and number of copies shall be as mentioned in Annexure-VI.		
8.03.03	PLANT HANDBOOK AND PROJECT COMPLETION REPORT		
8.03.03.01	PLANT HANDBOOK		
	The Contractor shall submit to the Employer a preliminary plant hand book preferably in A-4 size sheets which shall contain the design and performance data of various plants, equipments and systems covering the complete project including i) Design and performance data. ii) Process & Instrumentation diagrams. iii) Single line diagrams. iv) Sequence & Protection Interlock Schemes. v) Alarm and trip values. vi) Performance Curves. vii) General layout plan and layout of main plant building and auxiliary buildings viii) Important Do's & Don't's The plant handbook shall be submitted within twelve (12) months from the date of award of contract. After the incorporation of Employer's comments, the final plant handbook complete in all respects shall be submitted three (3) months before start-up and commissioning activities.		
8.03.03.02	PROJECT COMPLETION REPORT		
	The Contractor shall submit a Project Completion Report at the time of handing over the plant.		
8.03.04	DRAWINGS		
	a) i) All the plant layouts shall be made in computerised 3D modelling system. The Employer reserves the right to review the 3D model at different stages during the progress of engineering. The layout drawings submitted for Employer's review shall be fully dimensioned and extracted from 3D model after interference check.		
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	ii) All documents submitted by the Contractor for Employer's review shall be in electronic form (soft copies) along with the desired number of hard copies as per Annexure-VI of Part-C. The soft copies shall be uploaded by the vendors in C-folders, a Web-based system of NTPC ERP, for which a username and password will be allotted to the new vendor by NTPC. Similarly, the vendor can download the drawings/documents, approved/ commented by NTPC, through above site. The soft copies of identified drawings/documents shall be in pdf format, whereas the attachments/reply to the submitted document(s) can be in .doc, .xls, .pdf, .dwg or .std formats. iii) Final copies of the approved drawings along with requisite number of hard copies shall be submitted as per Annexure-VI of Part-C. iv) Contractor shall prepare the model of all the facilities located in Main Power Block area, covering Transformer Yard, TG building (including all facilities), Boiler area, ESP area, chimney area and any other facility located in Main Plant Block area in an integrated & intelligent 3D software solution using rule based, data centric 3D design software with equipment drawings, data sheets, intelligent P&ID correlated with intelligent 3D Model, BOQ, schematics and logic diagrams etc. attached to the respective equipment / systems in the aforesaid 3D model. All piping layouts, equipment layouts, floor plans, ducting layout (Air/flue gas, A/C, Ventilation etc.), General Arrangement drawings of major buildings, structural arrangement drawings and RCC layout drawings shall necessarily be extracted from the aforesaid 3D model and submitted for employer's review along with the 3D review model to enable NTPC to review and approve these drawings. Contractor shall prepare and provide 3D design review model (network ready, which shall include visual interference check, walk-through animation, video simulation for major equipment placement and removal, visual effect, photo realism etc.), which is extracted from intelligent 3D model and shall make a presentation of the same every 3 months from LOA to enable NTPC to review the progress of engineering or as & when required by employer. After the completion of engineering of respective area i.e. TG building/ Boiler/ ESP etc., the corresponding complete 3D review model shall be handed over to the employer for its reference.			
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	b) All documents/text information shall be in latest version of MS Office/MS Excel/PDF format as applicable. c) All drawings submitted by the Contractor including those submitted at the time of bid shall be in sufficient detail indicating the type, size, arrangement, weight of each component for packing and shipment, the external connection, fixing arrangement required, the dimensions required for installation and interconnections with other equipments and materials, clearance and spaces required between various portions of equipment and any other information specifically requested in the drawing schedules. d) Each drawing submitted by the Contractor (including those of subvendors) shall bear a title block at the right hand bottom corner with clear mention of the name of the Employer, the system designation, the specifications title, the specification number, the name of the Project, drawing number and revisions. If standard catalogue pages are submitted the applicable items shall be indicated therein. All titles, notings, markings and writings on the drawing shall be in English. All the dimensions should be in metric units. e) The drawings submitted by the Contractor (or their subvendors) shall bear Employer's drawing number in addition to contractor's (their sub-vendor's) own drawing number. Employer's drawing numbering system shall be made available to the successful bidder so as to enable him to assign Employer's drawing numbers to the drawings to be submitted by him during the course of execution of the Contract. The Contractor shall also furnish a "Master Drawing List" which shall be a comprehensive list of all drawings/ documents/ calculations envisaged to be furnished by him during the detailed engineering to the Employer. Such list should clearly indicate the purpose of submission of these drawings i.e. "FOR APPROVAL" or "FOR INFORMATION ONLY". Similarly, all the drawings/ documents submitted by the Contractor during detailed engineering stage shall be marked "FOR APPROVAL" or "FOR INFORMATION" prior to submission. Further, space shall be identified on each drawing for Approval stamp and electronic signature. f) The furnishing of detailed engineering data and drawings by the Contractor shall be in accordance with the time schedule for the project . The review of these documents/ data/ drawings by the Employer will cover only general conformance of the data/ drawings/ documents to the specifications and contract, interfaces with the equipments provided by others and external connections & dimensions which might affect plant layout. The review by the Employer should not be construed to be a thorough review of all dimensions, quantities and details of the equipments, materials, any devices or items indicated or the accuracy of the information submitted. The review and/ or		
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	approval by the Employer/ Project Manager shall not relieve the Contractor of any of his responsibilities and liabilities under this contract. g) After the approval of the drawings, further work by the Contractor shall be in strict accordance with these approved drawings and no deviation shall be permitted without the written approval of the Employer. h) All manufacturing, fabrication and execution of work in connection with the equipment / system, prior to the approval of the drawings, shall be at the Contractor's risk. The Contractor is expected not to make any changes in the design of the equipment /system, once they are approved by the Employer. However, if some changes are necessitated in the design of the equipment/system at a later date, the Contractor may do so, but such changes shall promptly be brought to the notice of the Employer indicating the reasons for the change and get the revised drawing approved again in strict conformance to the provisions of the Technical Specification. i) Drawings shall include all installations and detailed piping layout drawings. Layout drawings for all piping of 65 mm and larger diameter shall be submitted for review/ approval of Employer prior to erection. Small diameter pipes shall however be routed as per site conditions in consultation with site authority/ representative of Employer based on requirements of such piping indicated in approved/ finalised Flow Scheme/ Process & Instrumentation Diagrams and/or the requirements cropping up for draining & venting of larger diameter piping or otherwise after their erection as per actual physical condition for the entire scope of work of this turnkey package. Assessing & anticipating the requirement and supply of all piping and equipment shall be done by the contractor well in advance so as not to hinder the progress of piping & equipment erection, subsequent system charging and its effective draining & venting arrangement as per site suitability. j) As Built Drawings After final acceptance of individual equipment / system by the Employer, the Contractor will update all original drawings and documents for the equipment / system to "as built" conditions and submit no. of copies as per Annexure VI. k) Drawings must be checked by the Contractor in terms of its completeness, data adequacy and relevance with respect to Engineering schedule prior to submission to the Employer. In case drawings are found to be submitted without proper checking by the Contractor, the same shall not be reviewed and returned to the Contractor for re-submission. The contractor shall make a visit to site to see the existing facilities and understand the layout			
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8.04.00	completely and collect all necessary data/ drawings at site which are needed as an input to the engineering. The contractor shall do the complete engineering including interfacing and integration of all his equipment, systems & facilities within his scope of work as well as interface engineering & integration of systems, facilities, equipment & works under Employer's scope and submit all necessary drawings/ documents for the same. l) The Contractor shall submit adequate prints of drawing / data / document for Employer's review and approval. The Employer shall review the drawings and return soft copy to the Contractor authorizing either to proceed with manufacture or fabrication, or marked to show changes desired. When changes are required, drawings shall be re-submitted promptly, with revisions clearly marked, for final review. Any delays arising out of the failure of the Contractor to submit/rectify and resubmit in time shall not be accepted as a reason for delay in the contract schedule. m) All engineering data submitted by the Contractor after final process including review and approval by the Project Manager/ Employer shall form part of the contract documents and the entire works covered under these specification shall be performed in strict conformity with technical specifications unless otherwise expressly requested by the Project Manager in writing.				
	ENGINEERING INFORMATION SUBMISSION SCHEDULE Prior to the award of Contract, a Detailed Engineering Information Submission Schedule shall be tied up with the Employer. For this, the bidder shall furnish a detailed list of engineering information alongwith the proposed submission schedule. This list would be a comprehensive one including all engineering data / drawings / information for all bought out items and manufactured items. The information shall be categorised into the following parts. i) Information that shall be submitted for the approval to the Employer before proceeding further, and ii) Information that would be submitted for Employer's information only. The Master Drawing List(MDL) shall be updated periodically and submitted to the employer, highlighting the changes made in MDL. The schedule should allow adequate time for proper review and incorporation of changes/ modifications, if any, to meet the contract without affecting the equipment delivery schedule and overall project schedule. The early submission of drawings and data is as important as the manufacture and delivery of equipment and hardware and this shall be duly considered while determining the overall performance and progress.				
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8.05.00 8.05.01 8.05.02 8.05.03	Engineering Co-ordination Procedure The following principal coordinators will be identified by respective organizations at time of award of contract : NTPC Engineering Coordinator (NTPC EC) : Name : _____ Designation : _____ Address : _____ a) Postal : _____ b) Telegraphic / e-Mail : _____ c) FAX : _____ TELEPHONE : _____ Contractor's/ Vendor's Engineering Coordinator (VENDOR EC): Name : _____ Designation : _____ Address : _____ a) Postal : _____ b) Telegraphic / e-Mail : _____ c) FAX : _____ TELEPHONE : _____ All engineering correspondence shall be in the name of above coordinators on behalf of the respective organizations. Contractor's/Vendor's Drawing Submission and Approval Procedure : a) All data/information furnished by Vendor in the form of drawings/ documents/catalogues or in any other form for NTPC's information/ interface and or review and approval are referred by the general term "drawings". b) The 'Master drawings list' indicating titles, Drawing Number, Date of submission and approval etc. shall be finalised mutually between Contractor and Employer before the award of contract. This list shall be updated if required at suitable interval during detailed engineering.	
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	c) All drawings (including those of subvendor's) shall bear at the right hand bottom corner the 'title plate' with all relevant information duly filled in. The Contractor shall furnish this format to his subvendor along with his purchase order for subvendor's compliance. d) Employer and contractor shall follow their own numbering systems for the drawings. However, Employer shall intimate the contractor, NTPC drawing number on receipt of the first submission of each drawing. Vendor, thereafter, shall indicate NTPC's drawing number in subsequent Submission, in the space provided for this purpose in title plate, in addition to his own drawing number. e) The contractor shall make a visit to site to see the existing facilities and understand the layout completely and collect all necessary data / drawings at site which are needed as an input to the engineering. The contractor shall do the complete engineering including interfacing and integration of all his equipment, systems & facilities within his scope of work as well as interface engineering & integration of systems, facilities, equipment & works under Employer's scope and submit all necessary drawings/ documents for the same. f) Drawings must be checked by the Contractor in terms of its completeness, data adequacy and relevance with respect to engineering schedule prior to submission to the Employer. In case drawings are found to be submitted without proper endorsement for checking by the Contractor, the same shall not be reviewed and returned to the Contractor for re-submission. g) The Contractor shall submit adequate prints of drawing / data / document for Employer's review and approval. The drawings submitted by the Contractor/vendor shall be reviewed by NTPC and their comments shall be forwarded within four (4) weeks of receipt of drawings. Upon review of each drawing, depending on the correctness and completeness of the drawing, the same will be categorized and approval accorded in one of the following categories : CATEGORY- I: Approved CATEGORY- II Approved, subject to incorporation of comments/ modification as noted. Resubmit revised drawing incorporating the comments. CATEGORY –III Not approved. Resubmit revised drawings for approval after incorporating comments/ modification as noted. CATEGORY -IV For information and records.		
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	h) Contractor shall resubmit the drawings approved under Category II, III & IV within three (3) weeks of receipt of comments on the drawings, incorporating all comments. Every revision of the drawing shall bear a revision index wherein such revisions shall be highlighted in the form of description or marked up in the drawing identifying the same with relevant revision Number enclosed in a triangle (eg. 1, 2, 3 etc). Contractor shall not make any changes in the portions of the drawing other than those commented. If changes are required to be made in the portions already approved, the Contractor shall resubmit the drawing identifying the changes for Employer's review and approval. Drawings resubmitted shall show clearly the portions where the same are revised marking the relevant revision numbers and Employer shall review only such revised portion of documents. i) In case, the Contractor/ Vendor does not agree with any specific comment, he shall furnish the explanation for the same to NTPC for consideration. In all such cases the Contractor shall necessarily enclose explanations along with the revised drawing (taking care of balance comments) to avoid any delay and/or duplication in review work. j) It is responsibility of the Contractor/ Vendor to get all the drawings approved in the Category I & IV (as the case may be) and complete engineering activities within the agreed schedule. Any delay arising out of submission and modification of drawings shall not alter the contract completion schedule. k) If Contractor/ Vendor fails to resubmit the drawings as per the schedule, construction work at site will not be held up and work will be carried out on the basis of comments furnished on previous issues of the drawing. l) These comments will be taken care by the contractor while submitting the revised drawing. The contractor shall use a single transmittal for drawings. Submission. This shall include transmittal numbers and date, number of copies being sent, names of the agencies to whom copies being sent, drawing number and titles, remarks or special notes if any etc.		
8.06.00	ENGINEERING PROGRESS AND EXCEPTION REPORT		
8.06.01	The Contractor shall submit every month an Engineering progress and Exception Report giving the status of each engineering information including a) A list of drawings/engineering information which remains unapproved for more than four (4) weeks after the date of first submission b) Drawings which were not submitted as per agreed schedule.		
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8.06.02	The draft format for this report shall be furnished to the Employer within four (4) weeks of the award of the contract, which shall then be discussed and finalised with the Employer.			
9.00.00	TECHNICAL CO-ORDINATION MEETING			
9.01.00	The Contractor shall be called upon to organise and attend monthly Design/ Technical Co-ordination Meetings (TCMs) with the Employer/Employer's representatives and other Contractors of the Employer during the period of contract. The Contractor shall attend such meetings at his own cost at NEW DELHI / NOIDA or at mutually agreed venue as and when required and fully co-operate with such persons and agencies involved during the discussions.			
9.02.00	The Contractor should note that Time is the essence of the contract. In order to expedite the early completion of engineering activities, the Contractor shall submit all drawings as per the agreed Engineering Information Submission Schedule. The drawings submitted by the Contractor will be reviewed by the Employer as far as practicable within three (3) weeks from the date of receipt of the drawing. The comments of the Employer shall then be discussed across the table during the above Technical Co-ordination Meeting (s) wherein best efforts shall be made by both sides to ensure the approval of the drawing.			
9.02.01	The Contractor shall ensure availability of the concerned experts / consultants/ personnel who are empowered to take necessary decisions during these meetings. The Contractor shall be equipped with necessary tools and facilities so that the drawings/documents can be resubmitted after incorporating necessary changes and approved during the meeting itself.			
9.02.02	Should any drawing remain unapproved for more than six (6) weeks after it's first submission, this shall be brought out in the monthly Engineering Progress and Exception Report with reasons thereof.			
9.03.0	Any delays arising out of failure by the Contractor to incorporate Employer's comments and resubmit the same during the TCM shall be considered as a default and in no case shall entitle the Contractor to alter the Contract completion date.			
10.00.00	DESIGN IMPROVEMENTS The Employer or the Contractor may propose changes in the specification of the equipment or quality thereof and if the parties agree upon any such changes the specification shall be modified accordingly. If any such agreed upon change is such that it affects the price and schedule of completion, the parties shall agree in writing as to the extent of any changing the price and/or schedule of completion before the Contractor proceeds with the change.			
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	Following such agreement, the provision thereof, shall be deemed to have been amended accordingly.		
11.00.00	EQUIPMENT BASES		
	A cast iron or welded steel base plate shall be provided for all rotating equipment which is to be installed on a concrete base, unless otherwise specifically agreed to by the Employer. Each base plate shall support the unit and its drive assembly, shall be of a neat design with pads for anchoring the units, shall have a raised lip all around, and shall have threaded drain connections.		
12.00.00	PROTECTIVE GUARDS		
	Suitable guards shall be provided for protection of personnel on all exposed rotating and/or moving machine parts. All such guards shall be designed for easy installation and removal for maintenance purpose.		
13.00.00	LUBRICANTS, SERVO FLUIDS AND CHEMICALS		
13.01.00	All the first fill and one year's topping requirement of consumables such as greases, oils, lubricants, servo fluids / control fluids, gases (excluding H ₂ , CO ₂ and N ₂ for generator) and essential chemicals etc. which will be required to put the equipment covered under the scope of specifications into successful commissioning/initial operation and to establish completion of facilities shall be supplied by the contractor. Suitable standard lubricants as available in india are desired. Efforts should be made to limit the variety of lubricants to minimum.		
	Bidder scope shall also include supply of H ₂ , CO ₂ and N ₂ as applicable for the generator till successful commissioning of generator. Bidder shall also supply a quantity not less than 10% of the full charge of each variety of lubricants, servo fluids, gases, chemicals etc (as detailed above) used which is expected to be utilized during the first year of operation. This additional quantity shall be supplied in separate containers.		
13.02.00	As far as possible lubricants marketed by the Indian Oil Corporation shall be used. The variety of lubricants shall be kept to a minimum possible. Detailed specifications for the lubricating oil, grease, gases, servo fluids, control fluids, chemicals etc. required for the complete plant covered herein shall be furnished. On completion of erection, a complete list of bearings/ equipment giving their location and identification marks shall be furnished to the Employer alongwith lubrication requirements.		
14.00.00	LUBRICATION		
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14.01.00	Equipment shall be lubricated by systems designed for continuous operation. Lubricant level indicators shall be furnished and marked to indicate proper levels under both standstill and operating conditions.			
15.00.00	MATERIAL OF CONSTRUCTION			
15.01.00	All materials used for the construction of the equipment shall be new and shall be in accordance with the requirements of this specification. Materials utilised for various components shall be those which have established themselves for use in such applications.			
16.00.00	RATING PLATES, NAME PLATES & LABELS			
16.01.00	Each main and auxiliary item of plant shall have permanently attached to it in a conspicuous position, a rating plate of non-corrosive material upon which shall be engraved manufacturer's name, equipment, type or serial number together with details of the ratings, service conditions under which the item of plant in question has been designed to operate, and such diagram plates as may be required by the Employer.			
16.02.00	Each item of plant shall be provided with nameplate or label designating the service of the particular equipment. The inscriptions shall be approved by the Employer or as detailed in appropriate section of the technical specifications.			
16.03.00	Such nameplates or labels shall be of white nonhygroscopic material with engraved black lettering or alternately, in the case of indoor circuit breakers, starters, etc. of transparent plastic material with suitably coloured lettering engraved on the back.			
16.04.00	Items of plant such as valves, which are subject to handling, shall be provided with an engraved chromium plated nameplate or label with engraving filled with enamel. The name plates for valves shall be marked in accordance with MSS standard SP-25 and ANSI B 16.34 as a minimum.			
16.05.00	Hanger/ support numbers shall be marked on all pipe supports, anchors, hangers, snubbers and restraint assemblies. Each constant and variable spring support shall also have stamped upon it the designed hot and cold load which it is intended to support.			
16.06.00	Valves, steam traps and strainers shall be identified by Employer's tag number of a metal tap permanently attached to non pressure parts such as the yoke by a stainless steel wire.			
16.07.00	Safety and relief valves shall be provided with the following: a) Manufacturer's identification.			
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	b) Nominal inlet and outlet sizes in mm. c) Set pressure in Kg/cm² (abs). d) Blowdown and accumulation as percentage of set pressure. e) Certified capacity in Kg of saturated steam per hour or in case of liquid certified capacity in litres of water per minute.		
16.08.00	All such plates, instruction plates, etc. shall be bilingual with Hindi inscription first, followed by English. Alternatively, two separate plates one with Hindi and the other with English inscriptions may be provided.		
16.09.00	All segregated phases of conductors or bus ducts, indoor or outdoor, shall be provided with coloured phase plates to clearly identify the phase of the system.		
17.00.00	TOOLS AND TACKLES The Contractor shall supply with the equipment one complete set of all special tools and tackles and other instruments required and other instruments for the erection, assembly, disassembly and proper maintenance of the plant and equipment and systems (including software). These special tools will also include special material handling equipment, jigs and fixtures for maintenance and calibration / readjustment, checking and measurement aids etc. A list of such tools and tackles shall be submitted by the Bidder alongwith the offer. The price of each tool / tackle shall be deemed to have been included in the total bid price. These tools and tackles shall be separately packed and sent to site. The Contractor shall also ensure that these tools and tackles are not used by him during erection, commissioning and initial operation. For this period the Contractor should bring his own tools and tackles. All the tools and tackles shall be of reputed make acceptable to the Employer.		
18.00.00	WELDING		
18.01.00	If the manufacturer has special requirements relating to the welding procedures for welds at the terminals of the equipments to be performed by others the requirements shall be submitted to the Employer in advance of commencement of erection work.		
19.00.00	COLOUR CODE FOR ALL EQUIPMENTS/ PIPINGS/ PIPE SERVICES		
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19.01.00	All equipment/ piping/ pipe services are to be painted by the Contractor in accordance with Employer's standard colour coding scheme, which will be furnished to the Contractor during detailed engineering stage.			
20.00.00	PROTECTION AND PRESERVATIVE SHOP COATING			
20.01.00	PROTECTION			
	All coated surfaces shall be protected against abrasion, impact, discoloration and any other damages. All exposed threaded portions shall be suitably protected with either metallic or a nonmetallic protection device. All ends of all valves and piping and conduit equipment connections shall be properly sealed with suitable devices to protect them from damage. All primers/paints/coatings shall take into account the hot humid, corrosive & alkaline, subsoil or over ground environment as the case may be. The requirements for painting specification shall be complied with as detailed out in Part-A & B of the Technical Specification.			
20.02.00	PRESERVATIVE SHOP COATING			
	All exposed metallic surfaces subject to corrosion shall be protected by shop application of suitable coatings. All surfaces which will not be easily accessible after the shop assembly, shall be treated beforehand and protected for the life of the equipment. All surfaces shall be thoroughly cleaned of all mill scales, oxides and other coatings and prepared in the shop. The surfaces that are to be finish-painted after installation or require corrosion protection until installation, shall be shop painted as per the requirements covered in the relevant part of the Technical Specification.			
	Transformers and other electrical equipments, if included shall be shop finished with one or more coats of primer and two coats of high grade resistance enamel. The finished colors shall be as per manufacturer's standards, to be selected and specified by the Employer at a later date.			
20.03.00	Shop primer for all steel surfaces which will be exposed to operating temperature below 95 degrees Celsius shall be selected by the Contractor after obtaining specific approval of the Employer regarding the quality of primer proposed to be applied. Special high temperature primer shall be used on surfaces exposed to temperature higher than 95 degrees Celsius and such primer shall also be subject to the approval of the Employer.			
20.04.00	All other steel surfaces which are not to be painted shall be coated with suitable dust preventive compound subject to the approval of the Employer.			
20.05.00	All piping shall be cleaned after shop assembly by shot blasting or other means approved by the Employer. Lube oil piping or carbon steel shall be pickled.			
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20.06.00	Painting for Civil structures and equipment/system covered under this package shall be done as specified under technical requirements on civil works in relevant part of this specifications.			
21.00.00	QUALITY ASSURANCE PROGRAMME			
21.01.00	To ensure that the equipment and services under the scope of contract whether manufactured or performed within the Contractor's works or at his sub-contractor's premises or at the Employer's site or at any other place of work are in accordance with the specifications, the Contractor shall adopt suitable quality assurance programme to control such activities at all points, as necessary. Such programmes shall be outlined by the Contractor and shall be finally accepted by the Employer/authorised representative after discussions before the award of the contract. The QA programme shall be generally in line with ISO-9001/IS-14001. A quality assurance programme of the contractor shall generally cover the following: a) His organisation structure for the management and implementation of the proposed quality assurance programme b) Quality System Manual c) Design Control System d) Documentation Control System e) Qualification data for Bidder's key Personnel. f) The procedure for purchase of materials, parts, components and selection of sub-contractor's services including vendor analysis, source inspection, incoming raw-material inspection, verification of materials purchased etc. g) System for shop manufacturing and site erection control including process controls and fabrication and assembly controls. h) Control of non-conforming items and system for corrective actions. i) Inspection and test procedure both for manufacture and field activities. j) Control of calibration and testing of measuring testing equipments. k) System for Quality Audits. l) System for indication and appraisal of inspection status. m) System for authorising release of manufactured product to the Employer.			
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	n) System for handling storage and delivery. o) System for maintenance of records, and p) Furnishing of quality plans for manufacturing and field activities detailing out the specific quality control procedure adopted for controlling the quality characteristics relevant to each item of equipment/component as per formats enclosed as Annexure-I and Annexure-II respectively.		
22.00.00	GENERAL REQUIREMENTS - QUALITY ASSURANCE		
22.01.00	All materials, components and equipment covered under this specification shall be procured, manufactured, erected, commissioned and tested at all the stages, as per a comprehensive Quality Assurance Programme. An indicative programme of inspection/tests to be carried out by the contractor for some of the major items is given in the respective technical specification. This is, however, not intended to form a comprehensive programme as it is the contractor's responsibility to draw up and implement such programme duly approved by the Employer. The detailed Quality Plans for manufacturing and field activities shall be drawn up by the Bidder and will be submitted to Employer for approval. Schedule of finalisation of such quality plans will be finalised before award on enclosed format No. QS-01-QAI-P-1/F3-R0. Monthly progress reports shall be furnished.		
22.02.00	Manufacturing Quality Plan will detail out for all the components and equipment, various tests/inspection, to be carried out as per the requirements of this specification and standards mentioned therein and quality practices and procedures followed by Contractor's/ Sub-contractor's/ sub-supplier's Quality Control Organisation, the relevant reference documents and standards, acceptance norms, inspection documents raised etc., during all stages of materials procurement, manufacture, assembly and final testing/performance testing. The Quality Plan shall be submitted on electronic media through C-folders, a web based system of NTPC ERP in addition to hard copy, for review and approval. After approval the same shall be submitted in compiled form on CD-ROM (As per format at Annexure-I)		
22.03.00	Field Quality Plans will detail out for all the equipment, the quality practices and procedures etc. to be followed by the Contractor's "Site Quality Control Organisation", during various stages of site activities starting from receipt of materials/equipment at site (As per format at Annexure – II).		
22.04.00	The Bidder shall also furnish copies of the reference documents/plant standards/acceptance norms/tests and inspection procedure etc., as referred in Quality Plans along with Quality Plans. These Quality Plans and reference documents/standards etc. will be subject to Employer's approval without which manufacturer shall not proceed. These approved documents shall form a part of the contract. In these approved Quality Plans, Employer shall identify customer hold points (CHP), i.e. test/checks which shall be carried out in presence of the		
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	Employer's Project Manager or his authorised representative and beyond which the work will not proceed without consent of Employer in writing. All deviations to this specification, approved quality plans and applicable standards must be documented and referred to Employer along with technical justification for approval and dispositioning.			
22.05.00	The contractor shall submit to the Employer Field Welding Schedule for field welding activities in the format enclosed at Annexure-V . The field welding schedule shall be submitted to the Employer along with all supporting documents, like welding procedures, heat treatment procedures, NDT procedures etc. at least ninety days before schedule start of erection work at site.			
22.06.00	The contractor shall have suitable Field Quality Organization with adequate manpower at Employer's site, to effectively implement the Field Quality Plan (FQP) and Field Quality Management System for site activities. The contractor shall submit the details of proposed FQA setup (organizational structure and manpower) for employer's approval. The FQA setup shall be in place at least one month before the start of site activities.			
22.07.00	No material shall be despatched from the manufacturer's works before the same is accepted, subsequent to predespatch final inspection including verification of records of all previous tests/inspections by Employer's Project Manager/Authorised representative and duly authorised for despatch by issuance of Material Despatch Clearance Certificate (MDCC).			
22.08.00	All material used for equipment manufacture including casting and forging etc. shall be of tested quality as per relevant codes/standards. Details of results of the tests conducted to determine the mechanical properties; chemical analysis and details of heat treatment procedure recommended and actually followed shall be recorded on certificates and time temperature chart. Tests shall be carried out as per applicable material standards and/or agreed details			
22.09.00	All welding and brazing shall be carried out as per procedure drawn and qualified in accordance with requirements of ASME Section IX/BS-4870 or other International equivalent standard acceptable to the Employer. All welding/brazing procedures shall be submitted to the Employer or its authorised representative for approval prior to carrying out the welding/brazing.			
22.10.00	All brazers, welders and welding operators employed on any part of the contract either in Contractor's/his sub-contractor's works or at site or elsewhere shall be qualified as per ASME Section-IX or BS-4871 or other equivalent International Standards acceptable to the Employer.			
22.11.00	All brazers, welders and welding operators employed on any part of the contract either in Contractor's/sub-contractor's works or at site or elsewhere shall be qualified			
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	as per ASME Section-IX or BS-4871 or other equivalent International Standards acceptable to the Employer..		
22.12.00	For all IBR pressure parts and high pressure piping welding, the latest applicable requirements of the IBR (Indian Boiler Regulations) shall also be essentially complied with. However, other piping shall be as per relevant code. Similarly, any other statutory requirements for the equipment/systems shall also be complied with. On all back-gauged welds MPI/LPI shall be carried before seal welding		
22.13.00	All the heat treatment results shall be recorded on time temperature charts and verified with recommended regimes.		
22.14.00	No welding shall be carried out on cast iron components for repair.		
22.15.00	Unless otherwise proven and specifically agreed with the Employer, welding of dissimilar materials and high alloy materials shall be carried out at shop only.		
22.16.00	All non-destructive examination shall be performed in accordance with written procedures as per International Standards, The NDT operator shall be qualified as per SNT-TC-IA (of the American Society of non-destructive examination). NDT shall be recorded in a report, which includes details of methods and equipment used, result/evaluation, job data and identification of personnel employed and details of correlation of the test report with the job.		
22.17.00	In general all plates of thickness greater than 40mm & for pressure parts plates of thickness equal to or greater than 25mm shall be ultrasonically tested otherwise as specified in respective equipment specification. All bar stock/Forging of diameter equal to or greater than 40 mm shall be ultrasonically tested.. The Contractor shall list out all major items/ equipment/ components to be manufactured in house as well as procured from sub-contractors (BOI). All the sub-contractor proposed by the Contractor for procurement of major bought out items including castings, forging, semi-finished and finished components/equipment etc., list of which shall be drawn up by the Contractor and finalised with the Employer, shall be subject to Employer's approval on enclosed format No. QS-01-QAI-P-01/F3. The contractor's proposal shall include vendor's facilities established at the respective works, the process capability, process stabilization, QC systems followed, experience list, etc. along with his own technical evaluation for identified sub-contractors enclosed and shall be submitted to the Employer for approval within the period agreed at the time of pre-awards discussion and identified in "DR" category prior to any procurement. Monthly progress reports on sub-contractor detail submission / approval shall be furnished preferably on enclosed format at Annexure-IV . Such vendor approval shall not relieve the contractor from any obligation, duty or responsibility under the contract.		
22.18.00	For components/equipment procured by the contractors for the purpose of the		
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	contract, after obtaining the written approval of the Employer, the contractor's purchase specifications and inquiries shall call for quality plans to be submitted by the suppliers. The quality plans called for from the sub-contractor shall set out, during the various stages of manufacture and installation, the quality practices and procedures followed by the vendor's quality control organisation, the relevant reference documents/standards used, acceptance level, inspection of documentation raised, etc. Such quality plans of the successful vendors shall be finalised with the Employer and such approved Quality Plans shall form a part of the purchase order/contract between the Contractor and sub-contractor. Within three weeks of the release of the purchase orders /contracts for such bought out items /components, a copy of the same without price details but together with the detailed purchase specifications, quality plans and delivery conditions shall be furnished to the Employer on the monthly basis by the Contractor along with a report of the Purchase Order placed so far for the contract.		
22.19.00	Employer reserves the right to carry out quality audit and quality surveillance of the systems and procedures of the Contractor's or their sub-contractor's quality management and control activities. The contractor shall provide all necessary assistance to enable the Employer carry out such audit and surveillance.		
22.20.00	The contractor shall carry out an inspection and testing programme during manufacture in his work and that of his sub-contractor's and at site to ensure the mechanical accuracy of components, compliance with drawings, conformance to functional and performance requirements, identity and acceptability of all materials parts and equipment. Contractor shall carry out all tests/inspection required to establish that the items/equipment conform to requirements of the specification and the relevant codes/standards specified in the specification, in addition to carrying out tests as per the approved quality plan.		
22.21.00	Quality audit/surveillance/approval of the results of the tests and inspection will not, however, prejudice the right of the Employer to reject the equipment if it does not comply with the specification when erected or does not give complete satisfaction in service and the above shall in no way limit the liabilities and responsibilities of the Contractor in ensuring complete conformance of the materials/equipment supplied to relevant specification, standard, data sheets, drawings, etc.		
22.22.00	For all spares and replacement items, the quality requirements as agreed for the main equipment supply shall be applicable.		
22.23.00	Repair/rectification procedures to be adopted to make the job acceptable shall be subject to the approval of the Employer/ authorised representative.		
22.24.00	Environmental Stress Screening All solid state electronic system / equipment / sub assembly shall be free from infant mortile components. For establishing the compliance to this requirement, the		
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	contractor / sub – contractor should meet the following. 1) The Contractor / Sub – contractor shall furnish the established procedure being followed for eliminating infant mortile components. The procedure followed by the Contractor / Sub – contractor should be substantiated along with the statistical figures to validate the procedure being followed. The necessary details as required under this clause shall be furnished at the stage of QP finalization. Or In case the Contractor / Sub – contractor do not have any established procedure to eliminate infant mortile components then two or 10% whichever is less, most densely populated Panels shall be tested for Elevated Temperature Cycle Test as per the following procedure. <u>Elevated Temperature Test Cycle</u> During the elevated temperature test which shall be for 48 hours, the ambient temperature shall be maintained at 50° C. The equipment shall be interconnected with devices and kept under energized conditions so as to repeatedly perform all operations it is expected to perform in actual service with load on various components being equal to those which will be experienced in actual service. During the elevated temperature test the cubicle doors shall be closed (or shall be in the position same as they are supposed to be in the field) and inside temperature in the zone of highest heat dissipating components / modules shall be monitored. The temperature rise inside the cubicle should not exceed 10° C above the ambient temperature at 50° C. In case of any failure during the test cycle, the further course of action should be mutually discussed for demonstrating the intent of the above requirement. 2) <u>Burn in Test Cycle</u> The test shall be conducted on all the panels fully assembled and wired including the panels having undergone the above mentioned elevated temperature test. The period of Burn in Test Cycle shall be 120 hrs and process shall be similar to the elevated temperature test as above except that the temperature shall be reduced to the ambient temperature prevalent at that time. During the above tests, the process I/O and other load on the system shall		
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22.25.00	be simulated by simulated inputs and in the case of control systems; the process which is to be controlled shall also be simulated. Testing of individual components or modules shall not be acceptable. During the Burn in Test the cubicle doors shall be closed (or shall be in the position same as they are supposed to be in the field) and inside temperature in the zone of highest heat dissipating components / modules shall be monitored. The temperature rise inside the cubicle should not exceed 10° C above the ambient temperature. The Contractor / Sub-contractor shall carry out routine test on 100% item at contractor / sub-contractor's works. The quantum of check / test for routine & acceptance test by employer shall be generally as per criteria / sampling plan defined in referred standards. Wherever standards have not been mentioned quantum of check / test for routine / acceptance test shall be as agreed during detailed engineering stage.			
23.00.00	QUALITY ASSURANCE DOCUMENTS			
23.01.00	The Contractor shall be required to submit the QA Documentation in two hard copies and two CD ROMs, as identified in respective quality plan with tick (✓) mark.			
23.01.01	Each QA Documentation shall have a project specific Cover Sheet bearing name & identification number of equipment and including an index of its contents with page control on each document. The QA Documentation file shall be progressively completed by the Supplier's sub-supplier to allow regular reviews by all parties during the manufacturing. The final quality document will be compiled and issued at the final assembly place of equipment before despatch. However CD-Rom may be issued not later than three weeks.			
23.02.00	Typical contents of QA Documentation is as below:- (a.) Quality Plan (b.) Material mill test reports on components as specified by the specification and approved Quality Plans. (c.) Manufacturer / works test reports/results for testing required as per applicable codes and standard referred in the specification and approved Quality Plans. (d.) Non-destructive examination results /reports including radiography interpretation reports. Sketches/drawings used for indicating the method of traceability of the radiographs to the location on the equipment.			
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	(e.) Heat Treatment Certificate/Record (Time- temperature Chart) (f.) All the accepted Non-conformance Reports (Major/Minor)/deviation, including complete technical details / repair procedure). (g.) CHP / Inspection reports duly signed by the Inspector of the Employer and Contractor for the agreed Customer Hold Points. (h.) Certificate of Conformance (COC) wherever applicable. (i.) MDCC		
23.03.00	Similarly, the contractor shall be required to submit two sets (two hard copies and two CD ROMs), containing QA Documentation pertaining to field activities as per Approved Field Quality Plans and other agreed manuals/ procedures, prior to commissioning of individual system.		
23.04.00	Before despatch / commissioning of any equipment, the Supplier shall make sure that the corresponding quality document or in the case of protracted phased deliveries, the applicable section of the quality document file is completed. The supplier will then notify the Inspector regarding the readiness of the quality document (or applicable section) for review. (a.) If the result of the review carried out by the Inspector is satisfactory, the Inspector shall stamp the quality document (or applicable section) for release. (b.) If the quality document is unsatisfactory, the Supplier shall endeavor to correct the incompleteness, thus allowing to finalize the quality document (or applicable section) by time compatible with the requirements as per contract documents. When it is done, the quality document (or applicable section) is stamped by the Inspector. (c.) If a decision is made for despatch, whereas all outstanding actions cannot be readily cleared for the release of the quality document by that time, the supplier shall immediately, upon shipment of the equipment, send a copy of the quality document Review Status signed by the Supplier Representative to the Inspector and notify of the committed date for the completion of all outstanding actions & submission. The Inspector shall stamp the quality document for applicable section when it is effectively completed. The submission of QA documentation package shall not be later than 3 weeks after the despatch of equipment.		
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23.05.00	TRANSMISSION OF QA DOCUMENTATION On release of QA Documentation by Inspector, one set of quality document shall be forwarded to Corporate Quality Assurance Department and other set to respective Project Site of Employer. For the particular case of phased deliveries, the complete quality document to the Employer shall be issued not later than 3 weeks after the date of the last delivery of equipment.			
24.00.00	PROJECT MANAGER'S SUPERVISION			
24.01.00	To eliminate delays and avoid disputes and litigation, it is agreed between the parties to the Contract that all matters and questions shall be referred to the Project Manager and without prejudice to the provisions of 'Arbitration' clause in Section GCC, the Contractor shall proceed to comply with the Project Manager's decision.			
24.02.00	The work shall be performed under the supervision of the Project Manager. The scope of the duties of the Project Manager pursuant to the Contract, will include but not be limited to the following: (a.) Interpretation of all the terms and conditions of these documents and specifications: (b.) Review and interpretation of all the Contractor's drawing, engineering data, etc: (c.) Witness or his authorised representative to witness tests and trials either at the manufacturer's works or at site, or at any place where work is performed under the contract : (d.) Inspect, accept or reject any equipment, material and work under the contract : (e.) Issue certificate of acceptance and/or progressive payment and final payment certificates (f.) Review and suggest modifications and improvement in completion schedules from time to time, and (g.) Supervise Quality Assurance Programme implementation at all stages of the works.			
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25.00.00	INSPECTION, TESTING AND INSPECTION CERTIFICATES			
25.01.00	The word 'Inspector' shall mean the Project Manager and/or his authorised representative and/or an outside inspection agency acting on behalf of the Employer to inspect and examine the materials and workmanship of the works during its manufacture or erection.			
25.02.00	The Project Manager or his duly authorised representative and/or an outside inspection agency acting on behalf of the Employer shall have access at all reasonable times to inspect and examine the materials and workmanship of the works during its manufacture or erection and if part of the works is being manufactured or assembled on other premises or works, the Contractor shall obtain for the Project Manager and for his duly authorised representative permission to inspect as if the works were manufactured or assembled on the Contractor's own premises or works.			
25.03.00	The Contractor shall give the Project Manager/Inspector fifteen (15) days written notice of any material being ready for testing. Such tests shall be to the Contractor's account except for the expenses of the Inspector's. The Project Manager/Inspector, unless the witnessing of the tests is virtually waived and confirmed in writing, will attend such tests within fifteen (15) days of the date on which the equipment is noticed as being ready for test/inspection failing which the contractor may proceed with test which shall be deemed to have been made in the inspector's presence and he shall forthwith forward to the inspector duly certified copies of test reports in two (2) copies.			
25.04.00	The Project Manager or Inspector shall within fifteen (15) days from the date of inspection as defined herein give notice in writing to the Contractor, or any objection to any drawings and all or any equipment and workmanship which is in his opinion not in accordance with the contract. The Contractor shall give due consideration to such objections and shall either make modifications that may be necessary to meet the said objections or shall inform in writing to the Project Manager/Inspector giving reasons therein, that no modifications are necessary to comply with the contract.			
25.05.00	When the factory tests have been completed at the Contractor's or sub-contractor's works, the Project Manager /Inspector shall issue a certificate to this effect fifteen (15) days after completion of tests but if the tests are not witnessed by the Project Manager /Inspectors, the certificate shall be issued within fifteen (15) days of the receipt of the Contractor's test certificate by the Project Manager /Inspector. Project Manager /Inspector to issue such a certificate shall not prevent the Contractor from proceeding with the works. The completion of these tests or the issue of the certificates shall not bind the Employer to accept the equipment should it, on further tests after erection be found not to comply with the contract.			
25.06.00	In all cases where the contract provides for tests whether at the premises or works of the Contractor or any sub-contractor, the Contractor, except where otherwise			
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	specified shall provide free of charge such items as labour, material, electricity, fuel, water, stores, apparatus and instruments as may be reasonably demanded by the Project Manager /Inspector or his authorised representatives to carry out effectively such tests on the equipment in accordance with the Contractor and shall give facilities to the Project Manager/Inspector or to his authorised representative to accomplish testing.		
25.07.00	The inspection by Project Manager / Inspector and issue of Inspection Certificate thereon shall in no way limit the liabilities and responsibilities of the Contractor in respect of the agreed Quality Assurance Programme forming a part of the contract.		
25.08.00	To facilitate advance planning of inspection in addition to giving inspection notice as specified at clause no 9.05.03- of this chapter, the Contractor shall furnish quarterly inspection programme indicating schedule dates of inspection at Customer Hold Point and final inspection stages. Updated quarterly inspection plans will be made for each three consecutive months and shall be furnished before beginning of each calendar month.		
25.09.00	All inspection, measuring and test equipment used by contractor shall be calibrated periodically depending on its use and criticality of the test/measurement to be done. The Contractor shall maintain all the relevant records of periodic calibration and instrument identification, and shall produce the same for inspection by NTPC. Wherever asked specifically, the contractor shall re-calibrate the measuring/test equipment in the presence of Project Manager / Inspector.		
25.10.00	Associated document for Quality Assurance programme		
25.10.01	Manufacturing Quality Plan Format No. : QS-01-QAI-P-09/F1-R1 enclosed at Annexure-I.		
25.10.02	Field Quality Plan Format No.: QS-01-QAI-P-09/F2-R1 enclosed at Annexure-II.		
25.10.03	List of items requiring quality plan and sub supplier approval. Format No.: QS-01-QAI-P-01/F3-R0 (Annexure-III).		
25.10.04	Status of items requiring Quality Plan and sub supplier approval. Format enclosed at Annexure-IV.		
25.10.05	Field Welding Schedule Format enclosed at Annexure-V.		
25.11.00	TESTING OF MAJOR DESIGN FEATURES: The major design features of the system shall be demonstrated by the Contractor at the Contractor's works or any other place mutually agreed within Six months from the date of LOA. These are the system function tests, which have a major impact on the detailed system design & finalization of important engineering documents like		
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	configuration, functional grouping, BOM etc., but do not require a fully engineered system for conductance. Bidder shall identify these features & include detailed test procedures in the bid, which shall be finalized during discussions with the bidder before award. The developments and any augmentation of standard features undertaken by the Bidder to fulfill the various specification requirements, shall be also be tested during these major design tests. This shall include but not be limited to the following. a) System accuracy tests of DDCMIS for the various type of inputs identified in Part-B. b) Loop reaction time for sample loops/ logics. c) SOE functionality tests. d) Server changeover. e) Various response times, having serious implication on operation & maintenance philosophy. f) Duty cycle of controller/ HMIPIS with simulated load, representative of the final engineered load. g) Unified HMI for DDCMIS. The results of the above tests, after its acceptance by the Employer, shall be properly documented and submitted to Employer. If any of the envisaged tests have been carried out by Bidder in a previous NTPC project, then the same need not be specifically conducted by the Bidder for this project, provided it is clearly established by the Bidder & accepted by the Employer that there is no difference between the system offered for this project & the previous NTPC project with respect to the test. However, even in such a case, test report of the previous project shall be submitted by the Bidder as a part of MDFT (Major Design Feature Test) test report.			
25.12.00	DEMONSTRATION OF APPLICATION ENGINEERING			
25.12.01	Based on NTPC inputs, the Contractor shall prepare and submit typical implemented scheme in their system (Control system & HMI) on sample basis. The typical cases to be covered shall include but not be limited to the following. (i) Logics/Loops: a) Drive logics implementation for each type of binary drive along with its display in HMI.			
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25.12.02	b)	Sequence implementation along with its display in HMI.			
	c)	Single non-cascade controller implementation.			
	d)	Cascade loop implementation.			
	e)	Master slave implementation with different slave combination.			
	f)	Temperature & pressure compensation for flow signals & pressure compensation for level signals as applicable.			
25.12.02	(ii)	HMI Functions:			
	a)	LVS Annunciation.			
	b)	Graphics.			
	c)	HSR			
	d)	Logs/Reports.			
25.12.02	e)	Calculations (Basic & Performance Calculations).			
	The above typical cases shall be finalized with the Employer through Technical Co-ordination meetings.				
	After review and finalization of the typical cases, the implementation of each logic & control loop shall be carried out by the Contractor based on NTPC inputs. After implementation of these logics & loops, the Contractor shall test each logic /loop and record the observations in a format to be provided by the Employer and demonstrate to Employer at Employer premises during engineering finalization. Any modifications as a result of the demonstration shall be done and documented as part of the test report along with the final scheme. Similarly, HMI functions shall also be demonstrated by the Contractor at Employer premises & the results shall be documented as part of test report.				
	25.12.03 During the integrated testing at the Contractor's works, only sample checks shall be done by the Employer for the items covered in above application engineering demonstration.				
	26.00.00 PRE-COMMISSIONING AND COMMISSIONING FACILITIES				
26.01.00	(a)	As soon as the facilities or part thereof has been completed operationally and structurally and before start-up, each item of the equipment and systems forming part of facilities shall be thoroughly cleaned and then inspected jointly by the Employer and the Contractor for correctness of and completeness of facility or part thereof and acceptability for initial pre-			
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26.01.00	commissioning tests, commissioning and start-up at Site. The list of pre-commissioning tests to be performed shall be as mutually agreed and included in the Contractor's quality assurance programme as well as those included in Part-D, Section-VI and elsewhere in the Technical Specifications. (b) The Contractor's pre-commissioning/ commissioning/start-up engineers specially identified as far as possible, shall be responsible for carrying out all the pre-commissioning tests at Site. On completion of inspection, checking and after the pre-commissioning tests are satisfactorily over, the commissioning of the complete facilities shall be commenced during which period the complete facilities, equipments shall be operated integral with sub-systems and supporting equipment as a complete plant. (c) All piping system shall be flushed, steam blown, air blown as required and cleanliness demonstrated using acceptable industry standards. Procedures to accomplish this work shall be submitted for approval to the Employer six months prior to the respective implementations. The Employer will approve final verification of cleanliness. (d) The time consumed in the inspection and checking of the units shall be considered as a part of the erection and installation period. (e) The check outs during the pre - commissioning period should be programmed to follow the construction completion schedule. Each equipment/system, as it is completed in construction and turned over to Employer's commissioning (start-up) Engineer(s), should be checked out and cleaned. The checking and inspection of individual systems should then follow a prescribed schedule to be agreed by Employer. (f) The Contractor during initial operation and performance testing shall conduct vibration testing to determine the 'base line' of performance of all plant rotating equipment. These tests shall be conducted when the equipment is running at the base load, peak load as well as lowest sustained operating condition as far as practicable.			
	Contractor shall furnish the commissioning organization chart for review & acceptance of employer at least eighteen months prior to the schedule date of synchronization of 1st unit. The chart should contain : (1.) Biodata including experience of the Commissioning Engineers. (2.) Role and responsibilities of the Commissioning Organisation members. (3.) Expected duration of posting of the above Commissioning Engineers at site.			
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26.02.00	Initial Operation (a) On completion of all pre-commissioning activities/ tests and as a part of commissioning the complete facilities shall be put on 'Initial Operation' during which period all necessary adjustments shall be made while operating over the full load range enabling the facilities to be made ready for the Guarantee Tests. (b) The 'Initial Operation' of the complete facility as an integral unit shall be conducted for 720 continuous hours. During the period of initial operation of 720 hours, the unit shall operate continuously at full rated load for a period not less than 72 hours. The Initial Operation shall be considered successful, provided that each item/ part of the facility can operate continuously at the specified operating characteristics, for the period of Initial Operation with all operating parameters within the specified limits and at or near the predicted performance of the equipment/ facility. The Contractor shall intimate the Employer about the commencement of initial operation and shall furnish adequate notice to the Employer in this respect. (c) Any loss of generation due to constraints attributable to the Employer shall be construed as Deemed Generation. (d) An Initial Operation report comprising of observations and recordings of various parameters to be measured in respect of the above Initial Operation shall be prepared by the Contractor. This report, besides recording the details of the various observations during initial operation shall also include the dates of start and finish of the Initial Operation and shall be signed by the representatives of both the parties. The report shall have sheets, recording all the details of interruptions occurred, adjustments made and any minor repairs done during the Initial Operation. Based on the observations, necessary modifications/repairs to the plant shall be carried out by the Contractor to the full satisfaction of the Employer to enable the latter to accord permission to carry out the Guarantee tests on the facilities. However, minor defects which do not endanger the safe operation of the equipment, shall not be considered as reasons for with- holding the aforesaid permission.		
26.03.00	Guarantee Tests a) The final test as to prove the Functional Guarantees shall be conducted at Site by the Contractor in presence of the Employer. The contractor's Commissioning, start-up and initial operation shall make the unit ready to		
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	conduct such test. Such test will be commenced, within a period of three (3) months after the successful completion of Initial Operations. Any extension of time beyond the above three (3) months shall be mutually agreed upon. b) These tests shall be binding on both the parties of the Contract to determine compliance of the equipment with the functional guarantee. c) For performance/ demonstration tests instrumentations, of accuracy class shall be as per specified test codes. The numbers and location of the instruments shall be as per the specified test codes. In addition the values of parameters shall be logged from the information system provided under Employer's Distributed Digital Control Monitoring and Information system. Test will be conducted at specified load points. d) Any special equipment, tools and tackles required for the successful completion of the Guarantee Tests shall be provided by the Contractor, free of cost. e) The Guarantee tests and specific tests to be conducted on equipments have been brought out in detail elsewhere in the specifications.		
27.00.00	TAKING OVER		
	Upon successful completion of Initial Operations and all the tests, other than Guarantee Tests conducted to the Employer's satisfaction, the Employer shall issue to the Contractor a Taking over Certificate as a proof of the final acceptance of the equipment. Such certificate shall not unreasonably be withheld nor will the Employer delay the issuance thereof, on account of minor omissions or defects which do not affect the commercial operation and/or cause any serious risk to the equipment. Such certificate shall not relieve the Contractor of any of his obligations which otherwise survive, by the terms and conditions of the Contract after issuance of such certificate.		
28.00.00	TRAINING OF EMPLOYER'S PERSONNEL		
28.01.00	The scope of service under training of Employer's engineers shall include a training module covering the areas of Operation & Maintenance. Such training should cover the following areas as a minimum in order to enable these personnel to individually take the responsibility of operating and maintaining the power station in a manner acceptable to the Employer: (a) Training for Steam Generator & ESP Equipment, TG & Auxiliaries and related equipments. (b) Training for Electric Systems including VFD and Electric power supply system.		
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28.03.00	(c) Training for other SG/TG related C&I systems/equipments including training on Flame Monitoring System, Furnace and Flame Viewing System , Turbine Supervisory System (TSS) including vibration analyzer, vibration monitoring system axial shift, eccentricity measurements etc. for Main Turbine, BFP Turbine etc. Burner management study, control loop study, misc system for SG C&I, EHTC, Turbine stress control system, Turbine protection system, ATRS, instrumentation etc. (d) Training for special packages for various PC based systems specified elsewhere in Part-B of Technical Specification, Section-VI. (e) Training for various C&I systems/equipment supplied includes the following: i) DDCMIS - Human Machine Interface – Hardware & Operating System ii) DDCMIS-Human Machine Interface System Engineering & Application Software. iii) DDCMIS – Control System Hardware and Control system Application Software. iv) DDCMIS – Operator Training : Use of the system at Works + at site. v) DDCMIS – Specialized Network security. (f) Training for power cycle piping/critical piping. (g) Training for UPS systems Annunciation system, SWAS, PA system, flue gas analyzers, CCTV and 24 VDC system. (h) Training for numerical relays & networking systems supplied under MV & LT switchgear system. (i) Training for Simulator System (j) Details of training modules for SG, TG, Electrical, C&I systems and Simulator System are given at Annexure – VII, VIII, IX, X, XI & XII. The exact details, extent and schedule for training shall be as finalized during detailed engineering and shall be subject to Employer's approval.			
	The scope of services under training shall also necessarily include training of Employer's Engineering personnel covering a training module as indicated in Annexure – VII, VIII, IX, X, XI & XII . This shall cover all disciplines viz, Mechanical, Electrical, C&I , QA etc. and shall include all the related areas like Design familiarization, training on product design features and product deign software of major equipment and systems, engineering, manufacturing, erection, commissioning, training on operating features of equipment, quality assurance and testing, plant visits and visits to manufacturer's works, exposure to various kinds of			
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-C BID DOC. NO.:CS-9585-001-2	GENERAL TECHNICAL REQUIREMENTS	PAGE 43 OF 111

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	problems which may be encountered in fabrication, manufacturing erection, welding etc.		
28.04.00	Contractor shall also arrange for training of Employer's personnel in respect of fire detection and protection systems and other Balance of Plant equipments.		
28.05.00	Bidder shall furnish in his offer, details of training module(s) covering above requirements which shall be subject to Employer's approval. Consolidated training period included above [i.e. Annexure – VII, VIII, IX, X, XI & XII for O&M and Engineering] is indicative only. Employer reserves the right to reappropriate the training period between O&M and engineering depending upon the details of training module proposed by the Bidder.		
28.06.00	Exact details, extent of training and the training schedule shall be finalized based on the Bidder's proposal within two (2) months from placement of award.		
28.07.00	In all the above cases, wherever the training of Employer's personnel is arranged at the works of the manufacturer's it shall be noted that the lodging and boarding of the Employer's personnel shall be at the cost of Bidder. The Bidder shall make all necessary arrangements towards the same.		
28.08.00	Take off prices (product wise) should be indicated by the Bidder in the Bid Proposal Sheets. Employer reserves the right to include or exclude these item(s) during placement of Award. Note: For training purposes, one (1) man month implies 30 working days (excluding all intervening holidays) per person.		
29.00.00	SAFETY ASPECTS DURING CONSTRUCTION AND ERECTION In addition to the requirements given in Erection Conditions of Contract (ECC) the following shall also cover: i) Working platforms should be fenced and shall have means of access. ii) Ladders in accordance with Employer's safety rules for construction and erection shall be used. Rungs shall not be welded on columns. All the stairs shall be provided with handrails immediately after its erection.		
30.00.00	NOISE LEVEL The equivalent 'A' weighted sound pressure level measured at a height of 1.5 m above floor level in elevation and at a distance of one (1) metre horizontally from the nearest surface of any equipment/machine, furnished and installed under these specifications, expressed in decibels to a reference of 0.0002 microbar, shall not exceed 85 dBA except for		
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-C BID DOC. NO.:CS-9585-001-2	GENERAL TECHNICAL REQUIREMENTS PAGE 44 OF 111

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS		
	i) Safety valves and associated vent pipes for which it shall not exceed 105 dBA-115 dBA. ii) Regulating drain valves in which case it shall be limited to 90 dBA-115 dBA. iii) Mill noise which will be limited to 85-90 dBA. iv) TG unit in which case it shall not exceed 90 dBA. v) For HP-LP bypass valves and other intermittantly operating control valves, the noise level shall be within the limit of 90 dBA. vi) For BFP Motor Noise level shall be with in the limit of 90 dBA.		
31.00.00	PACKAGING AND TRANSPORTATION All the equipments shall be suitably protected, coated, covered or boxed and crated to prevent damage or deterioration during transit, handling and storage at Site till the time of erection. While packing all the materials, the limitation from the point of view of the sizes of railway wagons available in India should be taken account of. The Contractor shall be responsible for any loss or damage during transportation, handling and storage due to improper packing. The Contractor shall ascertain the availability of Railway wagon sizes from the Indian Railways or any other agency concerned in India well before effecting despatch of equipment. Before despatch it shall be ensured that complete processing and manufacturing of the components is carried out at shop, only restricted by transport limitation, in order to ensure that site works like grinding, welding, cutting & preassembly to bare minimum. The Employer's Inspector shall have right to insist for completion of works in shops before despatch of materials for transportation.		
32.00.00	ELECTRICAL EQUIPMENTS/ENCLOSURES		
32.01.00	All electrical equipments and devices, including insulation, heating and ventilation devices shall be designed for ambient temperature and a maximum relative humidity as specified elsewhere in the specifications.		
33.00.00	INSTRUMENTATION AND CONTROL All instrumentation and control systems/ equipment/ devices/ components, furnished under this contract shall be in accordance with the requirements stated herein, unless otherwise specified in the detailed specifications.		
33.01.00	All instrument scales and charts shall be calibrated and printed in metric units and shall have linear graduation. The ranges shall be selected to have the normal reading at 75% of full scale.		
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-C BID DOC. NO.:CS-9585-001-2	GENERAL TECHNICAL REQUIREMENTS PAGE 45 OF 111

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS		एनटीपीसी NTPC																		
	All scales and charts shall be calibrated and printed in Metric Units as follows: <table><tr><td>1. Temperature</td><td>- Degree centigrade (deg C)</td></tr><tr><td>2. Pressure</td><td>- Kilograms per square centimetre (Kg/cm²). Pressure instrument shall have the unit suffixed with 'a' to indicate absolute pressure. If nothing is there, that will mean that the indicated pressure is gauge pressure.</td></tr><tr><td>3. Draught</td><td>- Millimetres of water column (mm wc).</td></tr><tr><td>4. Vacuum</td><td>- Millimeters of mercury gauge (mm Hg) or water column (mm Wcl).</td></tr><tr><td>5. Flow (Gas)</td><td>- Tonnes/ hour</td></tr><tr><td>6. Flow (Steam)</td><td>- Tonnes/ hour</td></tr><tr><td>7. Flow (Liquid)</td><td>- Tonnes / hour</td></tr><tr><td>8. Flow base</td><td>- 760 mm Hg. 15 deg.C</td></tr><tr><td>9. Density</td><td>- Grams per cubic centimetre.</td></tr></table>			1. Temperature	- Degree centigrade (deg C)	2. Pressure	- Kilograms per square centimetre (Kg/cm ²). Pressure instrument shall have the unit suffixed with 'a' to indicate absolute pressure. If nothing is there, that will mean that the indicated pressure is gauge pressure.	3. Draught	- Millimetres of water column (mm wc).	4. Vacuum	- Millimeters of mercury gauge (mm Hg) or water column (mm Wcl).	5. Flow (Gas)	- Tonnes/ hour	6. Flow (Steam)	- Tonnes/ hour	7. Flow (Liquid)	- Tonnes / hour	8. Flow base	- 760 mm Hg. 15 deg.C	9. Density	- Grams per cubic centimetre.
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8. Flow base	- 760 mm Hg. 15 deg.C																				
9. Density	- Grams per cubic centimetre.																				
33.02.00	All instruments and control devices provided on panels shall be of miniaturized design, suitable for modular flush mounting on panels with front draw out facility and flexible plan-in connection at rear.																				
33.03.00	All electronic modules shall have gold plated connector fingers and further all input and output modules shall be short circuit proof. These shall also be tropicalised & components shall be of industrial grade or better.																				
34.00.00	ELECTRICAL NOISE CONTROL The equipment furnished by the Contractor shall incorporate necessary techniques to eliminate measurement and control problems caused by electrical noise. Areas in Contractor's equipment which are vulnerable to electrical noise shall be hardened to eliminate possible problems. Any additional equipment, services required for effectively eliminating the noise problems shall be included in the proposal. The equipment shall be protected against ESD as per IEC-61000-2. Radio Frequency interference (RFI) and Electro Magnetic Interference (EMI) protection against hardware damage and control system mal-operations/errors shall be provided for all systems as per EN-50082-2 (1995).																				
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-C BID DOC. NO.:CS-9585-001-2	GENERAL TECHNICAL REQUIREMENTS																		
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CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS		
35.00.00	SURGE PROTECTION FOR SOLID STATE EQUIPMENT All solid state systems /equipment shall be able to withstand the electrical noise and surge as encountered in actual service conditions and inherent in a power plant and shall meet the requirements of surge protection as defined in ANSI C37.90.1-1989 on its suitable equivalent class of IEC 254-4. Details of the features incorporated and relevant tests carried out. The test certificates. etc. shall be submitted by the Bidder.		
36.00.00	INSTRUMENT AIR SYSTEM The instrument air supply system as supplied by the Bidder for various pneumatic control & instrumentation devices like pneumatic actuators, power cylinders, E/P converters, piping / tubing etc. Each pneumatic instrument shall have an individual air shut - off valve. The pressure regulating valve shall be equipped with an internal filter, a 50 mm pressure gauge and a built-in filter housing blow down valve.		
37.00.00	TAPPING POINTS FOR MEASUREMENTS Tapping points shall include probes, wherever applicable, for analytical measurements and sampling. For direct temperature measurement of all working media, one stub with internal threading of approved pattern shall be provided along with suitable plug and washer. The Contractor will be intimated about thread standard to be adopted. The following shall be provided on equipment by the Bidder. The standard which is to be adopted, will be intimated to the Contractor. i) Temperature test pockets with stub and thermowell ii) Pressure test pockets		
38.00.00	SYSTEM DOCUMENTATION The Bidder shall provide drawings, system overview & description, hardware/ software details, technical literature, functional & hardware schemes, bill of material, parts list, interconnection diagrams, data sheets, erection/ installation/ commissioning procedures, instruction/ operating manuals, etc. for each of the C& I system / sub-systems/ equipment supplied under this package. The documentation shall include complete details of the C&I systems/ sub-systems/ equipment to enable review by Employer during detailed engineering stage and to provide information to plant personnel for operation & Maintenance (including quick diagnostics & trouble shooting) of these C&I systems/ sub-systems/ equipment at site. The minimum		
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	documentation requirements for C&I systems shall be as stipulated under C&I "Techncial Data Sheets" Part of specifications. In addition to this, system documentation for DDCMIS shall include as a minimum to that specified elsewhere in the Technical Specification. The exact format, submission schedule and contents of various documents shall be as finalised during detailed engineering stage.			
38.01.00	Bill of material (instrument list) for all C&I equipment/ devices shall be furnished by the bidder in standard formats as approved by the Employer.			
39.00.00	MAINTENANCE MANUALS OF ELECTRONIC MODULES The Contractor shall have to furnish two(2) sets of all maintenance manual of each and every electronic card/module as employed on the various systems and equipment including peripherals etc., offered by him.The Contractor will also have to furnish the data regarding the expected failure rate of various modules and other system components. Further , the contractor shall furnish a set of operating manuals which should include block diagrams ,make, model/type ,details wiring and external connection drawings etc as required to do the testing and maintenance of the electronic modules.			
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CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
	LIST OF CODES AND STANDARDS			
	Indian Standards	Title	International and Internationally recognised standards	
	IS:277	Galvanised steel sheets (plain or corrugated)		
	IS:655	Specification for metal air duct		
	IS:800	Code of practice for use of structural steel in general building construction	BS 449:1969 BS 5950 ASA A57, 1-1952	
	IS:807	Code of practice for design, manufacture, erection and testing (Structural portion) of cranes and hoists 6588 (Issued by Standards Association of Australia). DIN 120:1936 (Sheet 1) DIN 120:1936 (Sheet 2) 327 part-I, 1951 BS 466 part-II, 1960 BS 644:1960 BS 1757:1951 BS 2573:part-I:1960	Draft Revision of A.S. NO. CS.2 SAA Crane and Hoist code Doc:No. BU/4 Rev	
	IS:875	Code of practice for design loads (other than earthquake) for buildings and structures Leading standards (issued by Canadian Standard) DIN-1055-1955 (Issued by ASA)	National Building code of Canada (1953)-Part-IV Design section 4.1	
	IS:1239 Part-I	Mild steel tubes	(ISO/R 65-1957) (ISO/R-64-1958)	
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			(ISO/R-65-1958) (BS 1387 : 1957)	
	IS:1239 Part-II	Mild steel tubulars and other wrought steel pipe fittings	BS 1387 : 1967 BS 1387 :1967 BS 1740 :1965	
	IS:2825	Code for unfired vessels		
	IS:1520	Horizontal centrifugal pumps for clear cold and fresh water		
	IS:1600	Code for practice for performance of constant speed IC Engines for general purpose		
	IS:1601	Specification for perform- ance of constant speed IC Engines for general Purpose		
	IS:1893	Criteria for earthquake resistant design of structures		
	IS1978-1971	Line Pipe April 1969.	API Standards 5L	
	IS:2254-1970	Dimensions of vertical shaft motor for pumps	IEC Pub 72-1 part I NEMA Pub MG 1 1954	
	IS:2266	Steel wire ropes for general engineering purposes	BS :302 : 1968	
	IS:2312	Propellant type Ventilation fans		
	IS:2365	Steel wire suspension ropes for lifts and hoists	BS : 1957	
	IS:3346	Method for the determin- ation of thermal	DIN 52612 (Deutscher Normenausschuss)	
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		conductivity of thermal insulation materials (two slab guarded hot plate method) IS:3354 Outline dimensions for electric lifts. IS:3401 Silica gel IS:3588 Specification for electrical axial flow fans IS:3589 Electrically welded steel pipes for water, gas and sewage (200mm to 2000 mm Nominal Diameter) IS:3677 Unbonded rock and slag wool for thermal insulation IS:3815 Point hook with shank for general engineering purposes IS:3895 Specification for monocrystalline semiconductor rectifier cells and stacks IS:3963 Roof extractor unit IS:3975 Mild steel wires, strips and tapes for armouring cables IS:4503 Shell and tube type heat Exchanger IS:4540 Specification for monocrystalline rectifier assembly	ASTM C 163-1964 (American Society of Testing and materials) ASTM C 167-1974 ASTM C 177-1963 BS 482 - 1968 Doc.:67/3 1284 (Revision of BS 2903) (Issued BS)
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CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS	एनटीपीसी NTPC
	equipment IS:4671 Expanded polystyrene for thermal insulation purpose IS:4736 Hot dip zinc coating on steel tubes IS:4894 Centrifugal fans IS:5456 Code of practice for testing of positive displacement type air compressors and exhauster (For Test Tolerance Only) IS:5749 Forged ramshorn hooks Entwurf DIN 15402 Blett 1 Entwurf DIN 15402 BS 3017-1958 IS:6392 Steel pipe flanges BS 4504 : 1969 IS:6524 Part-I Code of practice for design of tower cranes Static and rail mounted BS 2799 : 1956 IS:7098 Cross linked Polyethylene insulated PVC sheathed cables Standard No. 1 to IPCEA (USA) Pub. No. 5-66-524 IS:7373 Specification for wrought aluminium and aluminium sheet and strips IS:7938 Air receivers for compressed air installation ISO:1217 Displacement compressor-Acceptance test ASHRAE-33 Methods of testing for rating of forced circulation air cooling and air heating coils. ASHRAE-52-76 Air cleaning device used in general ventilation for removing particle matter.	
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CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS	एनटीपीसी NTPC	
	ASHRAE-22-72 Method of testing for rating of water cooled refrigerant condensers. ASHRAE 23-67 Methods of testing for rating of positive displacement refrigerant compressors. ARI-450-6 Standard for water cooled refrigerant condensers. ARI-550 Standard for centrifugal water chilling packages. ARI-410 Standard for forced circulation air cooling and air heating coils ARI-430/435 Central station AHU/Application of Central Station AHU BS:848 Fans (Part-1,2) BS:400 Low carbon steel cylinders for the storage & transport of permanent gases. BS:401 Low carbon steel cylinders for the storage & transport of liquified gases. CTI Code Acceptance test code for Water Cooling Tower. ACT-105 ANSI-31.5 Refrigerant piping ASME-PTC- Atmospheric Water Cooling Equipment 23-1958 AMCA A-21C Test Code for air moving devices API:618 Reciprocating Compressor for general refinery services. HYDRAULIC INSTITUTE STANDARDS. HYDRANT SYSTEM MANUALS OF TAC. TAC MANUALS OF SPRAY SYSTEM NFPA USA/ NSC UK/ UL USA/ FM USA STANDARDS. INDIAN EXPLOSIVES ACT. INDIAN FACTORIES ACT. STANDARD OF TUBULAR EXCHANGER MANUFACTURER'S ASSOCIATION.		
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CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS	एनटीपीसी NTPC	
	CODE AND STANDARD FOR CIVIL WORKS Some of the applicable Standards, Codes and references are as follows: Excavation & Filling IS: 2720 (Part-II, IV TO VIII, XIV, XXI, XXIII, XXIV, XXVII TO XXIX, XL) Methods of test for soils-determination for water content etc. IS: 4701 Code of practice for earth work on canals. IS: 9758 Guide lines for Dewatering during construction. IS: 10379 Code of practice for field control of moisture and compaction of soils for embankment and sub-grade. Properties, Storage and Handling of Common Building Materials IS: 269 Specification for ordinary Portland cement, 33 grade. IS: 383 Specification for coarse and fine aggregates from natural sources for concrete. IS: 432 Specification for mild steel and (Parts 1&2) medium tensile steel bars and hard-drawn steel wires for concrete reinforcement. IS: 455 Specification for Portland slag cement. IS: 702 Specification for Industrial bitumen. IS: 712 Specification for building limes. IS: 808 Rolled steel Beam channel and angle sections. IS: 1077 Specification for common burnt clay building bricks. IS: 1161 Specification of steel tubes for structural purposes. IS: 1363 Hexagon head Bolts, Screws and nuts of production grade C. IS: 1364 Hexagon head Bolts, Screws and Nuts of Production grade A & B. IS: 1367 Technical supply conditions for Threaded fasteners. IS: 1489 Specification for Portland-pozzolana cement: (Part-I) Fly ash based.		
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	(Part-II)	Calcined clay based.	
	IS: 1542	Specification for sand for plaster.	
	IS: 1566	Specification for hard-drawn steel wire fabric for concrete reinforcement.	
	IS: 1786	Specification for high strength deformed bars for concrete reinforcement.	
	IS: 2062	Specification for steel for general structural purposes.	
	IS: 2116	Specification for sand for masonry mortars.	
	IS: 2386 (Parts-I to VIII)	Testing of aggregates for concrete.	
	IS: 3150	Hexagonal wire netting for general purpose.	
	IS: 3495 (Parts-I to IV)	Methods of tests of burnt clay building bricks.	
	IS: 3812	Specification for fly ash, for use as pozzolana and admixture.	
	IS: 4031	Methods of physical tests for hydraulic cement.	
	IS: 4032	Methods of chemical analysis of hydraulic cement.	
	IS: 4082	Recommendations on stacking and storage of construction materials at site.	
	IS: 8112	Specification for 43 grade ordinary portland cement.	
	IS: 8500	Medium and high strength structural steel.	
	IS: 12269	53 grade ordinary portland cement.	
	IS: 12894	Specification for Fly ash lime bricks.	
	Cast-In-Situ Concrete and Allied Works		
	IS: 280	Specification for mild steel wire for general engineering purposes.	
	IS: 456	Code of practice for plain and reinforced concrete.	
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	IS: 457	Code of practice for general construction of plain & reinforced concrete for dams & other massive structures.		
	IS: 516	Method of test for strength of concrete.		
	IS: 650	Specification for standard sand for testing of cement.		
	IS: 1199	Methods of sampling and analysis of concrete.		
	IS: 1791	General requirements for batch type concrete mixers.		
	IS: 1838 (Part-I)	Specification for preformed fillers for expansion joints in concrete pavements and structures (non-extruding and resilient type).		
	IS: 2204	Code of practice for construction of reinforced concrete shell roof.		
	IS: 2210	Criteria for the design of reinforced concrete shell structures and folded plates.		
	IS: 2438	Specification for roller pan mixer.		
	IS: 2502	Code of practice for bending and fixing of bars for concrete reinforcement.		
	IS: 2505	General requirements for concrete vibrators, immersion type.		
	IS: 2506	General requirements for concrete vibrators, screed board type.		
	IS: 2514	Specification for concrete vibrating tables.		
	IS: 2645	Specification for Integral cement water proofing compounds.		
	IS: 2722	Specification for portable swing weigh batches for concrete. (single and double bucket type)		
	IS: 2750	Specification for Steel scaffolding.		
	IS: 2751	Code of practice for welding of mild steel plain and deformed bars for reinforced concrete construction.		
	IS: 3025	Methods of sampling and test waste water.		
	IS: 3366	Specification for Pan vibrators.		
	IS: 3370	Code of practice for concrete structures for the storage of		
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CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS		
	(Part I to IV)	liquids.	
	IS: 3414	Code of practice for design and installation of joints in buildings.	
	IS: 3550	Methods of test for routine control for water used in industry.	
	IS: 3558 concrete.	Code of practice for use of immersion vibrators for consolidating	
	IS: 4014 (Parts I & II)	Code of practice for steel tubular scaffolding.	
	IS: 4326 of buildings.	Code of practice for earthquake resistant design and construction	
	IS: 4461	Code of practice for joints in surface hydro-electric power stations.	
	IS: 4656	Specification for form vibrators for concrete.	
	IS: 4925	Specification for batching and mixing plant.	
	IS: 4990	Specification for plywood for concrete shuttering work.	
	IS: 4995 (Parts I & II)	Criteria for design of reinforced concrete bins for the storage of granular and powdery materials.	
	IS: 5256	Code or practice for sealing joints in concrete lining on canals.	
	IS: 5525 concrete work.	Recommendations for detailing of reinforcement in reinforced	
	IS: 5624	Specification for foundation bolts.	
	IS: 6461	Glossary of terms relating to cement concrete.	
	IS: 6494	Code of practice for water proofing of underground water reservoirs and swimming pools.	
	IS: 6509	Code of practice for installation of joints in concrete pavements.	
	IS: 7861	Code of practice for extreme weather concreting. (Parts I & II)	
	IS: 9012	Recommended practice for shot concreting.	
	IS: 9103	Specification for admixtures for concrete.	
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-C BID DOC. NO.:CS-9585-001-2	GENERAL TECHNICAL REQUIREMENTS
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	IS: 9417 IS: 10262 IS: 11384 IS: 11504 IS: 12118 IS: 12200 IS: 13311 Part-1 Part-2 SP:23 SP: 24 SP: 34	Recommendations for welding cold worked steel bars for reinforced concrete construction. Recommended guidelines for concrete mix design. Code of practice for composite construction in structural steel and concrete. Criteria for structural design of reinforced concrete natural draught cooling towers. Specification for two-parts poly sulphide. Code of practice for provision of water stops at transverse contraction joints in masonry and concrete dams. Method of non-destructive testing of concrete. Ultrasonic pulse velocity. Rebound hammer. Handbook of concrete mixes Explanatory Handbook on IS: 456-1978 Handbook on concrete reinforcement and detailing.	
		Precast Concrete Works	
	SP: 7(PartVI/	National Building Code- Structural design of prefabrication and Sec.7) systems building.	
	IS: 10297	Code of practice for design and construction of floors and roofs using precast reinforced/prestressed concrete ribbed or cored slab units.	
	IS: 10505	Code of practice for construction of floors and roofs using pre-cast reinforced concrete units.	
		Masonry and Allied Works	
	IS: 1905	Code of Practice for Structural Safety of Buildings-Masonry walls.	
	IS: 2212	Code of Practice for Brickwork.	
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)	TECHNICAL SPECIFICATIONS SECTION VI, PART-C BID DOC. NO.:CS-9585-001-2	GENERAL TECHNICAL REQUIREMENTS	PAGE 58 OF 111

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS 		
	IS: 2250 SP: 20 Sheeting Works IS:277 IS: 459 IS: 513 IS: 730 IS: 1626 IS: 2527 IS: 3007 IS: 5913 IS: 7178 IS: 8183 IS: 8869 IS: 12093 IS: 12866 IS: 14246 Fabrication and Erection of Structural Steel Work IS: 2016	Code of Practice for Preparation and use of Masonry Mortar. Explanatory hand book on masonry code. Galvanised steel sheets (plain or corrugated). Unreinforced corrugated and semi-corrugated asbestos cement sheets. Cold-rolled carbon steel sheets. Specification for fixing accessories for corrugated sheet roofing. Specification for Asbestos cement building pipes and pipe fittings, gutters and gutter fittings and roofing fittings. Code of practice for fixing rain water gutters and down pipe for roof drainage. Code of practice for laying of asbestos cement sheets. Methods of test for asbestos cement products. Technical supply conditions for tapping screw. Bonded mineral wool. Washers for corrugated sheet roofing. Code of practice for laying and fixing of sloped roof covering using plain and corrugated galvanised steel sheets. Plastic translucent sheets made from thermosetting polyester resin (glass fibre reinforced). Specification for continuously pre-painted galvanised steel sheets and coils. Specification for plain washers.	
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)	TECHNICAL SPECIFICATIONS SECTION VI, PART-C BID DOC. NO.:CS-9585-001-2	GENERAL TECHNICAL REQUIREMENTS	PAGE 59 OF 111

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS	एनटीपीसी NTPC		
	IS: 814 Specification for covered Electrodes for Metal Arc Welding for weld steel. IS: 1852 Specification for Rolling and Cutting Tolerances for Hot rolled steel products. IS: 3502 Specifications for chequered plate. IS: 6911 Specification for stainless steel plate, sheet and strip. IS: 3757 Specification for high strength structural bolts IS: 6623 Specification for high strength structural nuts. IS: 6649 High Tensile friction grip washers. IS: 800 Code of practice for use of structural steel in general building construction. IS: 816 Code of practice for use of Metal Arc Welding for General Construction. IS: 4000 Code of practice for assembly of structural joints using high tensile friction grip fasteners. IS: 9595 Code of procedure of Manual Metal Arc Welding of Mild Steel. IS: 817 Code of practice for Training and Testing of Metal Arc Welders. IS: 1811 Qualifying tests for Metal Arc Welders (engaged in welding structures other than pipes). IS: 9178 Criteria for Design of steel bins for storage of Bulk Materials. IS: 9006 Recommended Practice for Welding of Clad Steel. IS: 7215 Tolerances for fabrication steel structures. IS: 12843 Tolerance for erection of structural steel. IS: 4353 Recommendations for submerged arc welding of mild steel and low alloy steels. SP: 6 (Part 1 to 7) ISI Hand book for structural Engineers.			
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-C BID DOC. NO.:CS-9585-001-2	GENERAL TECHNICAL REQUIREMENTS	PAGE 60 OF 111

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS		
	IS: 1608	Method of Tensile Testing of Steel products other than sheets, strip, wire and tube.	
	IS: 1599	Method of Bend Tests for Steel products other than sheet, strip, wire and tube	
	IS : 228	Methods of chemical Analysis of pig iron, cast iron and plain carbon and low alloy steel.	
	IS : 2595	Code of Practice for Radio graphic testing.	
	IS : 1182	Recommended practice for Radiographic Examination of fusion welded butt joints in steel plates.	
	IS : 3664	Code of practice for Ultra sonic Testing by pulse echo method.	
	IS : 3613	Acceptance tests for wire flux combination for submerged Arc Welding.	
	IS : 3658	Code of practice for Liquid penetrant Flaw Detection.	
	IS : 5334	Code of practice for Magnetic Particle Flaw Detection of Welds.	
	Plastering and Allied Works		
	IS : 1635	Code of practice for field slaking of Building lime and preparation of putty.	
	IS : 1661	Application of cement and cement lime plaster finishes.	
	IS : 2333	Plaster-of-paris.	
	IS : 2402	Code of practice for external rendered finishes.	
	IS : 2547	Gypsum building plaster.	
	IS : 3150	Hexagonal wire netting for general purpose.	
	Acid and Alkali Resistant Lining		
	IS : 158	Ready mixed paint, brushing, bituminous, black, lead free, acid, alkali & heat resisting.	
	IS : 412	Specification for expanded metal steel sheets for general purpose.	
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-C BID DOC. NO.:CS-9585-001-2	GENERAL TECHNICAL REQUIREMENTS PAGE 61 OF 111

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS	एनटीपीसी NTPC	
	IS : 4441 Code of practice for use of silicate type chemical resistant mortars. IS : 4443 Code of practice for use of resin type chemical resistant mortars. IS : 4456 Method of test for chemical resistant tiles. (Part I & II) IS : 4457 Specification for ceramic unglazed vitreous acid resistant tiles. IS : 4832 Specification for chemical resistant mortars. Part I Silicate type Part II Resin type Part III Sulphur type IS : 4860 Specification for acid resistant bricks. IS : 9510 Specification for bitumasitc, Acid resisting grade. Water Supply, Drainage and Sanitation IS : 458 Specification for concrete pipes. IS : 554 Dimensions for pipe threads, where pressure tight joints are made on thread. IS : 651 Specification for salt glazed stoneware pipes. IS : 774 Flushing cisterns for water closets and urinals. IS : 775 Cast iron brackets and supports for wash basins and sinks. IS : 778 Copper alloy gate, globe and check valves for water works purposes. IS : 781 Cast copper alloy screw down bib taps and stop valves for water services. IS : 782 Caulking lead. IS : 783 Code of practice for laying of concrete pipes.		
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)	TECHNICAL SPECIFICATIONS SECTION VI, PART-C BID DOC. NO.:CS-9585-001-2	GENERAL TECHNICAL REQUIREMENTS	PAGE 62 OF 111

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS		एनटीपीसी NTPC	
	IS : 1172	Basic requirements for water supply, drainage and sanitation.		
	IS : 1230	Cast iron rain water pipes and fittings.		
	IS : 1239	Mild steel tubes, tubulars and other wrought steel fittings.		
	IS : 1536	Centrifugally cast (Spun) iron pressure pipes for water, gas and sewage.		
	IS : 1537	Vertically cast iron pressure pipes for water, gas and sewage.		
	IS : 1538	Cast iron fittings for pressure pipe for water, gas and sewage.		
	IS : 1703	Ball valves (horizontal plunger type) including float for water supply purposes.		
	IS : 1726	Cast iron manhole covers and frames.		
	IS : 1729	Sand cast iron spigot and socket, soil, water and ventilating pipes, fittings and accessories.		
	IS : 1742	Code of practice for building drainage.		
	IS : 1795	Pillar taps for water supply purposes.		
	IS : 1879	Malleable cast iron pipe fittings.		
	IS : 2064	Code of practice for selection, installation and maintenance of sanitary appliances.		
	IS : 2065	Code of practice for water supply in building.		
	IS : 2326	Automatic flushing cisterns for urinals.		
	IS : 2470 (Part-I & II)	Code of practice for installation of septic tanks.		
	IS : 2501	Copper tubes for general engineering purposes.		
	IS : 2548	Plastic seat and cover for water-closets.		
	IS : 2556 (Part 1 to 15)	Vitreous sanitary appliances (vitreous china).		
	IS : 2963	Non-ferrous waste fittings for wash basins and sinks.		
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-C BID DOC. NO.:CS-9585-001-2	GENERAL TECHNICAL REQUIREMENTS	PAGE 63 OF 111

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
	IS : 3114 Code of practice for laying of cast iron pipes. IS : 3311 Waste plug and its accessories for sinks and wash basins. IS : 3438 Silvered glass mirrors for general purposes. IS : 3486 Cast iron spigot and socket drain pipes. IS : 3589 Electrically welded steel pipes for water, gas and sewage (200mm to 2000mm nominal diameter). IS : 3989 Centrifugally cast (Spun) iron spigot and socket soil, waste and ventilating pipes, fittings and accessories. IS : 4111 (Part I to IV) Code of practice for ancillary structure in sewerage system. IS : 4127 Code of practice for laying of glazed stone-ware pipes. IS : 4764 Tolerance limits for sewage effluents discharged into inland-surface waters. IS : 4827 Electro plated coating of nickel and chromium on copper and copper alloys. IS : 5329 Code of practice for sanitary pipe work above ground for buildings. IS : 5382 Rubber sealing rings for gas mains, water mains and sewers. IS : 5822 Code of practice for laying of welded steel pipes for water supply. IS : 5961 Cast iron grating for drainage purpose. IS : 7740 Code of practice for road gullies. IS : 8931 Cast copper alloy fancy bib taps and stop valves for water services. IS : 8934 Cast copper alloy fancy pillar taps for water services. IS : 9762 Polyethylene floats for ball valves. IS : 10446 Glossary of terms for water supply and sanitation.			
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)	TECHNICAL SPECIFICATIONS SECTION VI, PART-C BID DOC. NO.:CS-9585-001-2	GENERAL TECHNICAL REQUIREMENTS	PAGE 64 OF 111	

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS	एनटीपीसी NTPC		
	IS : 10592 Industrial emergency showers, eye and face fountains and combination units. IS : 12592 Specification for precast concrete manhole covers and frames. IS : 12701 Rotational moulded polyethylene water storage tanks. SP: 35 Hand book on water supply and drainage. - Manual on Sewerage and sewage treatment (Published by CPH & EEO) As updated. Doors, Windows and Allied Works IS : 204 Tower Bolts Part-I Ferrous metals. Part-II Nonferrous metals. IS : 208 Door Handles. IS : 281 Mild steel sliding door bolts for use with padlocks. IS : 362 Parliament Hinges. IS : 420 Specification for putty, for use on metal frames. IS : 1003 Specification for timber panelled and glazed shutters- Part-I door (Part-I) shutters. IS : 1038 Steel doors, windows and ventilators. IS : 1081 Code of practice for fixing and glazing of metal (steel and aluminium) doors, windows and ventilators. IS : 1341 Steel butt hinges. IS : 1361 Steel windows for industrial buildings. IS : 1823 Floor door stoppers. IS : 1868 Anodic coatings on Aluminium and its alloys. IS : 2202 Specification for wooden flush door shutters (solid core type); (Part-II) particle board face panels and hard board face panels			
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)	TECHNICAL SPECIFICATIONS SECTION VI, PART-C BID DOC. NO.:CS-9585-001-2	GENERAL TECHNICAL REQUIREMENTS	PAGE 65 OF 111	

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS		एनटीपीसी NTPC	
	IS:2209	Mortice locks (vertical type).		
	IS:2553	Safety glass		
	IS:2835	Flat transparent sheet glass.		
	IS:3548	Code of practice for glazing in buildings.		
	IS:3564	Door closers (Hydraulically regulated).		
	IS : 3614	Fire check doors; plate, metal covered and rolling type.		
	IS:4351	Steel door frames.		
	IS:5187	Flush bolts.		
	IS:5437	Wired and figured glass		
	IS:6248	Metal rolling shutters and rolling grills.		
	IS:6315	Floor springs (hydraulically regulated) for heavy doors.		
	IS:7196	Hold fasts.		
	IS:7452	Hot rolled steel sections for doors, windows and ventilators.		
	IS:10019	Mild steel stays and fasteners.		
	IS:10451	Steel sliding shutters (top hung type).		
	IS:10521	Collapsible gates.		
	R oof Water Proofing and AlliedWorks			
	IS:1203	Methods of testing tar and bitumen.		
	IS:1322	Specification for bitumen felts for water proofing and damp proofing.		
	IS:1346	Code of practice for water proofing of roofs with bitumen felts.		
	IS:1580	Specification for bituminous compound for water proofing and caulking purposes.		
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CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
	IS:3067	Code of practice for general design details and preparatory work for damp proofing and water proofing of buildings.		
	IS:3384	Specification for bitumen primer for use in water proofing and damp proofing.		
	Floor Finishes and Allied Works			
	IS:1237	Specification for cement concrete flooring tiles.		
	IS:1443	Code of practice for laying and finishing of cement concrete flooring tiles.		
	IS:2114	Code of practice for laying in-situ terrazzo floor finish.		
	IS:2571	Code of practice for laying in-situ cement concrete flooring.		
	IS:3462	Specification for unbacked flexible PVC flooring.		
	IS:4971	Recommendations for selection of industrial floor finishes.		
	IS:5318	Code of practice for laying of flexible PVC sheet and tile flooring.		
	IS:8042	Specification for white portland cement.		
	IS:13801	Specification for chequered cement concrete flooring tiles.		
	Painting and Allied Works			
	IS:162	Specification for fire resisting silicate type, brushing, for use on wood, colour as required.		
	IS:1477	Code of practice for painting of ferrous metals in buildings.		
	Part-I	Pretreatment.		
	Part-II	Painting.		
	IS:1650	Specification for colours for building and decorative finishes.		
	IS:2074	Specification for red oxide-zinc chrome, priming, ready mixed paint air drying.		
	IS:2338	Code of practice for finishing of wood and wood based materials.		
Part-I	Operations and workmanship			
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-C BID DOC. NO.:CS-9585-001-2	GENERAL TECHNICAL REQUIREMENTS	PAGE 67 OF 111

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS	
	Part-II Schedules IS:2395 Code of practice for painting concrete, masonry and plaster surfaces. Part-I Operations and workmanship. Part-II Schedule. IS:2524 Code of practice for painting of nonferrous metals in buildings. Part-I Pretreatment. Part-II Painting. IS:2932 Specification of synthetic enamel paint, exterior, under-coating and finishing. IS:2933 Specification enamel paint, under coating and finishing. IS:4759 Code of practice for hot dip zinc coating on structural steel and other allied products. IS:5410 Specification for cement paint IS:5411 Specification for plastic emulsion paint-for exterior use (Part-I) IS:6278 Code of practices for white washing and colour washing. IS:10403 Glossary of terms relating to building finishes. Piling and Foundation IS:1080 Code of practice for design and construction of simple spread foundations. IS:1904 Code of practice for design and construction of foundations in Soils; General Requirements. IS:2911 Code of practice for designs and construction of Pile foundations (Relevant Parts). IS:2950 Code of practice for designs and construction of Raft (Part-I) foundation. IS:2974 Code of practice for design and construction of machine (Part-I TO V) foundations. IS:6403 Code of practice for determination of Allowable Bearing pressure on Shallow foundation.	
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)	TECHNICAL SPECIFICATIONS SECTION VI, PART-C BID DOC. NO.:CS-9585-001-2	GENERAL TECHNICAL REQUIREMENTS PAGE 68 OF 111

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS		
	IS:8009 Code of practice for calculation of settlement of foundation subjected to symmetrical vertical loads. Part-I Shallow foundations. Part-II Deep foundations. IS:12070 Code of practice for design and construction of shallow foundations on rocks. DIN:4024 Flexible supporting structures for machines with rotating machines. VDI:2056 Criteria for assessing mechanical vibrations of machines. VDI:2060 Criteria for assessing rotating imbalances in machines. Stop Log and Trash Rack IS:4622 Recommendations for fixed - wheel gates structural design. IS:5620 Recommendations for structural design criteria for low head slide gates. IS:11388 Recommendations for design of trash rack for intakes. IS:11855 General requirements for rubber seals for hydraulic gates. Roads IRC:5 Standard specifications and Code of practice for road bridges, section-I general Features of Design. IRC:14 Recommended practice of 2cm thick bitumen and tar carpets. IRC:16 Specification for priming of base course with bituminous primers. IRC:19 Standard specifications and code of practice for water bound macadam. IRC:21 Standard specifications and Code of practice for road bridges, section-III - Cement concrete (plain and reinforced). IRC:34 Recommendations for road construction in waterlogged areas. IRC:36 Recommended practice for the construction of earth embankments for road works. IRC:37 Guidelines for the Design of flexible pavements. IRC:56 Recommended practice for treatment of embankment slopes for erosion control. IRC:73 Geometric design standards for rural (non-urban) highways. IRC:86 Geometric Design standards for urban roads in plains.		
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)	TECHNICAL SPECIFICATIONS SECTION VI, PART-C BID DOC. NO.:CS-9585-001-2	GENERAL TECHNICAL REQUIREMENTS	PAGE 69 OF 111

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS 		
	IRC:SP:13 IRC - Publication IS:73 Loadings IS:875 (Pt. I to V) IS:1893 IS:4091 IRC:6 M.O.T. Safety IS:3696 (Part I & II) IS:3764 IS:4081 IS:4130 IS:5121 IS:5916 IS:7205 IS:7293 IS:7969 IS:11769 - Indian Explosives Act. 1940 as updated. Architectural design of buildings SP:7 SP:41	Guidelines for the design of small bridges & culverts. Ministry of Surface Transport (Roads Wing), Specifications for road and bridge works. Specification for paving bitumen Code of practice for design loads other than earthquake) for buildings and structures. Criteria for earthquake resistant design of structures. Code of Practice for design and construction of foundation for transmission line towers & poles. Standard specifications & code of practice for road bridges, Section-II Loads and stresses. Deptt. of railways Bridge Rules. Safety code for scaffolds and ladders. Safety code for excavation work. Safety code for blasting and related drilling operations. Safety code for demolition of buildings. Safety code for piling and other deep foundations. Safety code for construction involving use of hot bituminous materials. Safety code for erection on structural steelwork. Safety code for working with construction machinery. Safety code for handling and storage of building materials Guidelines for safe use of products containing asbestos.	
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)	TECHNICAL SPECIFICATIONS SECTION VI, PART-C BID DOC. NO.:CS-9585-001-2	GENERAL TECHNICAL REQUIREMENTS	PAGE 70 OF 111

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
	Miscellaneous IS:802 Code of practice for use of structural steel in (Relevant parts) overhead transmission line towers. IS:803 Code of practice for design, fabrication and erection of vertical mild steel cylindrically welded in storage tanks. IS:10430 Creteria for design of lined canals and liner for selection of type of lining. IS:11592 Code of practice for selection and design of belt conveyors. IS:12867 PVC handrails covers. CIRIA Design and construction of buried thin-wall pipes. Publication REFERENCE CODES AND STANDARDS FOR CONTROL AND INSTRUMENTATION The design, manufacture, inspection, testing & installation of all equipment and system covered under this specification shall conform to the latest editions of codes and standards mentioned below and all other applicable VDE, IEEE, ANSI, ASME, NEC, NEMA, ISA AND Indian Standards and their equivalents. Temperature Measurements 1. Instrument and apparatus for temperature measurement - ASME PTC 19.3 (1974). 2. Temperature measurement - Thermocouples ANSI MC 96.1 - 1982. 3. Temperature measuremnet by electrical Resistance thermometers - IS:2806. 4. Thermometer - element - Platinum resistance - IS:2848. Pressure Measurements 1. a) Instruments and apparatus for pressure measurement - ASME PTC 19.2 (1964). b) Electonic transmitters BS:6447. 2. Bourdon tube pressure and vacuum gauges - IS:3624 - 1966. 3. Process operated switch devices (Pr. Switch) BS-6134.			
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CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
	Flow Measurements Instruments and apparatus for flow measurements - ASME PTC 19.5 (1972) Interim supplement, Part-II. Measurement of fluid flow in closed conduits - BS-1042. Electronic Measuring Instrument & Control Hardware/ Software - Automatic null balancing electrical measuring instruments - ANSI C 39.4 (Rev. 1973): IS:9319. - Safety requirements for electrical and electronic measuring and controlling instrument - ANSI C 39.5 - 1974. - Compatability of analog signals for electronic industrial process instruments - ISA - S 50.1 (1982) ANSI MC 12.1 - 1975. - Dynamic response testing of process control instrumentation ISA - S 26 (1968). - Surge Withstand Capability (SWC) tests - ANSI C 37.90 a/IEEE-472 or suitable class of IEC-255-4 equivalent to ANSI C37.90a/IEEE-472. - Printed circuit boards - IPC TM - 650, IEC 326 C. - General requirement and tests for printed wiring boards - IS 7405 (Part-I) 1973. - Edge socket connectors - IEC 130-11. - Requirements and methods of testing of wire wrap terminations DIN 41611 Part-2. - Dimensions of attachment plugs & receptacles - ANSI C 73 - 1973 (Supplement ANSI C 73 a - 1980). - Direct acting electrical indicating instrument - IS:1248 - 1968 (R). - Standard Digital Interface for Programmable Instrumentation - IEEE-488.2 - 1990. - Information Processing Systems - Local Area Networks - Part 2 : Logical Link Control - IEEE-802.2 - 1989. - Standard for Local Area Networks : Carrier Sense Multiple Access with Collision Detection - IEEE-802.3 - 1985. - Supplements A, B, C and E to Carrier Sense Multiple Access with Collision Detection - IEEE-802.3 - 1988.			
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-C BID DOC. NO.:CS-9585-001-2	GENERAL TECHNICAL REQUIREMENTS	PAGE 72 OF 111

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	16. Standard for Local Area Networks : Token - Passing Bus Access Method - IEEE-802.4 - 1985. 17. Standard for Local Area Networks : Token - Ring Access Method and Physical Layer Specification - IEEE-802.5 - 1985. 18. IEEE Guide to Software Requirements Specifications - IEEE-830 - 1984. 19. Hardware Testing of Digital Process Computers - ISA RP55.1 - 1983. 20. Electromagnetic Susceptibility of Process Control Instrumentation - SAMA PMC 33.1 - 1978. 21. Interface Between the Data Terminal Equipment and Data Circuit - Terminating Equipment Employing Serial Binary Data Interchange - EIA-232-D-1987. 22. Electromagnetic Compatibility for Industrial Process Measurement and Control Equipment, Part 3 : Radiated Electromagnetic Field Requirements - IEC 801-3-1984. Instrument Switches and Contact 1. Contact rating - AC services NEMA ICS 2 - 1978 (with revision through May 1983), Part - 2-125, A6000. 2. Contact rating - DC services NEMA ICS 2-1978 Part-2 125, N600. Enclosures 1. Type of Enclosures - NEMA ICS Part - 6 - 1978 (with Rev. 1 4/80) through 110.22 (Type 4 to 13). 2. Racks, panels and associated equipment - EIA : RS - 310 C- 1983 (ANSI C 83.9 - 1972). 3. Protection class for Enclosures, cabinets, control panels & desks - IS:2147 - 1962. Apparatus, enclosures and installation practices in hazardous area 1. Classification of hazardous area - NFPA 70 - 1984, Article 500. 2. Electrical Instruments in hazardous dust location - ISA - 512.11, 1973. 3. Intrinsically safe apparatus - NFPA 493 1978. 4. Purged and pressurised enclosure for electrical equipment in hazardous location - NFPA 496-1982. 5. Enclosures for Industrial Controls and Systems - NEMA IS 1.1 - 1977.			
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	Sampling System 1. Stainless steel material of tubing and valves for sampling system - ASTMA 296-82, Grade 7 P 316. 2. Submerged helical coil heat exchangers for sample coolers ASTM D11 92-1977. 3. Water and steam in power cycle - ASME PTC 19.11. 4. Standard methods of sampling system - ASTM D 1066-99. Annunciators 1. Specifications and guides for the use of general purpose annunciators - ISA S 19.1, 1979. 2. Surge withstand capability tests - ANSI C 37.90a - 1989/IEEE-472 or suitable class of IEC 255-4 equivalent to ANSI C37.90a 1989/IEEE-472 3. Damp heat cycling test - IS:2106 4. Specification for Electromagnetic Susceptibility - SAMA DMC 33, 1/78 Protections 1. Relays and relay system associated with electric power apparatus. ANSI C 37.90, 1 - 1989. 2. General requirements & tests for switching devices for control and auxiliary circuits including contactor relays - IS:6875 (Part-I) - 1973. 3. Turbine water damage prevention - ASME TDP-1-1980. 4. Boiler safety interlocks - NFPA Section 85 B - 1984, 85 C - 1991. UPS System 1. Practices and requirements for semi-conductor power rectifiers - ANSI C 34.2, 1973. 2. Relays and relays system associated with electrical power apparatus - ANSI C 3.90 - 1983. 3. Surge withstand capability test - ANSI C 37.90 1 -1989. 4. Performance testing of UPS - IEC 146. 5. Stationary cells & Batteries Lead Acid type (with tubular positive plates) specification IS-1651-1991.			
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	6. Recommended practice for sizing large lead storage batteries for generating stations & sub-stations - IEEE-485-1985. 7. Printed Circuit Board - IPC TM 650, IEC 326C. 8. General Requirements & tests for printed wiring boards, IS:7405 (Part-I) 1973. Control Valves 1. Control valve sizing - Compressible & Incompressible fluids - ISA S 75.01-1985. 2. Face to face dimensions of control valves - ANSI B 16.00 - 1973. 3. ISA Hand Book of Control Valves - (ISBN : B: 1047-087664-234-2). 4. Codes for pressure piping - ANSI B 31.1 5. Control Valve leak class - ISA RP 39.6 Process Connection & Piping 1. Codes for pressure piping "power piping" - ANSI B 31.1. 2. Seamless carbon steel pipe ASTM - A - 106. 3. Forged & Rolled Alloy steel pipe flanges, forged fittings and valves and parts - ASTM - A - 182. 4. Material for socket welded fittings - ASTM - A - 105. 5. Seamless ferritic alloy steep pipe - ASTM - A - 335. 6. Pipe fittings of wrought carbon steel and alloy steel - ASTM - A - 234. 7. Composition bronze of ounce metal castings - ASTM - B - 62. 8. Seamless Copper tube, bright annealed - ASTM - B - 168. 9. Seamless copper tube - ASTM - B - 75. 10. Dimension of fittings - ANSI - B - 16.11. 11. Valves flanged and butt welding ends - ANSI - B - 16.34. Instrument Tubing 1. Seamless carbon steel pipe - ASTM - A 106. 2. Material of socketweld fittings - ASTM - A105. 3. Dimensions of fittings - ANSI - B - 16.11.		
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)	TECHNICAL SPECIFICATIONS SECTION VI, PART-C BID DOC. NO.:CS-9585-001-2	GENERAL TECHNICAL REQUIREMENTS	PAGE 75 OF 111

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	4. Code for pressure piping, welding, hydrostatic testing - ANSI B 31.1. Cables 1. Thermocouples extension wires/cables - ANSI MC 96.1 - 1992. 2. Requirements for copper conductor-Wiring cables for telecommunications & information processing system - VDE:0815. 3. Colour coding of single or multi-pair cables - ICEA - S - 61-402 (third edition) NEMA WCS - 1979 with revisions thorough 2/83. 4. Insulation & Sheathing compounds for cables : VDE 0207 (Part-4, 5 & 6). 5. Guide design and installation of cable systems in power generating stations (insulation, jacket materials) - IEEE Std. 422-1977. 6. Rules for Testing insulated cables and flexible cables : VVDE - 0472 7. Requirements of vertical flame propagation test - IEEE 383 - 1974 (R 1980) 8. Standard specification for tinned soft or annealed copper wire for electrical purpose - ASTM B-33-81. 9. Oxygen index and temperature index test - ASTM D - 2863. 10. Smoke density measurement test - ASTM D - 2843. 11. Acid gas generation test - IEC - 754 - 1. 12. Swedish Chimney test - SEN - 4241475 (F3). 13. Teflon (FEP) insulation & sheath test - ASTM D - 2116. 14. Thermocouple compensating cables - Testing requirements & sampling plan IS:8784. 15. PVC insulated electric cables for working voltage upto and including 1100 V - IS:1554 (Part-I). Cable Trays, Conduits 1. Guide for design and installation of cable systems in power generating station (Cable trays, support systems, conduits) - IEEE Std. 422, 1977, NEMA VE-1 1979, NFPA 70-1984. 2. -do- Test Standards. NEMA VE-1-1979. 3. Zinc coating "hot dip" on assembled products for galvanising of carbon steel cable trays - ASTM A - 386-78.		
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)	TECHNICAL SPECIFICATIONS SECTION VI, PART-C BID DOC. NO.:CS-9585-001-2	GENERAL TECHNICAL REQUIREMENTS	PAGE 76 OF 111

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
	Public Address System 1. Specifications for loud speakers - IS:7741 (Part-I, II and III) 2. Code of safety requirement for electric mains operated audio amplifiers - IS:1301 3. Specification for Public Address Amplifiers - IS:10426. 4. Code of practice for outdoor installation of PA system - IS:1982. 5. Code of practice for installation for indoor amplifying and sound distribution system - IS:1881. 6. Basic environmental testing procedures for electronic and electrical items - IS:9000. 7. Characteristics and methods of measurements for sound system equipment - IS:9302 8. Code of practice of electrical wiring installations (System voltage not exceeding 650 volts) - IS:732 9. Rigid steel conduits for electric wiring - IS:9537 (Part-I and II) 10. Fittings for rigid steel conduits for electrical wiring - IS:2667 11. Degree of protection provided by enclosure for low voltage switchgear and control gear - IS:2147. Vibration Monitoring System 1. API 670 - 1994 2. BS : 4675 Part-2			
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-C BID DOC. NO.:CS-9585-001-2	GENERAL TECHNICAL REQUIREMENTS	PAGE 77 OF 111

ANNEXURE-I

MFGR.'s LOGO	MANUFACTURER'S NAME AND ADDRESS	MANUFACTURING QUALITY PLAN		PROJECT :
		ITEM :	QP NO.: REV.NO.: DATE: PAGE: OF....	PACKAGE : CONTRACT NO. : MAIN-SUPPLIER:
		SUB-SYSTEM:		

SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY			REMARKS
					M	C / N						M	C	
1.	2.	3.	4.	5.	6.		7.	8.	9.	D*	**	10.		11.

		LEGEND: * RECORDS, IDENTIFIED WITH “TICK” (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION. ** M: MANUFACTURER/SUB-SUPPLIER C: MAIN SUPPLIER, N: NTPC P: PERFORM W: WITNESS AND V: VERIFICATION. AS APPROPRIATE, CHP: NTPC SHALL IDENTIFY IN COLUM “N” AS ‘ W”	 FOR NTPC USE	DOC. NO.:		REV..... CAT.....	
MANUFACTURER/ SUB-SUPPLIER	MAIN-SUPPLIER						
SIGNATURE				REVIEWED BY	APPROVED BY	APPROVAL SEAL	

FORMAT NO.: QS-01-QAI-P-09/F1-R1

1/1

ENGG. DIV./QA&I

EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)	TECHNICAL SPECIFICATION SECTION – VI, PART-C BID DOC. NO.: CS-9585-001-2	GENERAL TECHNICAL REQUIREMENT	PAGE 78 OF 111

ANNEXURE-II

SUPPLIER'S LOGO	SUPPLIER'S NAME AND ADDRESS	FIELD QUALITY PLAN		PROJECT :
		ITEM :	QP NO.:	PACKAGE :
		SUB-SYSTEM:	REV. NO.:	CONTRACT NO. :
			DATE:	MAIN-SUPPLIER:
			PAGE: OF....	

SL. NO	ACTIVITY AND OPERATION	CHARACTERISTICS / INSTRUMENTS	CLASS OF CHECK #	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		REMARKS
1.	2.	3.	4.	5.	6.	7.	8.	9.	D*	10.

		LEGEND: * RECORDS, IDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION. LEGEND TO BE USED: CLASS # : A = CRITICAL, B=MAJOR, C=MINOR; 'A' SHALL BE WITNESSED BY NTPC FQA, 'B' SHALL BE WITNESSED BY NTPC ERECTION / CONSTRUCTION DEPTT. AND 'C' SHALL BE WITNESSED BY MAIN SUPPLIER (A & B CHECK SHALL BE NTPC CHP STAGE)		DOC. NO.:			REV.....		
MANUFACTURER/ SUB-SUPPLIER	MAIN-SUPPLIER								
SIGNATURE				FOR NTPC USE	REVIEWED BY	APPROVED BY	APPROVAL SEAL		

FORMAT NO.: QS-01-QAI-P-09/F2-R1

1/1

ENGG. DIV./QA&I

EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)	TECHNICAL SPECIFICATION SECTION – VI, PART-C BID DOC.NO.: CS-9585-001-2	GENERAL TECHNICAL REQUIREMENT	PAGE 79 OF111

ANNEXURE-III

	Project :	Stage ::	LIST OF ITEMS REQUIRING QUALITY PLAN AND SUB-SUPPLIER APPROVAL						DOC. NO.:	
	Package :								REV. NO.:	
	Supplier :		SUB-SYSTEM :						DATE :	
	Contractor No. :								PAGE : OF	
S. N.	Item	QP/ Insp. Cat.	QP No.	QP Sub. Schedule	QP approval schedule	Proposed sub-supplier	Place	Sub-suppliers approval status / category	Sub-supplier Details submission schedule	Remarks

LEGENDS

SYSTEM SUPPLIER/SUB-SUPPLIER APPROVAL STATUS CATEGORY (SHALL BE FILLED BY NTPC)

A – For these items proposed vendor is acceptable to NTPC. To be indicated with letter “A” in the list alongwith the condition of approval, if any.

DR – For these items “Detailed required” for NTPC review. To be identified with letter “DR” in the list.

NOTED – For these items vendors are approved by Main Supplier and accepted by NTPC without specific vendor approval from NTPC. To be identified with “NOTED.”

QP/INSPN CATEGORY:

CAT-I : For these items the Quality Plans are approved by NTPC and the final acceptance will be on physical inspection witness by NTPC.

CAT-II : For these items the Quality Plans approved by NTPC. However no physical inspection shall be done by NTPC. The final acceptance by NTPC shall be on the basis review of documents as per approved QP.

CAT-III : For these items Main Supplier approves the Quality Plans. The final acceptance by NTPC shall be on the basis certificate of conformance by the main supplier.

UNITS/WORKS : Place of manufacturing Place of Main Supplier of multi units/works.

FORMAT NO.: QS-01-QAI-P-1/F3-R0

1/1

Engg. Div. / QA&I

EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)	TECHNICAL SPECIFICATION SECTION – VI, PART-C BID DOC.NO.: CS-9585-001-2	GENERAL TECHNICAL REQUIREMENT	PAGE 80 OF105

ANNEXURE-IV

	Project :	Stage ::	STATUS OF ITEM REQUIRING QP& SUB-SUPPLIER APPROVAL						DOC. NO.:			
	Package :								REV. NO.:			
	Contractor :								DATE :			
	Contractor No. :								PAGE : OF			
S. N.	Item / Service	QP/ Insp. Cat.	QP Sub. Schedule Approval schedule	Date of sub-mission	Date of commt Appl.	Status Code C/II/I	Proposed Sub-suppliers	Place of manufacturing works	Approval Status	Sub-supplier detail submission schedule	Remarks	
FORMAT						1/1	Engg. Div. / QA&I					

EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)	TECHNICAL SPECIFICATION SECTION – VI, PART-C BID DOC.NO.:CS- CS-9585-001-2	GENERAL TECHNICAL REQUIREMENT	PAGE 81 OF 111

ANNEXURE-V

		Project :		Stage :		FIELD WELDING SCHEDULE (To be raised by the contractor) Welding Code:							DOC. NO.:			
		Contractor :											REV. NO.:			
		Contractor No. :				DATE :										
		System :				PAGE :		OF								
Sl. No.	DRG No. for Weld Location and Identification mark	Description of parts to welded	Matl. Spec.	Dimensions		Process of welding	Type of Weld	Electrode filler spec.	WPS. No.	Min. pre-heat	Heat treatment		NDT method/ Quantum	REF		Remarks
											Temp.	Holding time		Spec. No.	ACC Norm Ref.	
NOTES:																
SIGNATURE																
FORMAT						1/1						Engg. Div. / QA&I				

EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)	TECHNICAL SPECIFICATION SECTION – VI, PART-C BID DOC.NO.: CS-9585-001-2	GENERAL TECHNICAL REQUIREMENT	PAGE 82 OF 111

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS (Annexure-VI)																																																												
	<table><tr><th>S.No</th><th>Description of Drgs/Docs</th><th>No of Prints</th><th>No of CD ROMs/DVDs/Portable Hard Disk</th></tr><tr><td rowspan="8">1</td><td>Drawings, Data sheets, Design calculations, Purchase specifications and other documents</td><td></td><td></td></tr><tr><td>First submission and submission with major changes</td><td></td><td></td></tr><tr><td>▪ Layout (A0&A1 sizes)</td><td>4</td><td>-</td></tr><tr><td>▪ Other Drawings/Documents (A0&A1 sizes)</td><td>2</td><td>-</td></tr><tr><td>▪ P&ID (All sizes)</td><td>4</td><td>-</td></tr><tr><td>a) Final drawings/documents (Directly to site)</td><td>6</td><td>2</td></tr><tr><td>b) "As Built" Drawing/Documents (Directly to site)</td><td>6</td><td>2</td></tr><tr><td>c) Analysis reports of Equipments / piping /structures components/system employing software packages as detailed in the specifications.</td><td>2</td><td>2</td></tr><tr><td>2</td><td>Erection Manual (Directly to site)</td><td>4 sets</td><td>2</td></tr><tr><td rowspan="2">3</td><td>Operation & Maintenance manual</td><td rowspan="2">1 set</td><td rowspan="2">--</td></tr><tr><td>i) First Submission</td></tr><tr><td></td><td>ii) Final Submission (Directly to site)</td><td>4 sets</td><td>2</td></tr><tr><td>4</td><td>Plant Hand Book</td><td rowspan="2">1</td><td rowspan="2">1</td></tr><tr><td></td><td>i) First Submission</td></tr><tr><td rowspan="2">5</td><td>Commissioning and Performance Test Procedure manual</td><td rowspan="2">1 set</td><td rowspan="2">--</td></tr><tr><td>i) First Submission</td></tr><tr><td></td><td>ii) Final Submission (Directly to site)</td><td>4 sets</td><td>2</td></tr></table>				S.No	Description of Drgs/Docs	No of Prints	No of CD ROMs/DVDs/Portable Hard Disk	1	Drawings, Data sheets, Design calculations, Purchase specifications and other documents			First submission and submission with major changes			▪ Layout (A0&A1 sizes)	4	-	▪ Other Drawings/Documents (A0&A1 sizes)	2	-	▪ P&ID (All sizes)	4	-	a) Final drawings/documents (Directly to site)	6	2	b) "As Built" Drawing/Documents (Directly to site)	6	2	c) Analysis reports of Equipments / piping /structures components/system employing software packages as detailed in the specifications.	2	2	2	Erection Manual (Directly to site)	4 sets	2	3	Operation & Maintenance manual	1 set	--	i) First Submission		ii) Final Submission (Directly to site)	4 sets	2	4	Plant Hand Book	1	1		i) First Submission	5	Commissioning and Performance Test Procedure manual	1 set	--	i) First Submission		ii) Final Submission (Directly to site)	4 sets	2
S.No	Description of Drgs/Docs	No of Prints	No of CD ROMs/DVDs/Portable Hard Disk																																																										
1	Drawings, Data sheets, Design calculations, Purchase specifications and other documents																																																												
	First submission and submission with major changes																																																												
	▪ Layout (A0&A1 sizes)	4	-																																																										
	▪ Other Drawings/Documents (A0&A1 sizes)	2	-																																																										
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EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-C BID DOC. NO.:CS-9585-001-2	GENERAL TECHNICAL REQUIREMENTS Annexure-VI	PAGE 83 OF 111																																																									

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS (Annexure-VI)				
	S.No	Description of Drgs/Docs	No of Prints	No of CD ROMs/DVDs/Portable Hard Disk	
	6	Performance and Functional Guarantee Test Report i) First Submission	2 sets	—	
		ii) Approved Copies (Direct to Site)	4 sets	2	
	7	Project Completion Report (Directly to site)	6 sets	2	
	8	QA programme including Organisation for implementation and QA system manual(with revisions)	1	—	
	9	Vendor details in respect of proposed vendors including contractor's evaluation report.	2	—	
	10	Manufacturing QPs, Field QPs, Field welding schedules and their reference document like test procedures, WPS, POR etc i) For review/comment	1	—	
		ii) Approved final copies of Field QPs, Field welding schedules and their reference document like test procedures, WPS, POR etc (Direct to Site)	4	2	
	11	Welding Manual, Heat Treatment Manuals, Storage & preservation manuals i) For review/comment	1 set	—	
		ii) Approved copies (Direct to Site)	4 sets	2	
	12	QA Documentation Package for items / equipment manufactured and despatched to site	2 sets	2	
	13	QA Documentation Package for field activities on equipment/systems at site	2 sets	2	
	EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-C BID DOC. NO.:CS-9585-001-2		GENERAL TECHNICAL REQUIREMENTS Annexure-VI

STEAM GENERATOR AUXILIARIES

Sl.No	Area	Sub Area	Time of training from date of award	Batch size	Class Room training			Training at Manufacturer works			Training at Operating Plants			Total no. of days
					Content of traning	Location of training	No of days	Content of traning	Location of training	No of days	Content of traning	Location of training	No of days	
1.0	Steam Generator & Auxiliaries (Mechanical)													
1.1	Boiler	General famlarisatio n of supplied boiler	6 months	3	a) General Design, equipment, system and parameter famlarisation of supplied boiler i.e. features, design, operating parameters etc. b) Genaral Layout of boiler & ESP area, basic layout selection criteria, arrangement of pressure part, flue gas duct, coal pipe, bunker, valves, dampers, equipments, piping trestles etc.	Design office of the QSGM	3	1. Manufacturing of pressure parts 2. Welding processes 3. Testing Facilities 4. Product Development in process/ progress 5. Future plan for Technology induction 6. R&D work in progress	Manufacturer's works where the boilers of the subject project is being manufactured.	4	1. General Design, equipment, system and parameter famlarisation of operating boiler (visited) (which preferably should be simillar to supplied boiler) i.e. features, design, operating parameters. The palnt visit should include the following: a) Boiler each floor level walk through b) Visit to all the boiler auxiliaries location. c) Visit to BOP area. 2. Collection of Performance data of the plant	Operating plants in any country including India where same make with similar capacity boilers are under operation.	2	27
1.2	Boiler	Pressure parts	6 months	3	Basic theory/ concept, calculation with illustrative example, Design application, arrangement of following: 1. Thermal design and hydraulic circulation balance 2. Strength Calculation 3. Pressure Part arrangement, coil orientation and basis. 4. Tube metal temperature calculation, criteria for location of thermocouple. 5. Selection Creiteria for soot blower (i.e. location, nos. etc.)	Design office of the QSGM	3							9
1.3	Boiler	Performanc e	6 months	3	Basic concept, calculation of performance data with illustrative example (such as Heat Duty, boiler efficiency, predicted performance, NOX calculation, furnace sizing etc.) of offered boiler and its application to boiler design.	Design office of the QSGM	4							12
1.4	Boiler	Boiler System	6 months	3	a) Basic concept, Sizing calculation of following systems with illustrative examples alongwith details of criteria affecting the sizing calculation : 1. Air & Gas System (duct sizing, air & gas weight calculation, damper & gates sizing etc.) 2. Start up system (Circulation calculation, sizing and input data for SGWC pump etc.) 3. Fuel firing/ Combustion system (Sizing calculation of Pulveriser, feeders, burners, PA & Seal Air Fans etc.) 4. Fuel Oil firing system (Sizing calculation of HFO/ LFO pump, heater, strainers, pressure drop calculation etc.) 5. Draft System (sizing calculation of FD & ID Fans etc.) b) Impact of the above sizing calculation on the overall boiler design/ performance.	Design office of the QSGM	6							18

STEAM GENERATOR AUXILIARIES

Sl.No	Area	Sub Area	Time of training from date of award	Batch size	Class Room training			Training at Manufacturer works			Training at Operating Plants			Total no. of days
					Content of training	Location of training	No of days	Content of training	Location of training	No of days	Content of training	Location of training	No of days	
					c) Selection/ optimisation of above system from techno-economics point of view such as start up system: selection criteria for wet mode upto 30% or 40% BMCR flow etc. d) Selection/ Optimisation of various auxiliaries/ equipments covered under above systems from techno-economics point of view. Such as type & no. of fans (axial- single/ double stage), APH (Tri sector/ bisector APH), Mills etc.	Design office of the QSGM								
1.5	Boiler	General familiarisation of supplied SCR System	6 months	3	General Design, equipment, system and parameter familiarisation of supplied SCR system i.e. features, design, operating parameters etc.	Design office of the SCR System supplier	2	1. Manufacturing of Catalyst 2. Testing Facilities for Catalyst 3. Product Development in process/ progress	Manufacturer's works where the SCR Catalysts of the subject project is being manufactured.	1	1. General Design, equipment, system and parameter familiarisation of operating SCR System (visited) (which preferably should be similar to supplied boiler) i.e. features, design, operating parameters. The plant visit should include the following: a) SCR system each floor level walk through b) Visit to all the SCR system auxiliaries location including Ammonia Dosing system.	Operating plants in any country including India where same make with similar capacity SCR system are under operation.	1	12
1.6	Boiler	Ammonia Dosing System for SCR System	6 months	3	1. Basic theory/ concept. 2. Selection & Sizing calculation of Ammonia dosing system with illustrative examples for Compressors, Storage Tanks, Pumps, vaporisers, Air-NH3 mixers, Glycol-water heaters etc. 3. Familiarisation of Safety measures to be ensured for Storage & Using Ammonia. 4. Selection & Sizing Criteria for Safety equipments to be ensured as per Indian Regulations for Ammonia Handling	Design office of the SCR System supplier	2	4. Future plan for Technology induction 5. R&D work in progress						6
1.7	Boiler	Catalyst Modules for SCR System	6 months	3	1. Basic theory/ concept. 2. Selection criteria of catalyst 3. Sizing calculation of catalyst & calculation of performance data (i.e. Activity etc.) with illustrative examples	Design office of the SCR System supplier	1				2. Collection of Performance data of the plant			3
1.8	Boiler	FGD System	6 months	3	1. Mass balance, Design, selection and sizing calculations of FGD 2. Training on factors affecting sizing/ efficiency of FGD system, equipments & auxiliaries 3. Materials for FGD & selection 4. Basic concepts, Design and sizing calculations on slurry systems including piping, valves, etc. 5. Layout & model of FGD area, cable & piping trestles etc. 6. Erection strategies, erection procedures. 7. Performance as per applicable code and demonstration tests.	Design office of the FGD System supplier	5	1. Manufacturing process of Absorber and other equipment 2. Welding process 3. Testing facilities 4. Product development in process 5. Future plan for technology induction 6. R&D work in progress.	Manufacturer's works where FGD system equipment of the subject project are being manufactured.	2	1. Familiarization with various system and equipment 2. Performance, data collection analysis and review 3. O&M feed back 4. Operation history of various equipment and system 5. Failure analysis	Operating plants in any country including India where same type with similar capacity FGD system are under operation.	3	30
1.9	Boiler	Buck stay & structure	6 months	3	Basic theory, calculations with illustrative example & Design application of Buck stay & structure design	Design office of the QSGM	2							6
1.10	Boiler	Erection & PG Test	6 months	3	Erection strategies, erection procedures Performance and demonstration tests.	NTPC PMI	2							6

STEAM GENERATOR AUXILIARIES

Sl.No	Area	Sub Area	Time of training from date of award	Batch size	Class Room training			Training at Manufacturer works			Training at Operating Plants			Total no. of days
					Content of traning	Location of training	No of days	Content of traning	Location of training	No of days	Content of traning	Location of training	No of days	
1.11	Boiler	Review & discussion after Plant Visit	6 months	3	1. Analysis and review of collected performance data of the plant visited. 2. Co-relation of the operating plant design, parameter visited wrt to boiler supplied under contract. 3. O&M feedback of the plant 5. Failure analysis: Atleast elaborative case study of one major failure	NTPC PMI	2							6
1.12	Boiler Auxiliaries	Equipments /Auxiliaries	6 months		Selection criteria of auxiliaries (Type, Model, Nos. etc.) based on input data, design features, working & importance of	NTPC PMI		Manufacturer's works where the equipment of the subject project is being manufactured.						
				2	1. Coal pulveriser		2		Visit to manufacturer Works	1				6
				2	2. Fans (ID, FD, PA & Seal Air Fans)		2		Visit to manufacturer Works	1				6
				2	3. Air-preheater		2		Visit to manufacturer Works	1				6
				2	4. Soot Blowers		1							2
				2	5. Dampers & Gates		1							2
				2	6. Valves including safety valves		2							4
				2	7. Feeder		1							2
				2	8. Burner		1							2
				2	9. SG WC pump		1							2
				2	10. Fuel Oil (HFO & LFO) Pumps, Heaters, Strainers etc.		2							4
				2	11. Any other equipment/ auxiliaries not specified above		1							
Steam Generator & Auxiliaries (Mechanical) TOTAL Mandays		173					128			27			18	173

STEAM GENERATOR AUXILIARIES

Sl.No	Area	Sub Area	Time of training from date of award	Batch size	Class Room training			Training at Manufacturer works			Training at Operating Plants			Total no. of days
					Content of traning	Location of training	No of days	Content of traning	Location of training	No of days	Content of traning	Location of training	No of days	
2.0	Steam Generator & Auxiliaries (Power Cycle Piping)													
2.1	Power Cycle Piping	Stress analysis of piping	6months	4	1. Critical pipe sizing including pressure drop calculation	Design office of the QSGM	2	1. Familiarisation of manufacturing/ fabrication/testing of critical piping (including welding techniques & heat treatment methods employed) and norms	Manufacturer's works	2	Familiarisation of Power cycle piping & equipment layout	Operating plants in any country including India operating on similar parameters	1	20
2.2	Power Cycle Piping			4	2.Static analysis of critical piping system	Design office of the QSGM	2	2. Familiarisation of variable & constant load hanger setting & snubber setting	Manufacturer's works	1				12
2.3	Power Cycle Piping			4	3.Dynamic analysis (safety valve blowing, wind, siesmic & steam hammer) of critical piping	Design office of the QSGM	2							8
2.4	Power Cycle Piping			4	4.Familiarisation of Hanger engineering	Design office of the QSGM	1							4
2.5	Power Cycle Piping			4	5.Familiarisation of piping vibration analysis & norms	Design office of the QSGM	1							4
POWER CYCLE PIPING TOTAL Mandays		48		4			32			12			4	48
3.0	Steam Generator & Auxiliaries (Electrical)													
3.1	Boiler	Electrical	6 months	3	Integral Actuator	Manufacturer Works	3	1. Design,interface and funtional aspect 2. Familiarisation with various types of actuator	Manufacturer Works	2				15
3.2	Boiler	Electrical	6 months	3	BCW motor	Manufacturer Works	3	1. Design review , manufacturing process, preservation. 2. operation and maintenance,preservatio n during storage	Manufacturer Works	2				15
3.3	Boiler	Electrical	6 months	3	HT Motor	Manufacturer Works	3	Design review , manufacturing process, storage.	Manufacturer Works	2				15
Electrical TOTAL Mandays		45		3			27			18			0	45

STEAM GENERATOR AUXILIARIES

Sl.No	Area	Sub Area	Time of training from date of award	Batch size	Class Room training			Training at Manufacturer works			Training at Operating Plants			Total no. of days
					Content of traning	Location of training	No of days	Content of traning	Location of training	No of days	Content of traning	Location of training	No of days	
4.0	Steam Generator & Auxiliaries (Control & Instrumentation)													
4.1	C&I	SG-DDCMIS- Hardware and Operating System	18 months	4	(a) Hardware & Software organization of the system (b) Basis of selection of H/W memory sizing (c) Operating System features (d) Interface with other system, Openness and inter-operability (e) Upgradability and System testing features	SG-DDCMIS vendor works	2	(a) Hardware & Software organization of the system (b) Basis of selection of H/W memory sizing (c) Operating System features (d) Interface with other system, Openness and inter-operability (e) Upgradability and System testing features	SG-DDCMIS vendor works	2	Operational feedback	Operating plants in any country including India where same make/ model of SG-DDCMIS is in operation.	1.5	22
4.2	C&I	SG-DDCMIS- Human Machine Interface System Engineering & Application Software	18 months	5	(a) Specific system customization (b) Various system modules & interface with OS © Database organisation & development (d) Development of mimics, other applications like calculations, logs, historical storage functionalities & use	SG-DDCMIS vendor works	4	Hands on experience, Testing methodologies	SG-DDCMIS vendor works	2	Operational feedback	Operating plants in any country including India where same make/ model of SG-DDCMIS is in operation.	1	35
4.3	C&I	SG-DDCMIS- (i) Control system hardware (ii) Control system Application Software	18 months	4	(i) (a) Basic design features for system & its Modules, (b) System capabilites & system design techniques (c) Communication with HMI & other systems	SG-DDCMIS vendor works	4	(a) Manufacturing processes with special attention to handling of the modules (b)	SG-DDCMIS vendor works	1	Operational feedback	Operating plants in any country including India where same make/ model of SG-DDCMIS is in	1	24
				4	(ii) (a) Database structure (b) Organization & interface between application program & database(c) Application for implementation of Control functions (d) Study of standard algorithms & development of new algorithm	SG-DDCMIS vendor works	3	(ii) (a) System integration & system capabilites testing	SG-DDCMIS vendor works	1				16
4.4	C&I	Boiler Controls: (i) Study of Control loops (ii) Burner Manageme nt system	20 months	4	(i) (a) General concept of closed loop controls of the OEM (b) Critical analysis of some important control loops like Boiler Start up control, Feedwater control etc.	Design office of the QSGM	3				Operational feedback	Operating plants in any country including India where same make/ model of SG-DDCMIS is in operation.	1	16
				4	(ii) (a) Hardware logic (b) NFPA-85/ EN-50156/ EN-61508/ En-61511 requirements and other applicable safety standards (c) Flame scanner locations.	Design office of the QSGM	4							16
4.5	C&I	Special SG- related instrumenta tion (i) Flame Scaneers (ii) Boiler Flame viewing system(iii) Acoustic	24 months	2	(i) (a) Flame scanners: Principle of Operation (b) Suitability for the proposed boiler	Flame scanner vendor's work	1	Manufacturing & testing procedures	Flame scanner vendor's work	1	Operational feedback	Operating plants in any country including India where same make/ model of Flame scanner is in operation.	1	6
				2	(ii) (a) Boiler Flame viewing system: Principle of operation (b) Location (c) Details of software & methods of modification/ customization	Flame camera vendor's work	1				Operational feedback	Operating plants in any country including India where same make/ model of Flame scanner is in operation.	1	4

STEAM GENERATOR AUXILIARIES

Sl.No	Area	Sub Area	Time of training from date of award	Batch size	Class Room training			Training at Manufacturer works			Training at Operating Plants			Total no. of days
					Content of traning	Location of training	No of days	Content of traning	Location of training	No of days	Content of traning	Location of training	No of days	
		Pyrometer		2	(iii) (a) Acoustic Pyrometer: Principle of operation (b) Location (c) Details of software & methods of modification/ customization	Acoustic Pyrometer vendor's work	1				Operational feedback	Operating plants in any country including India where same make/ model of Acoustic Pyrometer is in operation.	1	4
4.6	C&I	Electric Power Supply System	22 months	2	System architecture and Component details	Electric power supply system vendor's work	2	Manufacturing/ assebling & testing procedures	Electric power supply system vendor's work	0.5				5
C&I TOTAL Mandays		148					94			29			25	148
5.0	Steam Generator & Auxiliaries (Quality Assurance)													
5.1	Quality Assurance & Inspection- QA System & Programme	QA System Procedure, Plant Standard	12 months	2	a) Integrated QAManagement System for enhanced reliability of equipments. b) QA system in design, procurement, manufacturing, installation and operation of equipments/ systems. c) QA System for developing and establishing new processes and vendors. d) System of structured documentation of Engg. and test records.	Manufacturer's work	5	1. Appreciation of implementation of QA programmes in various manufacturing, asembly and testing activities. 2. Appreciation of developmental activities for new processes and vendors. 3. System of prequalification of special processes.	Manufacturer's works where the equipment of the subject project is being manufactured.	3	1. operating feedbacks 2. Co-relation of reliability and performance of the equipment with implementation of QA system. 3. Appreciation of the use of structured Engg./ QA documentation during operational phase of plant and during RLA studies of plant.	Operating plants in any country includinh india where same make and similar capacity boilers are under operation.	1	18
5.2	Quality Assurance	SG & Auxiliaries	12 months	5	a) General Design, equipment, system and parameter famlarisation of supplied boiler	PMI	3							15
5.3	Quality Assurance	SG & Auxiliaries (Mechanical)	12 months	4	Pressure parts (Water wall panels, superheaters, Reheaters, headers, economiser, power cycle piping etc.) & Auxiliaries (Fans, Pulversier, APH, Soot blowers, Gates & Dampers, Feeder, SGWC pump etc.) Main design aspect including material of construction and applicable codes/ standards, manufacturing processes, machinery involved, various welding process involved, testing and inspection etc.	Manufacturer's work	3	1. Manufacturing, testing and inspection at various stages of Boiler Pressure parts and Auxiliaries 2. Shop level exposure to these processes with understanding of applicable code/ standard/ parameters involved in manufacturing of main pressure parts and auxiliaries. 3. Various testing and inspection activity in shop for above components.	Manufacturer's works where the equipment of the subject project is being manufactured.	4				28

STEAM GENERATOR AUXILIARIES

Sl.No	Area	Sub Area	Time of training from date of award	Batch size	Class Room training			Training at Manufacturer works			Training at Operating Plants			Total no. of days
					Content of traning	Location of training	No of days	Content of traning	Location of training	No of days	Content of traning	Location of training	No of days	
5.4	Quality Assurance	SG & Auxiliaries: Control & instrumentation: Material, construction, Manufacturing, assembly, testing wrt QA aspects, quality procedure and QA system & I	12 months	1	1. Familiarisation with control system and instrumentation. 2. QA system for manufacturing of reliable components.	Manufacturer's work	2	1. Manufacturing activities for critical instruments/ items. 2. Implementation of testing programme to ensure reliability.	Manufacturer's works where the equipment of the subject project is being manufactured.	2	Feedback on performance of C&I system	Operating plants in any country includinh india where same make and similar capacity boilers are under operation.	1	5
QA TOTAL Mandays		66					39			24			3	66

SUMMARY

1.0	Steam Generator & Auxiliaries (Mechanical) TOTAL Mandays	173
2.0	Power Cycle Piping TOTAL Mandays	48
3.0	Electrical TOTAL Mandays	45
4.0	C&I TOTAL Mandays	148
5.0	QA TOTAL Mandays	66
GRAND TOTAL MANDAYS OF TRAINING FOR STEAM GENERATOR & AUXILIARIES		480
GRAND TOTAL MANMONTHS OF TRAINING FOR STEAM GENERATOR & AUXILIARIES		16.0

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS ANNEXURE-VIII			
PRODUCT	AREAS OF TRAINING REQUIREMENT			
	PRODUCT DESIGN	Plant Visit	Visit to Manufacturer's Work	Operation & Maintenance of Plant
TURBINE GENERATOR AND ITS INTEGRAL AUXILIARIES	Turbine cycle optimization and turbine performance in off design condition. Rotor design and strength calculation Rotor dynamic behavior studies wrt natural frequency, critical speed, vibration etc. Blade profile/root design and blade strength design, blade vibration analysis Casing & diaphragm design Labyrinth seal selection & design for different turbine configurations Selection of turbine type (i.e. Tandem vs cross compounding, separate HP/IP vs combined HP/IP, material of construction etc.) Design principle for Up rating/down rating of existing design/ modules for the	Familiarization of power plants of various makes of turbines for super critical units Collection of data for analysis of availability of turbines Comparative studies for integral systems of turbine O&M history/problems related to turbine Failure analysis	Manufacturing processes of turbine Assembly of turbine Testing of turbines Product development in process Future plan for technology induction R&D work in progress	
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-C BID DOC. NO.:CS-9585-001-2		GENERAL TECHNICAL REQUIREMENTS ANNEXURE-VIII PAGE 92 OF 111

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS ANNEXURE-VIII			
PRODUCT	AREAS OF TRAINING REQUIREMENT			
	PRODUCT DESIGN	Plant Visit	Visit to Manufacturer's Work	Operation & Maintenance of Plant
	specific project. of bearings, load calculation on bearings, bearing oil flow calculation Selection, design and control principle for Turbine governing system Performance calculation Steam path audit Layout principle of various equipment's of TG and its integral system Latest technological advancements			
MANDAYS Boiler Feed Pumps	45 Techno-economic studies for Selection of BFP Configuration and its drive Criteria for selection of boiler Feed Pump parameters Rotor design, strength calculation and rotor dynamic behavior studies wrt critical speed, vibration etc	10 Familiarization of power plants of various makes of feed pumps for super critical units Data collection of BFP parameters and configuration Collection of data for analysis of availability of BFP	10 Manufacturing process of various components of BFP Assembly of BFP Testing, capabilities of BFP at works wrt performance, NPSH, dry run, visual cavitation, axial thrust measurement	
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-C BID DOC. NO.:CS-9585-001-2		GENERAL TECHNICAL REQUIREMENTS ANNEXURE-VIII PAGE 93 OF 111

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS ANNEXURE-VIII			
PRODUCT	AREAS OF TRAINING REQUIREMENT			
	PRODUCT DESIGN	Plant Visit	Visit to Manufacturer's Work	Operation & Maintenance of Plant
	Impeller design and its hydraulic behavior Role of critical parameters such as NPSH(R), Suction specific speed, running clearances, speed etc. in design of feed pumps Material selection of BFP components Guiding factors for selection of BFP seals Computation of axial thrust under various flows Performance calculation Transient analysis in pump suction piping wrt NPSH margin Latest technological trends in BFP design	O&M history/problems related to BFP Comparative studies for various types of BFP& its features	Product development in process Future plan for technology induction R&D work in progress	
MANDAYS	20	5	10	
Condenser	Selection of condenser type and its optimization wrt temp rise across condenser, pressure drop in condenser, surface area etc.	Comparative studies of salient features	Manufacturing process of various components of condenser Assembly	
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-C BID DOC. NO.:CS-9585-001-2		GENERAL TECHNICAL REQUIREMENTS ANNEXURE-VIII PAGE 94 OF 111

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
	ANNEXURE-VIII			
PRODUCT	AREAS OF TRAINING REQUIREMENT			
	PRODUCT DESIGN	Plant Visit	Visit to Manufacturer's Work	Operation & Maintenance of Plant
	Techno economic studies for Selection of condenser tube material and other parts depending on water quality Condenser support selection & design Sizing of condenser w.r.t. super critical units Latest technological trends in condenser arrangement and design Condenser vacuum system design	Collection of data for analysis of availability of Condenser O&M history/problems related to condenser	Testing capability at works Product development in process Future plan for technology induction R&D work in progress	
MANDAYS	10	5	5	
Feed Regenerative Equipment's	Thermal and mechanical design calculation of heaters Basis of selecting horizontal/vertical heaters Selection of TTD and DCAs for various heaters, and their effect on turbine heat rate Configuration of HP heaters (2x50% v/s100% capacity) Sizing criteria for De-aerator/Heaters Selection of tube & tube sheet material of heaters	Comparative studies of salient features Analysis of data O&M history/problems related to heaters	Manufacturing process of various components of heaters Assembly Testing capability at works Product development in process Future plan for technology induction R&D work in progress	
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-C BID DOC. NO.:CS-9585-001-2		GENERAL TECHNICAL REQUIREMENTS ANNEXURE-VIII
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CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
	ANNEXURE-VIII			
PRODUCT	AREAS OF TRAINING REQUIREMENT			
	PRODUCT DESIGN	Plant Visit	Visit to Manufacturer's Work	Operation & Maintenance of Plant
MANDAYS	Latest technological trends in heaters design 15	10	10	
3-dimensional CFD modeling	CFD model development and validation of design data for steam turbine, BFP, CEP, condenser, heaters etc.			
MANDAYS	20			
CONTROL & INSTRUMENTATION	Hardware & Software organization of the system	Operational feedback		
DDCMIS*-Man Machine Interface Hardware & Operating System	Basis of selection of H/W memory sizing			
	Operating system features, interface with other system, openness & interoperability			
	Upgradability			
	System testing features			
	Trouble shooting and fault analysis			
MANDAYS	15	5		
DDCMIS*-Man Machine Interface System Engineering & Application Software	Specific system customization	Operation feedback		
	Various system modules & interface with OS			
	Database organization & development			
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-C BID DOC. NO.:CS-9585-001-2	GENERAL TECHNICAL REQUIREMENTS ANNEXURE-VIII	PAGE 96 OF 111

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
	ANNEXURE-VIII			
PRODUCT	AREAS OF TRAINING REQUIREMENT			
	PRODUCT DESIGN	Plant Visit	Visit to Manufacturer's Work	Operation & Maintenance of Plant
	Development of mimics Other application like calculations, logs historical storage functionalities & use Trouble shooting and fault analysis			
MANDAYS	30	5		
DDCMIS* - Control System Hardware	Basic design features for system & its modules System capabilities & system design techniques Communication with MMI & other system	Operation feedback	Manufacturing processes special attention to handling of the modules Maintenance facilities	
MANDAYS	15	3	10	
DDCMIS*- Control system Application Software	Database structure Organisation & interface between application program & database Application for implementation of Control functions Study of standard algorithms & development of new algorithms Trouble shooting and fault analysis	Operation feedback	System integration & System capabilities testing	
MANDAYS	8	2	4	
DDCMIS* - DDCMIS- Control Strategies for TG System:	P&ID and process/System Descriptions of Governing System, Protection System, Automatic Turbine Testing, Oil System, Evacuation System & Generator Auxiliaries, Turbine stress Computation	Yes	Yes	
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-C BID DOC. NO.:CS-9585-001-2		GENERAL TECHNICAL REQUIREMENTS ANNEXURE-VIII
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CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS ANNEXURE-VIII			
PRODUCT	AREAS OF TRAINING REQUIREMENT			
	PRODUCT DESIGN	Plant Visit	Visit to Manufacturer's Work	Operation & Maintenance of Plant
Process Concepts of Main TG Integral Systems	System, Gland seals, Turbine Start up and Shut-down process, Hot ,cold and Warm modes of Turbine start up etc.			
DDCMIS* DDCMIS- Control Strategies for TG System: Control Strategies	- Measurement System-Redundancy in Measurement for OLCS/CLCS and Protection system. Function Blocks: Introduction and explanation of TG process specific Function block as being implemented in offered Control system. Open Loop Control strategies for ATRS, including turbine Run/Up Shutdown, Auto Synch, Oil System Automation concept, Auto Changer over philosophies, Condenser evacuation system, ATT and Generator Auxiliaries. Close Loop Control strategy-EHTC, Seal/Leak steam Controls, Interfacing of unit Controls Protection-Fail Safe philosophy implementation in turbine protection.	Yes	Yes	
DDCMIS- Control Strategies for TG System: Process Concepts of HP/LP BP Systems	P&ID and process/System Descriptions of HP/LP BP System, Protection System, Oil System, HPBP operations under various modes like start up, Shutdown, Load throw off etc.	Yes	Yes	
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-C BID DOC. NO.:CS-9585-001-2		GENERAL TECHNICAL REQUIREMENTS ANNEXURE-VIII PAGE 98 OF 111

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
	ANNEXURE-VIII			
PRODUCT	AREAS OF TRAINING REQUIREMENT			
	PRODUCT DESIGN	Plant Visit	Visit to Manufacturer's Work	Operation & Maintenance of Plant
DDCMIS-Control Strategies for TG System: HP/LP BP Systems Control Strategies	Measurement System-Redundancy in Measurement for OLCS/CLCS and Protection system. Function Blocks:- Introduction and explanation of HP/LP process specific Function block as being implemented in offered Control system. Open Loop Control strategies for HPBP operation during various modes of plant operation like Start Up/Shut down and Load Throw Off etc. Close Loop Control strategy- Applicable Control Loops like HP/LP BP Press Control/Position Control, LP BP Spray Controls etc. Interfacing o unit Controls etc. Protection-Fail Safe philosophy implementation in HP/LP BP system	Yes	Yes	
DDCMIS-Control Strategies for TG System: Process Concepts of BFP Drive Turbine/ BFP Systems	P&ID and process/System Descriptions of Drive Turbine Governing System, Protection System, Oil System, Turbine Start up and Shut-down process, Hot, cold and Warm modes of Turbine start up etc.	Yes	Yes	
DDCMIS-Control Strategies for TG System:	Measurement System-Redundancy in Measurement for OLCS/CLCS and Protection system.	Yes	Yes	
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-C BID DOC. NO.:CS-9585-001-2		GENERAL TECHNICAL REQUIREMENTS ANNEXURE-VIII
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CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
	ANNEXURE-VIII			
PRODUCT	AREAS OF TRAINING REQUIREMENT			
	PRODUCT DESIGN	Plant Visit	Visit to Manufacturer's Work	Operation & Maintenance of Plant
BFP Drive Turbine/ BFP Systems Control Strategies	Function Blocks:- Introduction and explanation of BFP Drive Turbine process specific Function block as being implemented in offered Control system. Open Loop Control strategies for Drive Turbine Start UP/Shutdown, Oil System Automation concept, Auto Changer over philosophies. Close Loop Control strategy-EHTC, Seal/Leak steam Controls, Interfacing of unit Controls Protection-Fail Safe philosophy implementation in Drive turbine protection.			
MANDAYS	24	5	4	
DDCMIS-operator	Use of the system at work + at Site			
MANDAYS	4			
Turbo supervisory system : Measurement Concepts	Discussions on various measurement points, Types, Ranges and locations for the offered Turbine	Yes	Yes	
Turbo supervisory system : System Concepts	System implementation of sensors, Monitors, Drivers, Cabling, earthing shielding and grounding, Buffered signals, Technical aspects of sensor selection, Sensor specifications, filter setting, Configuration settings for displacement, Velocity ,acceleration, key phasor and other types of sensors. Diagnostics and	Yes	Yes	
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-C BID DOC. NO.:CS-9585-001-2		GENERAL TECHNICAL REQUIREMENTS ANNEXURE-VIII
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CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
	ANNEXURE-VIII			
PRODUCT	AREAS OF TRAINING REQUIREMENT			
	PRODUCT DESIGN	Plant Visit	Visit to Manufacturer's Work	Operation & Maintenance of Plant
	trouble shooting features of Sensors, Drivers and Monitors.			
Turbo supervisory system : Analysis Software	1)System Setup-Hardware and Software 2)Case Studies showing utilization of various data displays e.g Bode Plot, Polar Plot, Waterfall Plot, Orbit & Waterfall Plot etc. 3)Tools and methods of finding Machinery faults like oil whirl, Oil whip, Mis-alignment etc	Yes	Yes	
MANDAYS	8	2	2	
Wherever "DDCMIS" is indicated, it will mean TG C&I part of DDCMIS, which is in Contractor's Scope				
(ELECTRICAL) GENERATOR	(a) Design aspects of the following areas - Insulation system - Cooling medium & arrangement - Winding & core support systems b) Design aspects associated auxiliary systems	- Operational feed back - Familiarisation with different sub-systems	(a) Manufacturing process for - Core - Winding bars - Assembly (b) Testing facilities	
MANDAYS	30	15	15	
Generator Excitation system including AVR.	Design features of various sub- System Exciter PMG Transformer Controllers & different limiters etc.	- Operational feed back - Familiarisation with various equipment functioning at reference plants	Manufacturing process & testing facilities for various equipment of excitation system	
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-C BID DOC. NO.:CS-9585-001-2	GENERAL TECHNICAL REQUIREMENTS ANNEXURE-VIII	PAGE 101 OF 111

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
	ANNEXURE-VIII			
PRODUCT	AREAS OF TRAINING REQUIREMENT			
	PRODUCT DESIGN	Plant Visit	Visit to Manufacturer's Work	Operation & Maintenance of Plant
	PSS & associated system studies	functioning at referplants		
MANDAYS	30	15	15	
Integral Actuators	a) Basic design philosophy of integral actuator b) Design aspects of wiring diagram c) Type and range of application of integral actuators d) Operation and selection of integral actuator to various type of loads Methods of fault diagnose system.		Manufacturing process & testing facilities for various equipment of actuators	
MANDAYS	2	1	1	
MDBFP motor	Design criteria for the stator core and winding rotor core and winding, insulation systems and cooling arrangement. Study of forces and vibration. Diagnostic and testing of large Electrical machines	Operational Feedback	Manufacturing process and testing facilities.	
MANDAYS	14	4	10	
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-C BID DOC. NO.:CS-9585-001-2	GENERAL TECHNICAL REQUIREMENTS ANNEXURE-VIII	PAGE 102 OF 111

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
	ANNEXURE-IX			
	Area	Topics	MANDAYS	
	DDCMIS-Man Machine Interface - Hardware & Operating System	- Hardware & Software organization of the system - Basis of selection of H/W memory sizing - Operating system features, interface with other system, openness & inter-operability - Upgradeability - System testing features	20	
		Trouble shooting and fault analysis.		
	DDCMIS-Man Machine Interface System Engineering & Application Software	- Specific system customisation - Various system modules & interface with OS - Database organisation & development - Development of mimics - Other application like calculations, logs historical storage functionalities & use - Trouble shooting and fault analysis.	40	
	DDCMIS - Control System Hardware and Control system Application Software	- Basic design features for system & its modules - Manufacturing processes with special attention to handling of the modules Maintenance facilities	50	
		- System capabilities & system design techniques - System integration & System capabilities testing		
		Communication with MMI & other system		
		Database structure Organisation & inter- face between application program & database		
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-C BID DOC. NO.:CS-9585-001-2	GENERAL TECHNICAL REQUIREMENTS ANNEXURE-IX	PAGE 103 OF 111

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS 		
		• Application for implementation of Control functions • Study of standard algorithms & development of new algorithms	
		• Trouble shooting and fault analysis.	
	DDCMIS-Operator Training	• Use of the system at Works + at Site	20 + 100
	DDCMIS-Specialized Network security training	• To be finalized during detailed engineering.	15
	UPS system	• Theory & design features Manufacturing/assembly process • Testing methodology	5
		• Trouble shooting and fault analysis.	
	24 V DC system	• Theory & design features Manufacturing/assembly process • Testing methodology • Trouble shooting and fault analysis.	5
	SWAS	• Theory & design features • Trouble shooting and fault analysis	5
	PA System	• Theory & design features • Trouble shooting and fault analysis	4
	CCTV System	• Theory & design features • Trouble shooting and fault analysis	4
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-C BID DOC. NO.:CS-9585-001-2	GENERAL TECHNICAL REQUIREMENTS ANNEXURE-IX
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CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
	QA SYSTEM & PROGRAMME	- Integrated QA Management system for enhanced reliability of equipments. - QA system in design, procurement, manufacturing, installation and operation of the equipments/ systems. - QA system for developing and establishing new processes and vendors. - System of structured documentation of Engg and test records. - Appreciation of implementation of QA Programme in various manufacturing, assembly and testing activities. - Appreciation of develop-mental activities for new processes and vendors. - System of pre-qualification of special processes.	10	
	Controls & Instruments	- Familiarization with control system and instrumentation - QA System for manufacture of reliable components. Manufacturing activities for critical instruments/items. - Implementation of testing programme to ensure reliability.	10	
	Note	One week shall constitute of five (5) man days.		
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-C BID DOC. NO.:CS-9585-001-2	GENERAL TECHNICAL REQUIREMENTS ANNEXURE-IX	PAGE 105 OF 111

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS				ANNEXURE-X
PRODUCT	AREAS OF TRAINING REQUIEMENT				
	PRODUCT DESIGN	Plant Visit	Visit to Manufacturer's Work	Operation & Maintenance of Plant	
GIS			Training on GIS equipments including system description basic design and engineering. Quality assurance concepts and Erection and operational aspects for the offered equipments. Concepts and operational aspects for the offered equipments	Training on Operation, Maintenance,, site testing & troubleshooting of GIS.	
MANDAYS			40	30	
Substation Automation System				Training for site personnel for operation, maintenance & troubleshooting of total system for 5 working days at NTPC site.	
MV and LT Switchgear : Numerical relays & Switchgear SCADA system	Numerical relay engineering and associated training for relay software and O&M SCADA system design, engineering and associated training for SCADA and O&M				
MANDAYS	60 (Total) inclusive of visit to manufacturer's site)				
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)		TECHNICAL SPECIFICATION SECTION-VI, PART-C BID DOC. NO.: CS-9585-001-2		GENERAL TECHNICAL REQUIREMENTS ANNEXURE-X	
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01/2022/ST-EM-MAX	CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS		एनटीपीसी NTPC						
		ANNEXURE - XI								
		<table><tr><th>Area</th><th>Topics</th><th>MANDAYS</th></tr><tr><td>UF Membranes</td><td> Product design - Basic design features - Theory & principle of operation - Latest technological trends in Ultrafiltration membranes and design Plant Visit - Operational feedback - O&M history/problems related to UF membranes Visit to Manufacturer's Work - Manufacturing process of UF membranes and equipments - Testing facilities Operation & Maintenance of Plant - Trouble shooting and fault analysis - Familiarization of special maintenance techniques - Special tool and tackles familiarization </td><td>7</td></tr></table>	Area	Topics	MANDAYS	UF Membranes	Product design - Basic design features - Theory & principle of operation - Latest technological trends in Ultrafiltration membranes and design Plant Visit - Operational feedback - O&M history/problems related to UF membranes Visit to Manufacturer's Work - Manufacturing process of UF membranes and equipments - Testing facilities Operation & Maintenance of Plant - Trouble shooting and fault analysis - Familiarization of special maintenance techniques - Special tool and tackles familiarization	7		
Area	Topics	MANDAYS								
UF Membranes	Product design - Basic design features - Theory & principle of operation - Latest technological trends in Ultrafiltration membranes and design Plant Visit - Operational feedback - O&M history/problems related to UF membranes Visit to Manufacturer's Work - Manufacturing process of UF membranes and equipments - Testing facilities Operation & Maintenance of Plant - Trouble shooting and fault analysis - Familiarization of special maintenance techniques - Special tool and tackles familiarization	7								

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CLAUSE NO.		GENERAL TECHNICAL REQUIREMENTS		एनटीपीसी NTPC
	RO membranes	Product design - Basic design features - Theory & principle of operation - Latest technological trends in RO membranes and design Plant Visit - Operational feedback - O&M history/problems related to RO membranes Visit to Manufacturer's Work - Manufacturing process of RO membranes and equipments - Testing facilities Operation & Maintenance of Plant - Trouble shooting and fault analysis - Familiarization of special maintenance techniques - Special tool and tackles familiarization	7	
	Zero Liquid Discharge (ZLD)	System Design - Plant water optimization and Scheme to achieve the ZLD - Basic design features - Latest technological trends for ZLD in Thermal Power Plant Plant Visit - Operational feedback	5	
	Note	One week shall constitute of five (5) man days.		

EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)	TECHNICAL SPECIFICATIONS SECTION VI, PART-C BID DOC. NO.:CS-9585-001-2	GENERAL TECHNICAL REQUIREMENTS ANNEXURE-XI	PAGE 108 OF 111

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			एनटीपीसी NTPC									
	Annexure-XII TRAINING REQUIREMENTS FOR SIMULATOR In addition to the other stipulations in the bidding documents regarding training of Employer's personnel, the following shall also be covered: (i) The scope of service under training of Employer's Engineers shall necessarily include, training in the areas of: (a) Design, engineering and Quality Assurance. (b) Operation & maintenance. Arrangement for the trainees to get trained at the Works of the Contractor's, Works of their sub-vendors and at the plants of similar type and comparable size, operating elsewhere shall be made by the Contractor. (ii) The training shall enable the O&M personnel to individually take responsibility of operating & maintaining the respective systems to ensure sustained guaranteed performance of the equipment and availability of the systems offered. The design & engineering personnel of the Employer shall be familiarized with the design philosophy adopted & practices followed by the Contractor or Sub-Contractor's Engineers for design engineering and shall be given special training in the shops, where the equipment will be manufactured and/or in their collaborator's works and where possible, in any other plant where equipment manufactured by the Contractor or his collaborator is under installation operation, or testing to enable these personnel to become familiar with the equipment being furnished by the Contractor. The training requirements of Employer's Engineering and O&M personnel are as below: <table><tr><th>Area</th><th>Topics</th><th>MANDAYS</th></tr><tr><td rowspan="4">Simulator & Human Machine Interface – Hardware and Operating System</td><td> • Hardware & software organization of the system </td><td rowspan="4">90</td></tr><tr><td> • Basis of selection of HW memory sizing </td></tr><tr><td> • Operating system features, interface with other system, openness & inter operability & upgradability System Testing features </td></tr><tr><td> • Trouble shooting & Fault Analysis </td></tr></table>				Area	Topics	MANDAYS	Simulator & Human Machine Interface – Hardware and Operating System	• Hardware & software organization of the system	90	• Basis of selection of HW memory sizing	• Operating system features, interface with other system, openness & inter operability & upgradability System Testing features	• Trouble shooting & Fault Analysis
Area	Topics	MANDAYS											
Simulator & Human Machine Interface – Hardware and Operating System	• Hardware & software organization of the system	90											
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	• Trouble shooting & Fault Analysis												
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-C BID DOC. NO.:CS-9585-001-2	GENERAL TECHNICAL REQUIREMENTS ANNEXURE-XII	PAGE 109 OF 111									

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
	Simulator System Engineering (Simulator Kernel and Interface) & Application Software (Process and C&I Modelling)	• Overview of Simulator • Starting up and Shutting down of the simulator • Details of Simulator hardware & software • Interaction between Simulator Models and controls & Instructor Station operations • Manipulation of Simulator parameters and data.	150	
		• Details of Plant Modelling & C&I Modelling simulation software		
		• Details of Simulator and DCS interface		
		• Backup and Restore procedures		
		• Details of I/O system		
		• Fault finding of simulator hardware & Software diagnostic procedures		
		• Simulator maintenance procedures		
	Human Machine Interface System Engineering & Application Software	• Specific system customisation	90	
		• Various system modules & interface with OS		
		• Database organisation & development • Development of mimics • Other application like calculations, logs historical storage functionalities & use		
		• Trouble shooting and fault analysis.		
	Instructor Training	Use of the system including • Interaction between Simulator Models and controls • Instructor Station operations	150	
		• Communication with MMI & other system		
• Database structure Organisation & inter-face between application program & database				
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-C BID DOC. NO.:CS-9585-001-2	GENERAL TECHNICAL REQUIREMENTS ANNEXURE-XII	PAGE 110 OF 111

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
		• Application for implementation of Control functions • Study of standard algorithms & development of new algorithms		
		• Trouble shooting and fault analysis.		
	UPS system	• Theory & design features manufacturing/assembly process • Testing methodology	10	
		• Trouble shooting and fault analysis.		
	Note	Note One week shall constitute of five (5) man days.		
	EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-C BID DOC. NO.:CS-9585-001-2	GENERAL TECHNICAL REQUIREMENTS ANNEXURE-XII

GENERAL TECHNICAL REQUIREMENT OF LOW PRESSURE PIPING

EPC PACKAGE FOR
PATRATU SUPER THERMAL POWER STATION
EXPANSION PHASE-1 (3x800 MW)

TECHNICAL SPECIFICATION
SECTION-VI PART-A
BID DOC NO: CS-9585-001-2

22/PS-PEM-MAX		SCOPE OF SUPPLY & SERVICES		एनटीपीसी NTPC	
1.00.00		LOW PRESSURE PIPING			
1.01.00		The Scope of Low Pressure (LP) piping systems for the following services shall be as defined in various tender drawings & the sub section pertaining to “Terminal points and exclusions” and shall include the following systems: a) DM water normal make-up system (condenser makeup, ECW makeup for both Steam Generator and Turbo Generator Auxiliaries, make-up to H2 generation plant & CPU regeneration plant etc.) b) Condenser emergency make up and ECW tank emergency make-up for SG & TG / condensate storage and transfer system. c) Boiler (Steam Generator) and Deaerator fill system. d) Equipment Cooling Water (ECW) system including its chemical dosing system for primary circuit for Steam generator and Turbo generator and their auxiliaries. e) Auxiliary cooling water system. f) Complete service water system, APH /ESP wash water system, Drinking (potable) water system, clarified water system & HVAC – system, Raw water system (PT plant and ash handling) , other applicable systems mentioned elsewhere in the specification g) Instrument Air System. h) Service (plant) Air System. i) Drain piping system for the piping\equipment etc. under the bidder's scope. j) Tanks as described elsewhere in the specification for the above systems. (Including condensate storage tanks etc.). k) Re-circulation pipes along with valves, breakdown orifices etc., wherever required/specified elsewhere in Technical Specification. l) Any other piping system required making the Low Pressure (LP) piping systems in the bidder's scope complete.			
1.02.00		The scope covers the following for the complete LP piping systems mentioned above: a) Design, engineering, manufacturing, supply, fabrication, testing packaging, transportation to site, storage, taking delivery of Employer supplied equipment from site stores, in plant transportation, erection, cleaning, testing and commissioning of all items i.e., pipes, fittings, supports/ hangers, valves, actuators, motors, specialties, expansion joints, strainers, moisture traps, tanks, chemical dosing system for Equipment Cooling Water System (Primary circuit), instruments, drains, vent including drain/ vent valves ,air release valves etc.			
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE -I (3X800 MW)		TECHNICAL SPECIFICATIONS SECTION-VI PART-A BID DOC.NO. CS-9585-001-2		SUB SECTION- IIA-01 LOW PRESSURE PIPING	
				PAGE 1 OF 5	

22/PS-PEM-MAX		NTPC		
CLAUSE NO.	SCOPE OF SUPPLY & SERVICES			
1.03.00	The items though not specifically mentioned or indicated here in but are needed to make the system / equipment complete shall also be furnished and treated as if included in the specification unless otherwise specifically excluded.			
	Bidder's scope of supply & works shall include but not be limited to the following: a) Pipes, headers and manifolds, bends, elbows, returns, tees, laterals crosses, reducers/ expanders, caps and closures, couplings, plugs, sleeves, and saddles, stubs and bosses, unions and other similar fittings, flanges, gaskets, fasteners and sealants, ring joints, backing rings, all types of valves including drain/ vent/ air release valves, 3-way valves(where applicable) with test connection for instruments/ manifolds etc.actuators, specialties, orifices, flow nozzles, etc. as per finalized single line flow diagrams and layout drawings/ isometric drawings. b) Complete assemblies of hangers, supports anchor, guides, restraints, etc. including welded attachments, clamps, devices tie-rods, turn-buckles, springs and spring cages, shoes, rollers, trapezes etc. c) Weather hoods for pipes crossing ceilings and walls. d) Instrument tapping and stub connections, root valves, 3-way valves (where applicable) with test connections, drains and vent valves & expanders / reducers as required and instruments as indicated else where for instruments supplied by the Contractor.. e) Drain funnels, drip pans, moisture traps etc. where ever required shall be provided. f) Instrument tapping, stub connections, root valves and instrument tubing up to root valves for instruments supplied by the Employer for onward connections by the Employer. g) All supporting attachments like plates, saddles, stools, shoes, base plate, saddle plates, angles, channels, I-beams, trapeze, cantilevers, brackets, sways, braces, nuts, bolts, cleats, clamps, needed to complete the erection of piping system covered under this specification. Anchor bolts, bed & foundation plates, pipe sleeves and Nuts to be embedded in concrete for piping where ever indicated in the drawing. All grouting and chipping work (including supply of cement, sand and stone chips) for equipment foundations, pipe supporting etc. Reinforced concrete valve chambers wherever required for underground piping. h) Surface preparation, priming and painting of all non-insulated above ground piping and equipment except galvanized steel piping & surfaces , stainless steel piping & surfaces, and gun metal surfaces.			
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE -I (3X800 MW)		TECHNICAL SPECIFICATIONS SECTION-VI PART-A BID DOC.NO. CS-9585-001-2	SUB SECTION- IIA-01 LOW PRESSURE PIPING	PAGE 2 OF 5

ZZ/PS-PEM-MAX		NTPC	
CLAUSE NO.	SCOPE OF SUPPLY & SERVICES		
	Paints and varnishes, primers, thinners etc. as required for anti-corrosive protection of piping & equipment above ground. i) Bidder shall provide anti-corrosive protection anticorrosive tape or coating-wrapping on the external surfaces of pipes to all directly buried piping including galvanized carbon steel piping. j) On the internal surface of all pipes 1000 mm and above, a coat of primer followed by a hot coat of coal tar enamel paint or coal tar epoxy paint shall be applied. k) Excavation, preparation of bed, backfilling with compaction of soil and removal of extra-earth to designated places in case of pipes to be buried. l) Bidder shall also design, supply, fabricate, erect, set and commission all hangers, tie-rods, turn-buckles, supports, guides, restraints, anchors, etc. as required for the, piping system. This includes the provision of all associated steel work including brackets, cradle supports, duck feet, channels, angles, etc. It is Bidder's responsibility to estimate these requirements and include them in their offer price. Whenever, straight run of the yard pipes are more than 300 meters, flexibility analysis shall be conducted by the contractor to identify the requirement of loops, type of supports etc. m) In covered concrete trenches bidder shall supply necessary supporting materials such as stools, saddles, base plates, clamps, U-bolts, angles, clips etc. n) Bidder shall supply all necessary drains and vents with drain & vent valves including anti-flash funnels and moisture traps for compressed air system as required for the safe and effective draining-venting of the piping systems based on the approved flow scheme / single line diagram. It is bidder's responsibility to identify the requirements of drains, vents, and supply the necessary pipe work, fittings, hangers and supports etc. for the same. o) Bidder shall supply and install necessary matching pieces as may be needed for connection of piping systems with equipment terminals, valves and specialties. p) Bidder shall erect all instrument impulse piping and fittings from the tap-off point of the last root valve including the root valve and instruments. q) Bidder shall perform necessary internal machining of pipe for installing orifices, flow nozzles, straightening vanes etc. r) The Bidder shall prepare the flow diagrams, detailed dimensional piping layout/ Isometric/ fabrication/ As built drawings of all the systems along with Cross sectional drawings, showing all supports and equipment as required.		
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE -I (3X800 MW)		TECHNICAL SPECIFICATIONS SECTION-VI. PART-A BID DOC.NO. CS-9585-001-2	SUB SECTION- IIA-0 LOW PRESSURE PIPING
			PAGE 3 OF 5

CLAUSE NO.	SCOPE OF SUPPLY & SERVICES
1.04.00	s) In addition to submission of drawings as stipulated above bidder shall also furnish the data/ documents with respect to following: 1) Thickness calculation of large diameter buried pipes as per AWWA-M-11. 2) System design calculation of Primary closed circuit ECW and secondary circuit ACW system for flow & pressure balancing. 3) Design calculations for condensate storage tank and Drinking water tank. 4) Static Analysis for Long (more than 300 metre straight run) above-ground piping wherever required. t) Bidder's scope of supply for fabrication, erection, cleaning, testing and commissioning of the piping systems installed by him shall include the following:- All welding consumables like welding electrodes, filler rods and wires; gases like oxygen, acetylenes, argon, carbon-dioxide, propane, backing rings etc. Films for radiographic examination of welds. X-ray and Gamma -ray equipment including isotopes, dye penetrants, and other required non-destructive testing materials and equipment (all to be taken back by the Bidder after completion of work). All heating and stress relieving equipment, thermocouples asbestos blankets, cables, temperature recorders, charts heat sensitive chalks and crayons etc. (All to be taken back by bidder after completion of work). All machinery, equipment tools and tackles as required for transportation handling, fabrication and erection (All to be taken back by Bidder after completion of work). All equipment/ materials as required for cleaning, flushing, blowing out and hydro testing of the piping systems; these shall include but not be limited to pumps and compressors with prime movers, instruments, pipe work with supports, valves, strainers and other specialties, blanks, plugs, spool pieces, dummy plates, electrical accessories, etc. (All to be taken back by Bidder after completion of work). All scaffolding materials and false work (To be taken back by Bidder after completion of work). The Bidder shall provide Services of erection superintendent and foremen, fitters and riggers, welders, transport and crane operators and other skilled and unskilled labour. The design engineering and providing all temporary pipe work as required for erection, cleaning, flushing, blowing out, testing and commissioning of the piping system is the responsibility of the Bidder.
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE -I (3X800 MW)	TECHNICAL SPECIFICATIONS SECTION-VI PART-A BID DOC.NO. CS-9585-001-2
SUB SECTION- IIA-01 LOW PRESSURE PIPING	PAGE 4 OF 5

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22/PS-PEM-MAX	
CLAUSE NO.	SCOPE OF SUPPLY & SERVICES
	एनटीपीसी NTPC The Bidder's scope shall include design, supply of required structural steel (except those which are specifically excluded), their fabrication and erection where ever required.
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE -I (3X800 MW)	TECHNICAL SPECIFICATIONS SECTION-VI PART-A BID DOC.NO. CS-9585-001-2
SUB SECTION- IIA-0 LOW PRESSURE PIPING	PAGE 5 OF 5



GENERAL TECHNICAL REQUIREMENT OF LOW PRESSURE PIPING (CONT.)

EPC PACKAGE FOR
PATRATU SUPER THERMAL POWER STATION EXPANSION
PHASE –I (3X 800MW)

TECHNICAL SPECIFICATION
SECTION-VI
BID DOC. NO.: CS:9585-001-2

05/2022/PS-PEM-MAX

CLAUSE NO.	TECHNICAL REQUIREMENTS	एनडीपीसी NTPC																																					
	<u>LOW PRESSURE PIPING</u> EQUIPMENT SIZING CRITERIA 1.00.00 1.01.00 All the piping systems and equipment supplied under this package shall be designed to operate without replacement and with normal maintenance for a plant service life of 30 years, and shall withstand the operating parameter fluctuations and cycling which can be normally expected during this period. 1.02.00 For all Low Pressure piping systems covered under this specification, sizing and system design shall be to the requirements of relevant codes and standard indicated. In addition to this, requirements of any statutory code as applicable shall also be taken into consideration. 1.03.00 Inside diameters of piping shall be calculated for the flow requirements of various systems. The velocities for calculating the inside diameters shall be limited to the following: a) Water Application <table><tr><th colspan="2"></th><th colspan="3">Water Velocity in m/sec</th></tr><tr><th></th><th>Pipe Size</th><th>Below 50 mm</th><th>50-150 mm</th><th>200 mm & above</th></tr><tr><td>(a)</td><td>Pump suction</td><td>-----</td><td>1.2-1.5</td><td>1.2-1.8</td></tr><tr><td>(b)</td><td>Pump discharge and recirculation</td><td>1.2-1.8</td><td>1.8-2.4</td><td>2.1-2.5</td></tr><tr><td>(c)</td><td>Header</td><td>-----</td><td>1.5-2.4</td><td>2.1-2.4</td></tr></table> Pipe line under gravity flow shall be restricted to a flow velocity of 1 m/sec generally. Channels under gravity flow shall be sized for a maximum flow velocity of 0.6 m/sec. WILLIAM & HAZEN formula shall be used for calculating the friction loss in piping systems with the following "C" value: <table><tr><td>(i)</td><td>Carbon steel pipe</td><td>100</td></tr><tr><td>(ii)</td><td>Ductile Iron.</td><td>140</td></tr><tr><td>(iii)</td><td>Rubber lined steel pipe</td><td>120</td></tr><tr><td>(iv)</td><td>Stainless steel pipe</td><td>100</td></tr></table> For calculating the required pump head for pump selection, at least 10% margin shall be taken over the pipe friction losses and static head shall be calculated from the minimum water level of the tank/ sump/ reservoir from which the pumps draw water. (b) Compressed Air Application Compressed air 15.0 m/sec.(under Average Pressure & Temp. conditions)			Water Velocity in m/sec				Pipe Size	Below 50 mm	50-150 mm	200 mm & above	(a)	Pump suction	-----	1.2-1.5	1.2-1.8	(b)	Pump discharge and recirculation	1.2-1.8	1.8-2.4	2.1-2.5	(c)	Header	-----	1.5-2.4	2.1-2.4	(i)	Carbon steel pipe	100	(ii)	Ductile Iron.	140	(iii)	Rubber lined steel pipe	120	(iv)	Stainless steel pipe	100	
		Water Velocity in m/sec																																					
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EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC. NO.:CS-9585-001-2	SUB-SECTION-A-10 (LOW PRESSURE PIPING)	PAGE 1 OF 20																																			

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05/2022/PS-TEM-MAX

CLAUSE NO.	TECHNICAL REQUIREMENTS																																										
1.04.00	The pipes shall be sized for the worst (i.e. maximum flow, temp. and pressure values) operating conditions.																																										
1.05.00	Based on the inside dia. so established, thickness calculation shall be made as per ANSI B 31.1 OD and thickness of pipes shall than be selected as per ANSI B 36.10/IS-1239 Heavy grade/IS-3589/ASTM-A-53/API-5L/ANSI B 36.19 as the case may be.																																										
1.06.00	Corrosion allowance of 1.6 mm will be added to the calculated thickness being considered (except stainless steel piping).																																										
1.07.00	Bend thinning allowance/manufacturing allowance etc. shall be as per the requirement of the design code provision.																																										
1.08.00	High points in piping system shall be provided with vents along with valves as per the system requirement. Low points shall be provided with drains along with drain valves as per the system requirement. Drain lines shall be adequately sized so as to clear condensate in the lines. Material for drain and vent lines shall be compatible with that of the parent pipe material.																																										
1.09.00	Material of construction for pipes carrying various fluids shall be as specified elsewhere.																																										
1.10.00	Compressed air pipe work shall be adequately drained to prevent internal moisture accumulation and moisture traps shall be provided at strategic locations in the piping systems.																																										
1.11.00	Depending upon the size and system pressure, joints in compressed air pipe work shall be screwed or flanged. The flange shall be welded with the parent pipe at shop and shall be hot dip galvanized before dispatch to site. Alternatively, the flanges on GI pipes may be screwed-on flanges also.																																										
1.12.00	Threaded joints shall be provided with Teflon sealant tapes.																																										
1.13.00	Following types of valves shall be used for the system/service indicated. <table><tr><th>SYSTEM</th><th colspan="6">TYPES OF VALVES</th></tr><tr><th></th><th>Butterfly</th><th>Gate</th><th>Globe</th><th>Check</th><th>Ball</th><th>Plug</th></tr><tr><td>Water</td><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td><td></td></tr><tr><td>Air</td><td></td><td>x</td><td>x</td><td>x</td><td>x</td><td></td></tr><tr><td>Drains & vents</td><td></td><td>x</td><td>x</td><td>x</td><td></td><td></td></tr><tr><td>Fuel oil (if any)</td><td></td><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td></tr></table>	SYSTEM	TYPES OF VALVES							Butterfly	Gate	Globe	Check	Ball	Plug	Water	x	x	x	x	x		Air		x	x	x	x		Drains & vents		x	x	x			Fuel oil (if any)		x	x	x	x	x
SYSTEM	TYPES OF VALVES																																										
	Butterfly	Gate	Globe	Check	Ball	Plug																																					
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Air		x	x	x	x																																						
Drains & vents		x	x	x																																							
Fuel oil (if any)		x	x	x	x	x																																					
1.14.0	Recirculation pipes along with valves, breakdown orifices etc. shall be provided for important pumping systems as indicated in respective process and instrumentation diagrams (P&IDs). The recirculation pipe shall be sized for minimum 30%design flow of single pump operation or the recommended flow of the pump manufacturer whichever is higher.																																										

EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)	TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC. NO.:CS-9585-001-2	SUB-SECTION-A-10 (LOW PRESSURE PIPING)	PAGE 2 OF 20



05/2022/PS-PEM-MAX

CLAUSE NO.	TECHNICAL REQUIREMENTS			
2.00.00	TECHNICAL SPECIFICATION			
2.01.00	GENERAL			
	Specific technical requirements of low-pressure piping, fittings, supports, valves, specialties and tanks etc. have been covered under this Sub-section. It includes details pertaining to design and material of construction for piping, fittings, valves, equipment, etc. cleaning/surface preparation application of primer and painting on over ground piping. It also includes detailed technical requirement of laying underground/buried piping including water proofing/anti corrosive protection. It also covers design, engineering, manufacturing, fabrication, technical details of piping, valves, specialties, piping hangers / supports, tanks etc.			
2.02.00	Pipes and fittings			
2.02.01	All low pressure piping systems shall be capable of withstanding the maximum pressure in the corresponding lines at the relevant temperatures. However, the minimum thickness as specified in the following clauses and or respective codes for pipes and fittings shall be adhered to. The bidder shall furnish the pipe sizing/ thickness calculation as per the criteria mentioned above under LP piping equipment sizing criteria of this Technical Specification.			
2.02.02	Piping and fittings coming under the purview of IBR shall be designed satisfying the requirements of IBR as a minimum.			
2.02.03	Supporting arrangement of piping systems shall be properly designed for systems where hydraulic shocks and pressure surges may arise in the system during operation. Bidder should provide necessary protective arrangement like anchor blocks/anchor bolt etc. for the safeguard of the piping systems under above mentioned conditions. The requirement will be, however, worked out by the contractor and he will submit the detailed drawings for thrust/anchor block to the Employer. External, and internal, attachments to piping shall be designed so as not to cause flattening of pipes and excessive localized bending stresses.			
2.02.04	Bends, loops, off sets, expansion or flexible joints shall be used as required in order to prevent overstressing the piping system and to provide adequate flexibility. Flexibility analysis (using software packages such as Caesar-II etc.) shall be carried out for sufficiently long piping (straight run more than 300M).			
2.02.05	Wherever Bidder's piping coming under this specification, terminates at an equipments or terminal point not included in this specification, the reaction and the thermal movement imposed by bidder's piping on equipment terminal point shall be within limits to be approved by the Employer.			
2.02.06	The hot lines shall be supported with flexible connections to permit axial and lateral movements. Flexibility analysis shall be carried out for pipelines which have considerable straight run as indicated above and necessary loops/ expansion joint etc. shall be provided as may be necessary depending on layout.			
2.02.07	Piping and fittings shall be manufactured by an approved manufacturer of repute. They should be truly cylindrical of clear internal diameter, of uniform thickness, smooth and strong, free from dents, cracks and holes and other defects.			
2.02.08	For rubber lined ERW pipes, beads shall be removed.			
2.02.09	Inspection holes shall be provided at suitable locations for pipes 800 Nb and above as required for periodic observations and inspection purposes.			
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2.03.06	In water lines, pipes upto 150mm Nb shall conform to ANSI B36.10/ASTM-A-53, Type-E Gr.B /IS:1239 Gr. Heavy and minimum selected thickness shall not be less than IS:1239 Grade Heavy except for demineralised water, drinking water and condensate spill lines.			
2.03.07	Pipes of above 150mm Nb shall be to AWWA-C200/ANSI B 36.10/ASTM A-53/IS 3589 Gr.410. Pipe to be fabricated by the bidder shall be rolled and butt welded from plates conforming to ASTM A-53 type 'E' Gr. B/IS 2062 Gr.E-250B/ASTM-A-36. However, larger pipes, i.e. 1000mm Nb and above shall be made from plates conforming to ASTM A 36/IS 2062 Gr.E-250B and shall meet the requirements of AWWA-M-11 (for deflection & buckling criteria considering water filled pipe as well as vacuum condition that may prevail during transient/surge conditions, truck-load, rail-load and weight density for compacted soil or any other load as the case may be).			
2.03.08	In demineralised water service, the pipes upto 50 Nb shall be of stainless steel ASTM A 312, Gr. 304 sch. 40 Seamless. The size for these pipes shall be to ANSI B 36.19. These shall be socket welded. The material for pipe from 65mm NB upto and including 400 NB shall be to ASTM A 312, Gr. 304 (welded). In no case the thickness of fittings shall be less than parent pipe thickness. Bidder/Contractor shall note that pipes offered as per a particular code shall conform to that code in all respects i.e. Dimension, tolerances, manufacturing methods, material, heat treatment, testing requirements, etc. unless otherwise mentioned elsewhere in the specification.			
2.03.09	Instrument air, Plant (service) air lines and Drinking water lines shall be to ASTM A 53 type E grade B/ANSI B 36. 10/IS 3589, Gr. 410 / IS: 1239 Heavy (in case thickness calculated is more than gr. Heavy, ANSI B 36.10 Schedule numbers shall be followed) and galvanized to IS 4736 or any equivalent internationally reputed standard. The material of the pipes shall be to ASTM A 53 type 'E' Gr. B / IS: 3589, Gr. 410 / IS: 1239 Gr. Heavy. The fittings shall be of either same as parent material or malleable iron to IS-1879 (galvanized).			
2.03.10	Spiral welded pipes as per API-5L/IS-3589 are also acceptable for pipe of size above 150 NB. However minimum thickness of the pipes shall be as elaborated in above clauses.			
2.03.11	Condensate lines shall be to ASTM A 106 Gr. B and dimension to ANSI B 36.10 schedule "standard" as minimum to be maintained.			
2.03.12	If carbon steel plates of thickness more than 12 mm are used for manufacture of pipes, fittings and other appurtenances, then the same shall be control-cooled or normalized as the case may be following the guidelines of the governing code.			
2.04.00	Field routed pipes:			
2.04.01	Pipe lines of NB 50 size and below are regarded as field run piping. It is Bidder's responsibility to plan suitable layouts for these system insitu. Bidder shall prepare drawings indicating the layout of field run pipe work. These drawings shall be approved by Project Manager to the installation of the field run pipe work. Based on these approved layouts the Bidder shall prepare the BOQ of field run-pipes and submit to Employer for approval.			
2.05.00	Slope/Drains and Vents			
2.05.01	Suitable slope shall be provided for all pipelines towards drain points. It is Bidder responsibility to identify the requirements of drains and vents, and supply the necessary pipe work, valves, fittings, hangers and supports etc. As per the system requirement low points in the pipelines shall be provided with suitable draining arrangement and high points shall be provided with vent connections where air or gas pockets may occur. Vent for use during hydrostatic test shall be plugged after the completion of the test. Vent shall not be less than 15mm size. Drains shall be provided at low points and at pockets in piping such that complete drainage of all systems is possible. Drain shall not be less than 15mm for line size			
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	up to 150mm, not less than 20mm up to 300mm and not less than 25mm for 350mm to 600mm pipes and not less than 50mm for 600mm and above pipes.			
2.05.02	Air piping shall be sloped so that any part of the system can be drained through the shut-off drain valve or drain plugs.			
2.06.00	Pipe Joints In general all water lines 65mm NB and above, are to be joined generally by butt welding except the locations where valves/fittings are to be installed with flanged connections and 50mm and below by socket welding unless mentioned otherwise specifically. All air lines shall be of screwed connection and rubber lined pipes of flanged connections.			
2.06.01	Screwed Joints (a) Threading of pipes shall be carried out after bending, heat treatment etc. If not possible, threading may be done prior to these operations but proper care should be taken to protect them from damage. Threads shall be to ANSI B 2.1 (taper) NPT/IS: 554 unless specified otherwise. (b) Galvanized pipe shall generally be joined by screwing into sockets. The exposed threaded portion on the outside of the pipes shall be given a zinc silicate coating. Galvanized pipes shall not be field joined by welding for protection of Galvanising Zinc layer. Screwed ends of GI pipes shall be thoroughly cleaned and painted with a mixture of red and white lead before jointing. For galvanized pipe sizes above 150 mm NB, screw & socket jointing as per ASTM-A-865 shall be employed for both pipe-to-pipe and pipe-to-fitting jointing. For pipe to fitting connection since no direct threading can be done on the fittings (supplied as per ASTM-A-234 Gr. WPB and ANSI B-16.9) necessary straight pipe lengths acting as match pieces shall be welded to the fitting at both ends and subsequently the free ends of the straight lengths shall be threaded as per ASTM A-865 for jointing with main pipe. Once welding of fittings with match pieces and threading of free ends of match pieces are over, the entire fabricated piece shall be galvanized, or in case match pipes and fittings are already galvanized before the above mentioned fabrication then suitable application of Zinc-Silicate paste adequately at the welded surface (both in side & out side) after welding with zinc rich electrode, along with the nascent threaded metal portions at both free ends given the same application of Zinc Silicate paste. Alternatively flanged jointing may be employed for pipe sizes 100 NB and above. However, the bidder shall ensure the galvanized pipe joints do not fail during hydro test. (c) Teflon tapes shall be used to seal out screwed joints and shall be applied to the male threads only. Threaded parts shall be wiped clean of oil or grease with appropriate solvent if necessary and allowing proper time for drying before applying the sealant. Pipe ends shall be reamed and all chips shall be removed. Screwed flanges shall be attached by screwing the pipe through the flange and the pipe and flange shall be refaced accurately. (d) For pipe sizes from 350 mm NB to 550 mm NB (including 350 NB & 550 NB) the GI pipes shall be of flanged connection. However, the pipes after welding of flanges shall be completely galvanized. Any site welding done on galvanized pipes shall be done with zinc-rich special electrodes and the welded surfaces whether inside or outside shall be coated with zinc-silicate paste. Seal welding of flanges with zinc-rich electrode will be permitted only when any flange is leak-prone during hydro testing. (e) For pipe sizes 600 mm NB and above, the GI pipes shall be of welded connection (with zinc-rich special electrodes) followed by application of zinc silicate coating at welded surfaces both inside and outside the pipe, except for the last blank/blind flange, or, equipment connection where application of zinc-silicate paste after welding cannot be done due to inaccessibility of the inside welded surface and where			
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	galvanic protection has been impaired due to welding of pipe-to-pipe joint. Thus the last erection joint shall be flanged joint.			
2.06.02	Welded Joints (a) For making up welded joints (butt weld or socket weld) the welding shall be performed by manual shielded metal arc process in accordance with the requirements specified elsewhere in the spec. Any welder employed for carrying butt welding shall be qualified as per ASME section IX for the type of joints he is going to weld. Jointing by butt weld, or socket weld shall depend upon the respective piping material specifications.			
2.06.03	Flanged Joints (a) Flanged connections for pipes are to be kept to the minimum and used only for connections to vessel, equipments, flanged valves and other fittings like strainer/traps/orifices etc. for ease of connection and maintenance etc. Rubber lined pipes shall be flange joined only. (b) All flanged valves intended for installation on steel piping system, shall have their flanges drilled to ANSI B 16.5 (or equivalent) and according to the pressure class stated in their respective piping material specification. (c) Drilling on flanges of flanged valves must correspond to the drilling of flanges on the piping system on which the valves are installed.			
2.07.00	Bends/elbows/mitre bends/ Tees/ Reducers & other fittings			
2.07.01	For pipe fittings such as elbows (long radius), reducers, tees, etc. the material shall be to ASTM-A-234 Gr. WPB/ASTM-105 up to 300 NB. For pipe fittings above 300 NB, the fittings may be fabricated conforming to parent pipe material. Provision of compensation pads shall be kept as per ANSI B 31.1. The fitting shall conform to the dimensional standard of ANSI B-16.9/ 16.11. Further branching in pipes for sizes 65nb and above is also acceptable (ANSI B 31.1). However, for pipes up to 150 NB, pipe fittings may be supplied with material and dimension conforming to IS 1239 in case parent pipes also conform to IS 1239.			
2.07.02	For pipe size 350Nb and above mitre bends may be used for all pipes except rubber lined pipes. The bend radius shall be 1½ times the nominal pipe diameter. 90 deg. bends (mitre) shall be in 4 pieces (3 cuts) and 45 deg. mitre bends shall be in 3 pieces 22½ deg. Fabrication of mitre bends shall be as detailed in BS 2633/BS534.			
2.07.03	For pipes, above 1200 NB, reducer and tees shall be to dimensional standard of AWWA-C-208.			
2.07.04	Stainless steel fittings shall conform to either ASTM-A-182 Gr. 304 or ASTM-A-403 Grade WP. 304 Class-S, for sizes upto and including 50 mm NB, i.e. the fittings shall be of seamless construction. However, for stainless fittings above 50 mm NB, the same shall conform to ASTM-A-403 Gr. WP 304 Class W i.e. the fittings shall be of welded construction strictly in accordance with ASTM-A-403.			
2.07.07	In no case, the thickness of fittings shall be less than the thickness of parent pipe, irrespective of material of construction.			
2.08.00	Flanges			
2.08.01	Flanges shall be slip on type. Welding of flanges in tension is not permitted.			
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2.08.02	All flanges and-flanged drilling shall be to ANSI B 16.5/BS EN-1092 of relevant pressure/temperature class. Flanges shall be fabricated from steel plates conforming to ASTM A 105/IS 2062 Gr. E-250B. However stainless steel flanges shall be fabricated from SS plates to ASTM-A-240, Gr. 304 or equivalent.			
2.09.00	Specific technical requirement of laying buried pipe with anti corrosive treatment The pipe in general shall be laid with the top of the pipe minimum 1.0 (one) meter below finished general ground level.			
2.09.01	Trenching (a) The trench shall be cut true to the line and level and shall follow the gradient of the pipeline. The width of the trench shall be sufficient to give free working space on each side of the pipe. Trenches shall conform to IS 5822 or any international standard.			
2.09.02	Preparation and cleaning of piping (a) The pipeline shall be thoroughly cleaned of all rust, grease, dirt, weld scales and weld burrs etc. moisture or other foreign matter by power cleaning method such as sand or grit blasting, power tool cleaning, etc. Grease or heavy oil shall be removed by washing with a volatile solvent such as gasoline. Certain inaccessible portions of the pipeline (which otherwise not possible to be cleaned by power cleaning methods) may be scrubbed manually with a stiff wire brush and scrapped where necessary with specific permission of the Project Manager. (b) On the internal surface for pipes 1000 Nb and above, a coat of primer followed by a hot coal-tar enamel or coal tar epoxy painting (cold) shall be applied.			
2.09.03	Coating and wrapping/ Anti corrosive Protection Coal tar tape a. Buried piping shall be coated and wrapped, as per specification, after completion of welded and/or flanged connections, and after completion and approval of Hydro testing. Materials to be used for coating and wrapping of underground pipelines are: (1) Coating primer (coal tar primer) (2) Coating enamel (coal tar enamel) (3) Wrapping materials. All primer/coating/wrapping materials and methods of application shall conform to IS: 10221 except asphalt/bitumen material. Materials (primer/coating/wrapping) as per AWWA-C-203 are also acceptable. Protective coating shall consist of coal tar primer, coal tar enamel coating, glass fiber, tissue inner wrap followed by glass fiber or coal tar impregnated Kraft outer wrap or finish coat. Number of coats and wraps, minimum thickness for each layer of application shall be as per IS-10221. Number of. Coats and wraps shall be decided based on soil corrosivity/resistivity as indicated in IS-10221. Soil data-for this purpose shall be made available. Total thickness of completed coating and wrapping shall not be less than 4.0 mm. b. Alternatively, the anti-corrosive protection for buried pipes can consist of anti-corrosive protection Coal-tar tapes. Material and application of tapes shall conform to IS 15337 or equivalent. These-tapes shall be applied hot over the cold coal tar			
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	primer in steps of 2mm thickness so as to cover the spiral edges of the first tape by the application of second tape. The total thickness of the finished protective coating shall be 4.0 mm minimum.			
2.09.04	Trench bed preparation and back filling Prior to lowering and laying pipe in any excavated trench, the bottom of the trench may require to be back filled and compacted (or as the case may be) to provide an acceptable bed for placing the pipe. Bed preparation in general shall be as per IS: 5822.			
2.09.05	laying of galvanized steel (GI) pipes All the joints shall be screwed with socket or flanged. Screwed ends of GI pipes shall be thoroughly cleaned and painted with a mixture of red and white lead before jointing Threaded portion on either side of the socket joint shall be applied with Zinc silicate paste. All the provisions for trenching' bed preparation' laying the pipe application of primer' coating' wrapping with tapes and back filling etc. as indicated for "laying of buried piping" and " anti corrosive protection for buried piping" are applicable for buried galvanized steel (GI) pipes also.			
2.10.00	Cleaning and flushing			
2.10.01	All piping shall be cleaned by the Bidder before and after erection to remove grease, dirt, dust, scale and welding slag.			
2.10.02	Before erection all pipe work, assemblies, sub-assemblies, fittings, and components, etc. shall be thoroughly cleaned internally and externally by blast cleaning or by power driven wire brushes and followed by air-blowing . However for pipe sizes below 100nb the pipes may be cleaned internally by compressed air blowing as an alternative to internal blast cleaning. The brushes shall be of the same or similar material as the metal being cleaned. Cleaning of Galvanized pipes shall be done by air blowing only.			
2.10.03	After erection, all water lines shall be mass flushed with water. The cleaning velocities in water lines shall be 1.2-1.5 times the operating velocities in the pipelines.			
2.10.04	All compressed air pipe work shall be cleaned by blowing compressed air.			
2.11.00	Specification for hangers and supports			
2.11.01	All supports and parts shall conform to the requirement of power piping code ANSI B 31.1 or approved equivalent.			
2.11.02	The maximum spans of the supports of straight length shall not exceed the recommended values indicated in ANSI B 31.1.			
2.11.03	At all sliding surfaces of supports suitable arrangement is to be provided to minimize sliding friction.			
2.12.00	Design/Construction/Material Particulars of Gate/ Globe /Check /Butterfly / Ball / Air release /Float valves / Moisture Traps.			
2.12.01	GENERAL (a) All valves shall have indicators or direction clearly marked on the hand-wheel so that the valves opening/closing can be readily determined.			
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2.12.02		(b) Special attention shall be given to operating mechanism for large size valves with a view to obtaining quick and easy operation ensuring that a minimum of maintenance is required. (c) The valves coming in vacuum lines shall be of extended gland type and/or water sealed. (d) The actuator-operated valves shall be designed on the basis of the following: (1) The internal parts shall be suitable to support the pressure caused by the actuators; (2) The valve-actuator unit shall be suitably stiff so as not to cause vibrations, misalignments, etc. (3) All actuator-operated valves shall be provided with hand operated gearing mechanism also. (4) All actuators operated valves shall open/ close fully within time required by the process. (e) Valves coming under the purview of IBR shall meet IBR requirements. (f) All valves shall be provided with embossed name plate giving details such as tag number, type, size etc. (g) Wherever required valves shall be provided with chain operator, extension spindles and floor stands or any other arrangement approved by employer so that they can be operated with ease from the nearest operating floor. Wherever necessary for safety purpose locking device shall be provided. Further, necessary small platforms for facilitating easy valve operation shall be provided by the contractor wherever necessary in consultation with project manager within the bid price at no extra cost to employer		
		VALVE BODY MATERIAL Valve body material for various services shall be as follows: Valve body material for water application like Secondary circuit auxiliary cooling water of ECW system, Raw water, Ash water make-up, service water, clarified water, DM cooling water (pH corrected) , drinking water etc. shall be cast iron for sizes 65NB and above; gun-metal for sizes 50 Nb and below. For compressed air application, valve body material shall be cast carbon steel or forged carbon steel for sizes 65 mm NB & above and Gun metal for sizes 50 NB and below. DM water: SS body and disc along with SS internals. However for butterfly valves, Cast Iron /Ductile Iron/SG iron/carbon steel body and disc with elastomer lining are also acceptable. Condensate: Cast Carbon Steel / Forged Carbon Steel.		
2.12.03		The design, material, construction, manufacture, inspection, testing and performance of valves shall comply with all currently applicable statutes, regulations and safety codes in the locality where the valves will be installed. The valves shall conform to the latest editions of applicable codes and standards as mentioned elsewhere. Nothing in this specification shall be construed to relieve the Bidder of his responsibility. Valves in general shall conform to the requirements of the following standards.		
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2.12.04	Standards and Codes				
	AWWA-C-504		Rubber seated butterfly valves.		
	BS-5155/EN-593		Cast iron and steel body butterfly valves for general purpose.		
	IS-778		Gun-metal gate, globe and check valves for general purpose.		
	BS-5154		Copper alloy globe/globe stop and check and gate valves for general purpose.		
	IS-780		Sluice valves for water works purpose (50-300 mm size)		
	IS-2906		Sluice valves for water works purpose (350-1200 mm size)		
	IS-5150		Cast iron wedge and double disc gate for general purpose.		
	BS-5152		Specification for cast iron globe valves.		
	BS-5153		Cast iron check valves for general purpose.		
	IS-5312		Swing check type reflux (non-return) valves.		
	ANSI B 16.34		Standard for valves.		
	API-594		Standard for Dual-check valves.		
	API-600		Steel gate valves.		
	ANSI-B-16.10		Valves face to face and other relevant dimension.		
	API-598		Valves inspection test.		
	End Connections				
	The end connections, shall comply with the following:				
	Socket welding (SW) - ANSI B 16.11				
	Butt Welding (BW) - ANSI B 16.25.				
	Threaded (SC) - ANSI B 2.1				
	Flanged (FL) - ANSI B 16.5& AWWA-C-207 (steel flanges), ANSI B 16.1 (Cast Iron flanges).				
	2.13.00	Gate/Globe/Check Valves			
		(a) All cast iron body valves (gate, globe and non-return) shall have flanged end connections; (screwed ends for Ductile D.2NI body valves are not acceptable).			
		(b) All steel and stainless steel body valves of sizes 65 mm and above shall have flanged or butt welding ends. Valves of sizes below 65mm shall have flanged or socket welded ends. Compatibility of welding between valve body material and connecting pipe material is a pre-requisite in case of butt-welded joints.			
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	(c) All gun metal body valves shall have screwed ends. (d) All flanged end valves/specialties. shall be furnished along with matching counter flanges, fasteners, gaskets etc. as required to complete the joints. (e) Gate/sluice valves shall be used for isolation of flow. All gate valves shall be of the full-way type, and when in the full open position the bore of the valve shall not be constricted by any part of the gate. Gate valves shall be of the solid/elastic or articulated wedge disc. Gate valves shall be provided with the following accessories in addition to other standard items: (1) Hand wheel (2) Position indicator (for above 50 mm NB valve size) (3) Draining arrangement wherever required. (f) Globe valves shall be used for regulation purposes. They shall be provided with hand wheel, position indicator, draining arrangement (wherever required) and arrow indicating flow direction. Preferably, the valves shall be of the vertical stem type. Globe valves shall preferably have radiused or spherical seating and discs shall be free to revolve on the spindle. The pressure shall preferably be under the disc of the valve. However, globe valves, with pressure over the disc shall also be accepted provided (i) no possibility exists that flow from above the disc can remove either the disc from stem or component from disc (ii) manual globe valves can easily be operated by hand. If the fluid load on the top of the disc is higher than 40-60 KN, bypass valve shall be provided which permits the downstream system to be pressurized before the globe valve is opened. (g) Check valves shall be used for non-return service. They shall be swing. check type or double door (Dual plate)check type with a permanent arrow inscription on the valve body indicating the fluid flow direction. In long distance pipes lines with possibility of surge-occurrence, dual plate check valves are preferable for its spring controlled opening /closing of flaps/doors against flow reversals. However, dual plate check valves shall not be used for sizes more than 600mm NB. (h) For bore greater than 2" the valves must be swing check type or dual plate check type suitable for installation in all positions (vertical and horizontal); (i) For bore smaller than or equal to 2" the valves must be of the piston type to be installed, in horizontal position. (j) All gate and globe valves shall be provided with back seating arrangement to enable on line changing of gland packing. The valves shall be preferably outside screw & yoke type. (k) All gate and globe valves shall be rising stem type and shall have limit switches for full OPEN and full CLOSED indication wherever required. This will include motor-operated valves also wherever required. In such cases the limit switches shall form an integral part of the valve. Stop-gap arrangement in this respect is not acceptable. (l) All valves except those with rising stems shall be provided with continuous mechanical position indicators; rising stem valves shall have only visual indication through plastic/metallic stem cover for sizes above 50 mm nominal bore.			
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2.13.01	(m)	For CI gate, globe and check valves wherever thickness of body/bonnet is not mentioned in the valves standards, thickness mentioned in IS- 1538 for fitting shall be applicable.		
	MATERIAL OF CONSTRUCTION (GATE/GLOBE/CHECK VALVE)			
	(a)	The materials shall generally comply with the following:		
	(1)	Cast Steel Valves		
		Body & bonnet	ASTM A 216 Gr. WCB/ ASTM A 105	
		Disc for non-return Valves	ASTM A 216 Gr. WCB/ ASTM A 105	
		Trim.	ASTM A 182 Gr. F6 or Equivalent	
	(2)	Stainless steel valves		
		Body & Bonnet	SS 304	
		Disc	-do-	
		Trim.	SS 316	
	(3)	Cast iron valves		
		Body & bonnet	BS 1452 Gr. 14/ IS-210 Gr. FG 260	
		Seating surfaces and rings	13% chromium steel/ 13% Chrome overlay	
		Disc for non-return valves	BS 1452 Gr. 14/IS-210 Gr FG 260	
		Hinge pin for non-return valves	AISI 316	
		Stem for gate globe valves	13% chromium steel or Equivalent	
		Back seat	13 % chromium steel / 13% Chrome overlay	
	(4)	Gun Metal valves		
		Body and bonnet	IS 318 Gr. 2/ Equivalent Standard	
	Trim.	-do-		
(b)	Cast iron body valves shall have high alloy steel stem and seat.			
(c)	Material for counter flanges shall be the same as for the piping.			
(d)	Forged carbon steel valves are also acceptable in place of Gun metal valves.			
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2.14.00	Air Release Valve (a) The air release valves shall be of automatic double air valve with two orifices and two floats. The float shall not close the valve at higher air velocities. The orifice contact joint with the float shall be leak tight joint. (b) The valve shall efficiently discharge the displaced air automatically from ducts/pipes while filling them and admit air automatically into the ducts/pipes while they are being emptied. The valve shall also automatically release trapped air from ducts/pipes during operation at the normal working pressure. (c) Body material of automatic air release valves shall comply generally with BS 1452 Gr. 14/IS: 210 Gr. FG 260. and spindle shall conform to high tensile brass. (d) Air release valves shall not have any integral isolation device within them. Each Air release valve shall be mounted, preceded by a separate isolation gate/ butterfly valve.			
2.15.00	Butterfly valves			
2.15.01	Design/Construction (a) The valves shall be designed for the design pressure/temperature of the system on which it is installed and in accordance with AWWA-C-504, EN-593 or any other approved equivalent standard latest edition. Fabricated steel (IS: 2062 GR. E-250B) butterfly valves instead of cast iron body valves are also acceptable for size above 300 mm nb diameter. (b) The valves shall be suitable for installation in any position (horizontal/vertical etc.) and shall be generally of double-flanged construction. However for sizes 600 NB and below the valves of Wafer construction are also acceptable (c) Valves-350Nb and above shall have pressure equalizing bypass valves, wherever system parameters warrant the same. (d) Valves-200Nb and above shall also be provided with gear operator arrangement as a standard practice suitable for manual operation. Manual operation of valve shall be through gear arrangement having totally enclosed gearing with hand wheel diameter and gear ratio designed to meet the required operating torque It shall be designed to hold the valve disc in intermediate position between full open and full closed position without creeping or fluttering. Adjustable stops shall be provided to prevent over travel in either direction. Limit and torque switches (if applicable) shall be enclosed in water tight enclosures along with suitable space heaters for motor actuated valves, which may be either for On-Off operation or inching operation with position transmitter.			
2.15.02	Material of Construction (Butterfly Valves) Materials and other design details shall be as indicated below : (a) Cast Iron Butterfly Valves Body & Disc ASTM A48, Gr. 40 with 2% Ni / IS: 210. Gr. FG-260, with 2% Ni / SG iron BSEN 1563, Gr EN GJS-400-15 with 2%Ni and epoxy coated			
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC. NO.:CS-9585-001-2	SUB-SECTION-A-10 (LOW PRESSURE PIPING)	PAGE 14 OF 20

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CLAUSE NO.					
2.15.03	Shaft	BS 970 431 S: 291 / EN 57, or AISI-410 or AWWA-permitted shaft material equivalent to EN-57/AISI-410 or better.			
	Seat ring	18-8 Stainless steel			
	SEAL	NITRILE RUBBER			
	(b)	Stainless Steel Butterfly Valves			
	Body & Disc	SS 304			
	Shaft	SS 316			
	Seat Rings	EPT/BUNA-N/Neoprene			
	(c)	Carbon steel Butterfly Valves			
	Body & Disc	ASTM A 216, Gr. WCB			
	Shaft	SS 304			
	Disc & Seat Rings	EPT/BUNA-N/Neoprene			
	(d)	Elastomer lined Butterfly Valves			
	Body & Disc	ASTM A48, Gr. 40 / IS: 210. Gr. FG-260 / SG Iron (ductile iron) IS 1865 Gr 400-15 or BSEN 1563, Gr EN GJS-400-15 / ASTM A 216, Gr. WCB with elastomer lining.			
	Shaft	SS 316			
	2.15.03	Proof of Design Test (Type Test) for Butterfly Valves			
	Proof of Design (P.O.D.) test certificates shall be furnished by the bidder for all applicable size-ranges and classes of Butterfly valves supplied by him, in the absence of which actual P.O.D. test shall be conducted by the bidder.				
	All valves that are designed and manufactured as per AWWA-C-504 / AWWA-C-516 shall be governed by the relevant clauses of P.O.D test in AWWA-C-504/AWWA-C-516. For Butterfly valves, designed and manufactured to EN-593 or equivalent, the P.O.D. test methods and procedures shall generally follow the guidelines of AWWA-C-504 in all respect except that Body & seat hydro test and disc-strength test shall be conducted at the pressures specified in EN-593 or the applicable code. Actuators shall also meet requirements of P.O.D. test of AWWA-C-504/AWWA-C-516.				
2.16.00	Float operated valves				
	(a) Valve shall automatically control the rate of filling and will shut off when a predetermined level is reached and close to prevent over flow on pre-set maximum water level. Valve shall also open and close in direct proportion to rise or fall of water level.				
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC. NO.:CS-9585-001-2		SUB-SECTION-A-10 (LOW PRESSURE PIPING)	
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CLAUSE NO.		TECHNICAL REQUIREMENTS			
		(b) DESIGN AND CONSTRUCTION FEATURES The following design and construction feature of the valve shall be the minimum acceptable. (c) Valves shall be right-angled or globe pattern. (d) Valves shall be balance piston type with float ball. (e) Leather liner shall not be provided. (f) The body and cover material shall be cast iron conforming to ASTM-A 126 Grade 'B' or IS: 210 Grade 200 or equivalent, and Float shall be of copper with epoxy painting of two (2) coats. (g) Valves shall be suitable for flow velocities of 2 to 2.5m/sec. (h) The valves shall have flanged connections.			
2.17.00		Tanks and Accessories			
2.17.01		The designer and manufacturer of storage tanks shall comply with and obtain approval of all currently applicable statutory regulations and safety codes in the locality where the equipment will be installed. The tanks shall conform to IS 803/IS804/IS 805/ IS 2825/ API 650/ IS 4049/ IS 4682 (part-I) and IS 4864 to 4870/ ASME B & PV code Sec.-VIII as the case may be.			
2.17.02		DESIGN AND CONSTRUCTION			
		(a) Design of all vertical atmospheric storage tanks containing water, acid, alkali and other chemical shall conform to IS:803 & API 650. (b) Design of all horizontal atmospheric storage tanks containing water, acid, alkali and other chemicals shall generally conform to IS:2825 as regards to fabrication and general construction taking care of combined bending, shear & hoop stresses developed due to supporting arrangement. (c) Tank shall be made from mild steel plates to BS 4360/IS-2062 Gr.E-250B (or equivalent) for ordinary wafer application when it is not corrosive in nature. (f) Tank shall be provided with suitable supporting joints. All vessels shall be provided with lifting lugs, eye bolts etc. for effective handling during erection. (j) Tanks shall be provided with float operated level indicators/level gauges/level transmitters and level switches, as required, with complete assembly. Suitable flanged pads for level switches mounting shall also be provided. The level indicator can be top or side mounted as the case may be. (k) In addition to inlet and outlet nozzles, the tanks shall be provided with vents, overflow, drain nozzles complete for various connections on tanks. Overflow lines from storage tanks is to be routed to the nearest surface drains. For tanks containing dm water, alkaline water or power cycle water the vent to atmosphere shall be through carbon-di-oxide absorber vessel suitably mounted on the tank. CO2 absorber vessel shall be provided with the initial fill of chemicals. (l) Tanks shall have suitable stairs/ladders on inside and outside of the tanks, manholes/inspection covers as required and also platform suitably located.			
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC. NO.:CS-9585-001-2		SUB-SECTION-A-10 (LOW PRESSURE PIPING)	
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CLAUSE NO.	TECHNICAL REQUIREMENTS		एनडीपीसी NTPC				
2.17.03	(m)	Tank supporting arrangement as approved by Employer shall be provided with all plates/angles/joints/flats and supporting attachment including lugs, saddles, legs etc.					
	(o)	Tank fabrication drg. and design calculations shall be approved by the Project Manager.					
	Corrosion protection						
	(a)	A corrosion allowance, applicable to surface in contact with corrosive media, when required after thorough cleaning by blast cleaning preceded by wire brushing shall be taken into consideration.					
	(b)	Manholes shall be provided for easy access into the vessels. The size shall be minimum 500 mm and will be with cover plate, nuts bolts, etc. to ensure leak tightness at the test pressure.					
	(c)	Each tank shall be provided with drilled cleats welded to the tank for electrical grounding. Material of cleats shall be same as that of the shell.					

	Sl. No.	Description	Tech. Particulars				

	1.00	CONDENSATE STORAGE TANKS					
	1.01	Number required	one for each unit				
	1.02	Capacity of each tank (Effective)	450 Cu.m (for 800MW units),				
	1.03	Size (Dia & Height)/Plate Thickness	9mx8.2m minimum), Shell & Roof plate Thickness 8mm and Base plate thickness 10mm				
	1.04	Type and pressure class	Vertical, cylindrical, atmospheric				
	1.05	Material of construction	MS- (IS-2062 Gr.B or equivalent) as per specified code, 8mm thickness (minimum)				
1.06	Location	Outdoor					
1.07	Overflow, drain, vent and Sample connection(piping &valve)	required					
1.08	Level Indicator						
	a) Number	One for each tank					
	b) Type	Mechanical float type with dial type indicator (Guide wire, Float and Housing of Stainless steel - 316 Gr. construction)					
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC. NO.:CS-9585-001-2		SUB-SECTION-A-10 (LOW PRESSURE PIPING)		PAGE 17 OF 20	

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CLAUSE NO.	TECHNICAL REQUIREMENTS		एनटीपीसी NTPC
	1.09	Manhole (minimum 500mm size)	Two (2)-one on shell and the other on roof
	1.10	Special Fittings	
	a)	Hydraulic Seal of Overflow/Drain	Required
	b)	Additional nozzle Connection	number and size to be indicated to successful Bidder
	c)	Nozzle connection for Instrument/spare	Three (3) nos. for each tank
	d)	CO2 Absorber for vent (not to be kept on roof of tank, but to be kept on ground level)	required
	e)	Outside stair case (spiral)	required
	f)	Inside Ladder	Required
	g)	Draw off sump	required
	h)	Root valve for level Transmitter	Root valves for two (2) nos. level transmitter for each tank Required
2.18.00	RUBBER EXPANSION JOINTS		
2.18.01	All parts of expansion joints shall be suitably designed for all stresses that may occur during continuous operation and for any additional stresses that may occur during installation and also during transient condition.		
2.18.02	The expansion joints shall be single bellow rubber expansion joints. The arches of the expansion joints shall be filled with soft rubber.		
2.18.03	The tube (i.e. inner cover) and the cover (outer) shall be made of natural or synthetic rubber of adequate hardness. The shore hardness shall not be less than 60 deg. A for outer and 50 deg. A for inner cover.		
2.18.04	The carcass between the tube and the cover shall be made of high quality cotton duck, preferably, square woven to provide equal strength in both directions of the weave. The fabric plies shall be impregnated with age resistant rubber or synthetic compound and laminated into a unit.		
2.18.05	Reinforcement, consisting of solid metal rings embedded in carcass shall be provided.		
2.18.06	Expansion joints shall be complete with stretcher bolt assembly. The expansion joints shall be suitable to absorb piping movements and accommodate mismatch between pipe lines.		
2.18.07	The expansion joints shall be of heavy duty construction made of high grade abrasion-resistant natural or synthetic rubber compound. The basic fabric for the ' duck' shall be either		
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC. NO.:CS-9585-001-2	SUB-SECTION-A-10 (LOW PRESSURE PIPING)
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CLAUSE NO.		TECHNICAL REQUIREMENTS			
		a superior quality braided cotton or synthetic fibre having maximum flexibility and non-set characteristic.			
2.18.08		The expansion joints shall be adequately reinforced, with solid steel rings, to meet the service conditions under which they are to operate.			
2.18.09		All expansion joints shall be provided with stainless steel retaining rings for DM water application and IS 2062 Gr E-250B galvanized steel retaining rings for ordinary water for use on the inner face of the rubber flanges, to prevent any possibility of damage to the rubber when the bolts are tightened. These rings shall be split and beveled type for easy installation and replacement and shall be drilled to match the drilling on the end rubber flanges and shall be in two or more pieces.			
2.18.10		The expansion joints shall have integral fabric reinforced full-face rubber flanges. The bolt on one flange shall have no eccentricity in relation to the corresponding bolt hole on the flange on the other face. The end rubber flanges shall be drilled to suit the companion pipe flanges. The flanges shall be as per ANSI B 16.5. For higher sizes, not covered under ANSI B 16.5, the same shall be as per AWWA.			
2.18.11		All exposed surfaces of the expansion joint shall be given a 3 mm thick coating of neoprene. This surface shall be reasonably uniform and free from any blisters, porosity and other surface defects.			
2.18.12		Each control unit shall consist of two (2) numbers of triangular stretcher bolt plates, a stretcher bolt with washers, nuts, and lock nuts. Each plate shall be drilled with three holes, two for fixing the plate on to the companion steel flange and the third for fixing the stretcher bolt.			
2.18.13		Each joint shall have a permanently attached brass or stainless steel metal tag indicating the tag numbers and other salient design features.			
2.18.14		Bidder to note that any metallic part which comes in contact with DM /corrosive water shall be of Stainless Steel material.			
2.19.00		STRAINERS			
2.19.01		Simplex type			
		The strainers shall be basket type and of simplex construction. The strainer shall be provided with plugged drain/blow off and vent connections. The free area of the strainer element shall be at least four (4) times the internal area of the connecting pipe lines. The strainer element shall be 20 mesh. Pressure drop across the strainers in new condition shall not exceed 1.5 MCW at full flow. Wire mesh of the strainers shall be suitably reinforced, to avoid buckling under operation. Strainer shall have screwed blow off connection fitted with a removable plug. The material of construction of various parts shall be as follows:			
		(a)	Body	IS: 318, Gr. 2 up to 50 mm Nb, and IS: 210 Gr. FG 260 above 50 mm Nb. (For DM water/ -Body: AISI 316 or equivalent)	
		(b)	Strainer Element	Stainless steel (AISI 316)	
		(c)	End connection	Screwed upto 50 mm Nb, and Flanged above 50 mm Nb	
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC. NO.:CS-9585-001-2		SUB-SECTION-A-10 (LOW PRESSURE PIPING)	
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05/2022/PS-PEM-MAX		TECHNICAL REQUIREMENTS									
CLAUSE NO.											
2.19.02	Duplex type (a) The strainers shall be basket type and of duplex construction. The strainer shall be provided with plugged drain/blow off and vent connections. The free area of the strainer element shall be at least four (4) times the internal area of the connecting pipe. The mesh of strainer element shall be commensurate with the actual service required. Pressure drop across the strainer in new condition shall not exceed 4.0 MWC at full flow. (b) Wire mesh (if applicable) of the strainers shall be suitably reinforced. The material of construction of various parts shall be as follows. <table><tr><td>Body</td><td>IS: 318, Gr. 2 up to 50 mm Nb, and IS:210, Gr. FG 260 or ASTM-A-515 Gr. 75/IS-2062 Gr. E-250B and internally epoxy-painted above 50 mm NB.</td></tr><tr><td>Strainer element</td><td>Stainless steel (AISI 316)</td></tr><tr><td>End connection</td><td>Screwed up to 50mm Nb, and Flanged above 50 mm Nb. Gasket shall be of full face type</td></tr></table> (c) The strainer will have a permanent stainless steel tag fixed on the strainer body indicating the strainer tag number and service and other salient data. (d) The size of the strainer and the flow direction will be indicated on the strainer body casting. (e) Thickness of the strainer element should be designed to withstand the pressure developed within the strainer due to 100% clogged condition exerting shut-off pressure on the element.					Body	IS: 318, Gr. 2 up to 50 mm Nb, and IS:210, Gr. FG 260 or ASTM-A-515 Gr. 75/IS-2062 Gr. E-250B and internally epoxy-painted above 50 mm NB.	Strainer element	Stainless steel (AISI 316)	End connection	Screwed up to 50mm Nb, and Flanged above 50 mm Nb. Gasket shall be of full face type
Body	IS: 318, Gr. 2 up to 50 mm Nb, and IS:210, Gr. FG 260 or ASTM-A-515 Gr. 75/IS-2062 Gr. E-250B and internally epoxy-painted above 50 mm NB.										
Strainer element	Stainless steel (AISI 316)										
End connection	Screwed up to 50mm Nb, and Flanged above 50 mm Nb. Gasket shall be of full face type										
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC. NO.:CS-9585-001-2		SUB-SECTION-A-10 (LOW PRESSURE PIPING)							
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TECHNICAL SPECIFICATION FOR
COAL HANDLING PLANT
RUN-OFF WATER TREATMENT SYSTEM
3X800 MW PATRATU STPP EXT.PH-I

BHEL DOCUMENTS NO.: PE-TS-434-157-A001

VOLUME-II-B

SECTION-D

REV. NO. 00

DATE:

GENERAL TECHNICAL REQUIREMENT OF PUMPS

CLAUSE NO.		TECHNICAL REQUIREMENTS			
Annexure-1 to "Auxiliary Water System"					
HORIZONTAL CENTRIFUGAL PUMPS					
1.00.00		SCOPE			
		General requirements in respect of design, material, constructional features, manufacture, inspection, testing the performance at the Vendor's/ Sub-Vendor's works and delivery to site erection, field testing and commissioning of Horizontal Centrifugal Pumps.			
2.00.00		CODES AND STANDARDS			
2.01.00		Design, material, construction manufacture inspection and performance testing of Horizontal Centrifugal Pumps shall comply with all currently applicable statutes, regulations and safety codes in the locality where the equipment will be installed. The equipment supplied shall comply with the latest applicable Indian standards listed below. Other National Standards are acceptable, if they are established to be equal or superior to the Indian Standards.			
2.02.00		List of Applicable Standards			
		i) IS : 1520 - Horizontal Centrifugal Pumps for clear cold fresh water.			
		ii) IS : 5120 - Technical requirements of roto-dynamic special purpose pumps			
		iii) API - 610 - Centrifugal pumps for general refinery service.			
		iv) IS : 5639 - Pumps Handling Chemicals & corrosion liquids.			
		v) IS : 5659 - Pumps for process water			
		vi) HIS - Hydraulic Institute Standards; USA			
		vii) ASTM-I-165-65- Standards Methods for Liquid Penetration Inspection.			
2.03.00		In case of any contradiction with aforesaid standards and the stipulations as per the technical specifications as specified hereinafter the stipulations of the technical specifications shall prevail.			
3.00.00		DESIGN REQUIREMENTS			
3.01.00		The maximum efficiency of pumps shall be preferably within + 10% of the rated design flow indicated in data sheets.			
3.02.00		Total head capacity curve shall be continuously rising from the operating point towards shut - off without any zone of instability and with a minimum shut off head of 15% more than design head.			
3.03.00		Pumps of a particular category shall be identical and shall be suitable for parallel operation with equal load division. The head Vs capacity and BHP Vs capacity characteristics should match to ensure even load sharing and trouble free operation throughout the range. Components of identical pumps shall be interchangeable.			
3.04.00		Pumps shall run smoothly without undue noise and vibration. Peak to peak vibration limits shall be restricted to the following values during operation.			
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-A-15 ACW SYSTEM	
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CLAUSE NO.		TECHNICAL REQUIREMENTS			
		Speed	Antifriction bearing	Sleeve bearing	
		1500 rpm and below	75.0 micron	75.0 micron	
		3000 rpm	50.0 micron	65.0 micron	
		The noise level shall not exceed 85 dBA. Overall sound pressure level reference 0.0002 microbar (the standard pressure reference for air sound measurement) at a distance of 1M from the equipment surface.			
3.05.00		The pumps shall be capable of starting with discharge valve fully open and close condition.			
4.00.00		DESIGN CONSTRUCTION			
4.02.00		Pump casing shall have radially/axially split type construction. The casing shall be designed to withstand the maximum shut - off pressure developed by the pump at the pumping temperature.			
4.03.00		Pump casing shall be provided with a vent connection and piping with fittings & valves Casing drain as required shall be provided complete with drain valves, piping and plugs. It shall be provided with a connection for suction and discharge pr. Gauge as standard feature.			
4.04.00		Impeller			
		Impeller shall be closed or semi-closed as specified elsewhere and designed in conformance with the detailed analysis of the liquid being handled. The impeller shall be secured to the shaft, and shall be retained against circumferential movement by keying pinning or lock rings.			
4.05.00		Impeller/ Casing Wearing Rings			
		Replaceable type wearing rings shall be provided at suitable locations pumps. Suitable method of locking the wearing ring shall be used.			
4.06.00		Shaft			
		The critical speed shall be well away from the operating speed and in no case less than 130% of the rated speed.			
4.07.00		Shaft Sleeves			
		Shaft sleeves shall be fastened to the shaft to prevent any leakage or loosening shaft and shaft sleeve assembly should ensure concentric rotation.			
4.08.00		Bearings			
		Heavy duty bearings, adequately designed for the type of service specified in the enclosed pump data sheet and for long, trouble - free operation shall be furnished.			
		The bearings offered shall be capable of taking both the radial and axial thrust coming into play during operation. In case, sleeve bearings are offered additional thrust bearings shall be provided. Anti-friction bearings of standard type, if provided, shall be selected for a minimum life 16,000 hours of continuous operation at maximum axial and a radial loads and rated speed.			
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-A-15 ACW SYSTEM	
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CLAUSE NO.		TECHNICAL REQUIREMENTS			
4.09.00		Proper lubricating arrangement for the bearings shall be provided such that lubricating element does not contaminate the liquid pumped. Where there is a possibility of liquid entering the bearings suitable arrangement in the form of deflectors or any other suitable arrangement must be provided ahead of bearing assembly. Bearings shall be easily accessible without disturbing the pump assembly. A drain plug shall be provided at the bottom of each bearing housing.			
		Stuffing Boxes Stuffing boxes of packed ring construction type shall be provided wherever specified. Packed ring stuffing boxes shall be properly lubricated and sealed as per service requirements and manufacturer's standard. If external gland sealing is required, it shall be done from the pump discharge. The Bidder shall provide the necessary piping, valves, fitting etc. for the sealing connection.			
		Mechanical Seals: Wherever specified in pump data sheet, mechanical seals shall be provided The sealing face should be highly lapped surfaces of material known for their low frictional co-efficient & resistance to corrosion against the liquid being pumped.			
		Pump Shaft Motor Shaft Coupling The Pump and motor shaft shall be connected with a adequately sized flexible coupling of proven design with a spacer to facilitate dismantling of the pump without disturbing the motor.			
		Base Plate A common base plate mounting both for the pump and motor shall be furnished. The base plate shall be of fabricated steel and of rigid construction, suitable ribbed and reinforced.			
4.10.00		Assembly and Dismantling Assembly and dismantling of each pump with drive motor shall be possible without disturbing the grouting base plate or alignment.			
4.11.00		Drive Motor (Prime Mover) The KW rating of the drive shall be based on continuously driving the connected equipment for the conditions specified. In case, where parallel operation of the pumps is specified, the actual motor rating is to be selected considering overloading of the pump in the event of tripping of operating pumps. Continuous motor rating (at 50 deg. Cent, ambient) for pump shall be at least 10% above the maximum load demand of the driven equipment in the complete range.			
4.12.00					
4.13.00					
4.14.00					
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-A-15 ACW SYSTEM	
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CLAUSE NO.		TECHNICAL REQUIREMENTS		एनटीपीसी NTPC	
		Annexure-2 to “Auxiliary Water System”			
		VERTICAL PUMPS			
1.00.00		SCOPE			
1.01.00		This specification covers general requirements in respect of design, construction features, manufacture, inspection and performance at Vendor's / sub-vendor's works delivery to site, erection field testing and commissioning of Makeup Water & Raw Water Pumps.			
2.00.00		CODES AND STANDARDS			
2.01.00		The design, material, construction, manufacture, inspection, testing and performance of Vertical Pumps shall comply with all currently applicable statutes, regulations and safety codes in the locality where the equipment will be installed. The equipment supplied shall comply with the latest applicable Standards listed below. Other national standards are acceptable, if they are established to be equal or superior to the listed standards.			
2.02.00		List of Applicable Standards			
		IS: 1710 : Vertical Turbine Pumps for clear cold fresh water.			
		IS: 5120 : Technical requirement of rotor dynamic special purpose pumps.			
		HIS : Hydraulic Institute Standards U.S.A.			
		PTC 82 : Centrifugal pumps-power test code			
		API 610 : Centrifugal pumps for general refinery purposes.			
		In case of any contradiction with aforesaid standards and the specifications requirements as specified hereinafter the stipulations of the technical specifications shall prevail.			
3.00.00		DESIGN AND PERFORMANCE REQUIREMENTS			
3.01.00		The maximum efficiency point of the pumps shall preferably lie within 10% of the rated design flow.			
3.02.00		Pumps of a particular category shall be identical, suitable for parallel operation and provided with interchangeable components. Head vs. capacity and BHP vs. Capacity characteristic should match to ensure even load sharing and trouble free operation throughout the range.			
3.03.00		The pumps shall have stable Head vs. Capacity characteristic continuously rising towards shut-off with the highest at shut-off and with an approximate shut-off head of 15% or more than the design head for radial flow pumps and 50% more than the design head for mixed flow/ turbine type pumps.			
3.04.00		The operating range of operation of pumps shall generally be 40% to 120% of rated flow for sustained period of operation.			
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CLAUSE NO.		TECHNICAL REQUIREMENTS			
3.05.00		The power requirement of the pump shall be non-over loading type for mixed flow/turbine type pumps.			
3.06.00		The critical speed of the pump shall be less than 80% of the rated speed or more than 130% of the rated speed. Also, the critical speed of the pump-motor assembly shall be more than the maximum reverse run-away speed.			
3.07.00		Pump shall run smoothly without undue noise and vibration. The vibration limit measured at motor end shall not exceed the limit specified in Hydraulic Institute Standards. The noise level shall not exceed 85 dBA overall sound pressure level reference 0.0002 microbar (the standard pressure reference for air sound measurement) at a distance of 1M from the equipment surface.			
3.08.00		The base plate, foundation bolts, motor stool and other components shall be designed to take the full force coming on the discharge elbow under shut-off condition due to provision of expansion joint (untied condition prevailing)) on the discharge pipe.			
3.09.00		Water for motor cooling and thrust bearing cooling, if required, shall be tapped from the discharge of the pumps and/or fed from an over-head tank. All piping, valves, strainer, instruments etc. required for this purpose and line shaft bearing lubrication (if required) shall be provided by the Contractor. Hence the coolers shall be designed to operate satisfactorily with the cooling water discharge pressure available. Cooling water if required during starting of the pumps shall be arranged by the bidder by provision of water supply tank, valves piping etc.			
3.12.00		Reverse Rotation a) The pump shall be provided with an approved mechanical device to protect reverse rotation on loss of drive motor power and failure of discharge valve to close. b) It is possible that the pump may rotate in the reverse direction in case the discharge butterfly valve is not fully closed or is passing. Hence to prevent starting of the pump, a reverse rotation detection switch shall be provided to prevent starting of motor while rotating in reverse direction.			
3.13.00		Motor Rating The pumps shall be capable of starting with discharge valve fully closed as well as fully open conditions. Motors shall be selected to suit to the above requirements. Continuous motor rating (at 50°C ambient) for all pumps shall be at least ten per cent (10%) above the maximum load demand of the driven equipment in the complete operating range (including run out condition) to take care of the system frequency/voltage variation. Drive motors shall be connected directly to the line shaft of the pump.			
4.00.00		DESIGN AND CONSTRUCTION			
4.01.00		Pump Type Pumps shall be of vertical shaft, single stage/multi-stage, submerged suction, complete with bowl, column & head assembly and drive assembly. The pump design shall be of pullout/non-pull-out type as specified			
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-A-15 ACW SYSTEM	
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4.02.00		Discharge head The pump discharge shall be of above-floor type/sub- floor type as indicated. In certain cases of pump installation where expansion joint is located immediately at the pump discharge, the pump assembly will be subjected to the unbalanced hydraulic thrust. A thrust pad will be built in with the discharge head for transmitting the hydraulic thrust to external structures such that this hydraulic thrust is not transmitted to the foundation bolts for which they may not be designed.			
4.03.00		Column Pipe Column pipes shall be flanged and bolted and shall be complete with gaskets, nuts and bolts.			
4.04.00		Impeller The impeller shall be closed, or semi-open or open as specified elsewhere.			
4.05.00		Wearing Rings Replaceable type wearing rings shall be provided for both casing and the impeller. For open impellers replaceable casing liners shall also be provided. The difference in hardness of the casing & impeller wearing rings shall be minimum 50 BHN.			
4.06.00		Impeller & Line Shaft Shaft size selected on the basis of maximum combined shear stress must take into consideration the critical speed as per API - 610.			
4.07.00		Pump & Shaft Bearings - lubrication			
4.07.01		Adequate number of properly designed bearings shall be furnished. All interconnected piping, valves, instruments and fittings for bearing lubrication shall be provided. The type of lubrication i.e. self water lubrication or forced water lubrication shall be provided.			
4.07.02		Self water Lubrication System The line shaft bearings shall be lubricated by the water being pumped. The main pump and line shaft bearings which are above minimum water level shall be of 'Thordon' type/equivalent. For other line shaft bearings located below minimum water level, cutless rubber bearings can be used.			
4.07.03		Forced water lubrication system The line shaft shall be provided with shaft enclosing tube to exclude pumped water from shaft and bearings. Lubricating water pumps shall be provided to supply lubricating water for bearings. These lubricating water pumps shall get supply from the overhead water storage tank. This tank shall be fed water from the pump discharge header as indicated in tender drawings. Strainers downstream of each lubrication water pumps shall be provided to ensure clean water for the bearings. The lubrication water pumps shall conform to Specification titled "Horizontal Centrifugal Pumps" Complete instrumentation, piping, valves to ensure reliable operation of lubrication system			
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CLAUSE NO.		TECHNICAL REQUIREMENTS			
4.08.00		shall be provided. During initial filling and normal operation the lubricating water shall be tapped from water filling line/potable/nearest source and fed to overhead tank. Thrust Bearings Single thrust bearing at motor top or separate thrust bearings at pump and motor shall be provided to take care of hydraulic thrust and weight of the rotating assembly. Thrust bearing shall be spherical roller type or superior, capable of absorbing axial thrust in both directions of rotation. Water required for cooling of thrust bearing shall be taken from pump discharge, wherever applicable. The thrust bearing shall be rated for continuous operation with thrust as developed in shut-off condition with clearance between the wearing rings in worn out condition to be at least four (4) times the clearance between the wearing rings in new condition.			
4.09.00		Pump Motor Supports, Base plate etc. The pump and motor shall have a common support. The necessary supporting frame, base plates, mounting plates etc. as required shall be supplied under this specification.			
4.10.00		Stuffing Box Gland packing shall be provided at the top of the line shaft. Shaft sleeves shall be provided at the stuffing box. The stuffing box shall be of sufficient depth to provide ample packing. The packing glands shall be split type to facilitate repackaging of the stuffing boxes. The space between motor and the stuffing box shall be sufficient to permit removal of gland packing and insertion of new gland packing without dismantling of pump.			
4.11.00		Assembly and Dismantling Assembly and dismantling of each pump with drive motor shall be possible without disturbing the grouted base/sole plate or alignment.			
5.00.00		MATERIALS OF CONSTRUCTION Materials of construction of the pumps shall not be inferior to those specified in this sub-section.			
6.00.00		OPERATION PHILOSOPHY			
6.01.00		The Pumps shall be controlled from the Central Control Room (CCR). The start/stop commands of these pumps, all associated auxiliaries/drives including all the motor operated discharge valves, shall be routed through control system where all interlocks & permissive shall be implemented and start/stop signals shall be issued to MCC/Switchgear. The operation of interconnecting valve and any other common drive shall be possible from pump house as well as DDCMIS. The exact details of the same shall be finalised during detailed engineering.			
6.02.00		A local pushbutton switch shall be used for emergency tripping of the motor.			
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-A-15 ACW SYSTEM	
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CLAUSE NO.		TECHNICAL REQUIREMENTS					
6.03.00		The pump can be started either with pump discharge valve partially open or in closed position depending upon contractor's standard practice.					
6.04.00		An interlock shall prevent the starting of pump unless bearing lubricating water flow and motor bearing cooling water flow has been established over a period of time. Low flow of either pump or motor bearing cooling water when the pump is running will give alarm(s) and trip the pump with alarm in case of sustained low value over a preset time.					
6.05.00		In case of high pressure at pump discharge due to accidental closure of any of the butterfly valves, an alarm shall be generated.					
6.06.00		In case of normal stopping, when a pump control switch is turned 'OFF', the butterfly valve at its discharge first closes (25-30) % before the respective pump motor is de-energised.					
6.07.00		On tripping of motor due to any reason, the butterfly valve at the discharge shall close fully automatically.					
6.08.00		If water level in pump sump is low, an alarm shall be initiated. Pump shall be tripped in case of very low level of water in the intake sumps and very high discharge header pressure. Ultrasonic type Level transmitters to be provided for sump level measurement.					
6.09.00		Pump shall be tripped from very high winding temperature of motor and very high metal temperature of thrust bearings. Alarm shall be provided for high motor winding temperature and high motor/ pump bearing temperature.					
6.10.00		The operation philosophy as detailed above is suggestive only. .The control and interlock scheme to be adopted shall be finalised in consultation with the successful bidder after award of contract and shall be subject to Employer's approval.					
7.00.00		INSTRUMENTATION					
7.01.00		Vibration monitoring system if necessary shall be provided. The alarm and trip signals from vibration system shall be connected to the Control system.					
7.02.00		Bidder shall provide Duplex temperature elements for bearing & winding temperature monitoring points if specified. The excessive bearing/winding temperature shall be used for alarm and tripping of pumps/ motors.					
7.03.00		Further, Bidder shall provide required level & pressure sensing instruments as specified elsewhere in relevant Subsections of Control & Instrumentation and/or tender drawings.					
8.00.00		PERFORMANCE TESTS					
		The requirements of Performance Tests of pumps shall be same as that Performance Test specified for the CW Pump of Vertical wet pit type as referred in relevant clauses of Technical Specification.					

CLAUSE NO.		TECHNICAL REQUIREMENTS		एनटीपीसी NTPC	
Annexure-3 to Chapter "AWS System" SUBMERSIBLE PUMPS					
1.00.00		SCOPE			
1.01.00		This specification covers general requirements in respect of design, material, manufacture, construction, testing & inspection at Vendor's/sub-vendor's delivery to side, of submersible pumps.			
2.00.00		CODES AND STANDARD			
		The design manufacture and performance of submersible pumps shall comply with all currently applicable statues, regulation, and safely codes in the locality where the Equipment will be installed. The Equipment shall also conform to the latest applicable Indian standards listed below/equivalent standards.			
2.01.00		List of Applicable Indian Standards			
		IS: 5120- Technical requirement of Rotodynamic Special Purpose pumps.			
		In case of any contradiction with aforesaid standards and the technical specification requirements, the stipulation of the technical specification shall prevail.			
3.00.00		General			
3.01.00		The submersible pumps shall be of proven design. The Pumps shall be purchased from a pump manufacturer who has manufactured and supplied at least One (1) no. of submersible pump set for continuous duty for similar application, of type and capacity as offered or higher and which has been in successful operation for at least one (1) year prior to the date of Techno-Commercial bid opening. The pump set shall be suitable for pumping raw water with high turbidity and soft solids/fibrous solids which are generally observed in contaminated rivers / canal water. Components of Identical pumps shall be interchangeable.			
3.02.00		Pumps shall have continuously rising head characteristics. The pump sets shall be suitable for parallel operation as well as solo operation in the system. The performance characteristics of the pumps running in parallel shall be identical. The manufacturer shall have to submit the parallel operation curve superimposed with system resistance curve to know the exact point of pump operation with various combinations.			
4.00.00		FEATURES OF CONSTRUCTION			
		a) The pump set shall be single stage, submersible type, monoblock, volute type driven by squirrel cage induction motor. The motor shall be an integral part of the pump set. It shall be a totally sealed unit suitable for completely as well as partially submerged condition. The pump shall operate continuously even if the water level in the sump is low (motor portion not in submerged condition). The pump shall be suitable for reverse rotation and shall not have any adverse effect on the operation of mechanical seal or any other component.			
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-A-15 ACW SYSTEM	
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CLAUSE NO.		TECHNICAL REQUIREMENTS		एनटीपीसी NTPC	
		b) Pumps shall be able to pass through solids upto 40 mm. c) The impeller shall be multi vane. The impeller shall not get blocked with solids. The impeller shall be keyed on shaft, retained with an expansion ring. The impellers shall be dynamically balanced to the grade 6.3 as per ISO 1940. d) Coupling device when provided shall ensure leak proof joint between the pump and discharge elbow. This shall also enable pump to be removed from the sumps without the necessity of dismantling any nuts, bolts etc. e) Pumps shall be portable/ fixed type and capable of using in any sump as and when required. Pump shall be provided with required duck foot bend, guide pipe, chain connection etc. for easy installation, removal and maintenance. Adequate length of chain required for lowering the pump into the sump and discharge pipe or duck foot shall be provided. f) Bearing: The shaft shall rotate on grease lubricated bearings. The upper bearing, provided for radial forces, shall be a single roller bearing. The lower bearing shall consist of at least one roller bearing for radial forces and one angular contact ball bearing for axial thrust. The bearings shall be pre-lubricated and packed for life. External lubrication for any of the bearings will not be accepted. The lower bearing housing shall include an independent thermal sensor to monitor the bearing temperature. If a high temperature occurs, the sensor shall activate an alarm and shut the pump down. Any other proven arrangement which is manufacturer's standard is also acceptable. g) Sealing: Each pump shall be provided with a mechanical seal assemblies. The seal faces shall be of corrosion resistant tungsten carbide. The seal shall not require any maintenance or adjustment and shall be bi-directional. Should the seals fail and allow fluid to enter the stator housing, the fluid shall not come in contact with the lower bearing or stator. h) Shaft: The pump shaft and motor shaft shall be one piece construction. The pump shaft is an extension of motor shaft and no coupling for pump shaft and motor shaft is allowed. The shaft should not come in direct contact with pumped liquid. Use of stainless steel sleeves will not be considered as substitute for stainless steel shaft. i) Installation Accessories For transportable type of installation, a suitable stand / base frame type of arrangement shall be provided in such a way that in no case the pump will tilt. Each pump set shall be provided with the suitable length of stainless steel lifting chain.			
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-A-15 ACW SYSTEM	
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CLAUSE NO.		TECHNICAL REQUIREMENTS		एनटीपीसी NTPC	
		Following accessories to be included in scope of supply for pumps supported on discharge bend: i. Pump pedestal and discharge connection("duck foot' type discharge bend) ii. Guide rails, guide rail support brackets and lifting chain as appropriate iii. Fasteners and anchor bolts j) The major pump components shall be of material mentioned at CI 9.00.00 of this sub-section and shall be with smooth surfaces, free of blow holes or other casting irregularities.			
5.00.00		MOTOR RATING Continuous motor rating (at 50 deg. C ambient) for pumps shall be at least ten percent (10%) above the maximum load demand of the driven equipment in the complete operating range (including run out condition) to take care of the system frequency variations.			
6.00.00		Painting Details of Pump All metal surfaces coming in contact with the pumping media, other than stainless steel shall be protected by factory applied water based primer and finally covered by a two component high-solid top coating.			
7.00.00		Control and Monitoring For Submersible Type pumps all Control & Instrumentation is to be provided as per manufacturer's standard proven practice. If integral control system is provided for each pump, then Microprocessor / PLC / GIU based control system as per manufacturer's practice shall be provided. If Control system is provided externally for each pump, then it shall be implemented from DDCMIS. For both the cases, over all Control will be through DDCMIS. For details of DDCMIS refer C&I sections.			
8.00.00		PERFORMANCE GUARANTEE TESTS			
8.01.00		Shop Test			
8.01.01		After the manufacture, all the pumps shall be subjected for performance test at the manufacturer's works to determine the power consumption and the head capacity characteristic in the presence of Employer's representative, as per requirements of Hydraulic Institute Standards, (HIS 11.6)			
8.01.02		Hydrostatic test to be conducted to demonstrate that the hydraulic end, when assembled to the motor, will not leak or fail structurally when subjected to hydrostatic pressure as per HIS 11.6. NPSHR test also to be conducted to demonstrate the NPSHR requirement of pump.			
8.01.03		Contractor shall submit along with his offer details of the proposed test facilities available for testing the pumps. The details must include the capacity, head, maximum motor rating, voltage level, sanctioned load and permissible starting current.			
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-A-15 ACW SYSTEM	
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CLAUSE NO.		TECHNICAL REQUIREMENTS		एनटीपीसी NTPC	
8.01.04		It may be noted that during shop tests no negative tolerance shall be permitted on head (H), capacity (Q) and the pump efficiency (n). Instruments accuracy used shall be plus or minus 1.5% or better for measurement of flow and plus or minus 0.5% or better for measurement of pressure and power.			
8.01.05		Apart from the above, any testing if specified in subsection titled “Functional Guarantees and Liquidated damages” [subsection –IV of Part-A] of this Technical Specification shall also be conducted.			
8.02.00		Site Test a) Manufacturer shall demonstrate at site the trouble free mechanical running of individual pumps. b) The following parameters shall be measured during the demonstration test. i) Current, Voltage and Motor Input Power. ii) Frequency iii) Bearing temperature & Motor winding temperature. c) All interlocks and protections relating to the pumps, motors and motorised valves shall be tested. c) <u>Parallel operation:</u> There should be equal load sharing between pumps running in parallel with no abnormal vibrations, sound or hunting of head and flow. Load sharing between any pumps running in parallel should be within 10%.			
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-A-15 ACW SYSTEM	
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GENERAL TECHNICAL REQUIREMENT OF ELEVATORS, CRANES AND HOISTS, WEIGH BRIDGE

EPC PACKAGE FOR
PATRATU SUPER THERMAL POWER STATION
EXPANSION PHASE-1 (3x800 MW)

TECHNICAL SPECIFICATION
SECTION-VI, PART-A
BID DOC NO: CS-9585-001-2

EPC-P&M-MAX		SCOPE OF SUPPLY & SERVICES			
CLAUSE NO.					
		ELEVATORS, CRANES AND HOISTS			
1.00.00		ELEVATOR			
1.01.00		Passenger Elevators for TG Building, Service Building, Administrative Building and ESP control room (If applicable) The Passenger elevators for TG Building, Service Building, ESP control room (if applicable) and Administration Building shall be as under. (i) Two (2) nos. conventional type elevator having capacity of 13 persons for TG Building. (ii) Two (2) nos. conventional type elevator having capacity of 13 persons for Service Building. (iii) One (1) no. temporary Rack and pinion type elevator having capacity of 1000 kg for TG Building. (iv) Two (2) nos. panoramic type elevator with five glass panels on rear side having capacity of 13 persons, for Administrative building. (v) Three (3) nos. conventional type elevator having capacity of 10 persons for ESP control room (If applicable).			
1.01.01		The scope shall include all items / accessories, service along with all electrical equipment etc. required to meet all design, installation, operation, safety, protection and other requirements of IS: 14665 (latest edition) (all parts), 'Lift' and service lifts'. This scope shall include all items / devices needed to comply with the requirements indicated elsewhere in the specification. The scope shall include but not limited to the following: (a) 1 No. fireman's switch for each elevator. (b) Machinery supporting Beam.			
1.01.02		The location of Elevators shall be as per tender drawings enclosed with the specification.			
1.01.03		Complete erection, testing and commissioning including all testing and commissioning materials, consumables and other tools and tackles required for erection.			
1.01.04		To obtain necessary local administration permits / approvals and make arrangements for inspection and tests required thereby.			
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE -I (3X800 MW)		TECHNICAL SPECIFICATIONS SECTION-VI, PART-A BID DOC.NO. CS-9585-001-2		SUB SECTION- IIA-19 ELEVATORS, CRANES AND HOIST	
				PAGE 1 OF 2	

CLAUSE NO.	SCOPE OF SUPPLY & SERVICES			
2.00.00 2.01.00	CRANE & HOIST Suitable EOT Crane/HOT crane/monorail beams with hoists/chain pulley blocks of adequate capacity, to meet the erection and maintenance requirements are to be provided by the vendors for the various equipment/areas. Some of the areas/equipment not covered by TG hall EOT crane are indicated below. For balance areas/equipment, not listed herein, the requirements of Technical Specification shall be followed. (a) Feed water heaters & deaerator. (b) Various pumps & Heat Exchangers. (c) Condenser water boxes (front & rear), vacuum pumps, CW butterfly valves, control fluid room etc. (d) Auxiliary cooling water pumps and DM cooling water pumps of ECW systems and Plate heat exchangers. (e) Central lube oil system room. (f) Any other equipment. The above requirement is indicative only; the requirement given in the respective chapter is to be adhered to.			
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE -I (3X800 MW)	TECHNICAL SPECIFICATIONS SECTION-VI, PART-A BID DOC.NO. CS-9585-001-2	SUB SECTION- IIA-19 ELEVATORS, CRANES AND HOIST	PAGE 2 OF 2	



GENERAL TECHNICAL REQUIREMENT OF ELEVATORS, CRANES AND HOISTS, WEIGH BRIDGE (CONT.)

EPC PACKAGE FOR
PATRATU SUPER THERMAL POWER STATION EXPANSION
PHASE -I (3X 800MW)

TECHNICAL SPECIFICATION
SECTION-VI
BID DOC. NO.: CS:9585-001-2

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CLAUSE NO.	TECHNICAL REQUIREMENTS			
1.02.00	CONSTRUCTION			
	Construction of the elevators shall specifically meet all requirements of the codes indicated and shall have following additional features:			
	i)	Flooring of Cabin	:	Vitrified ceramic tiles of mat finish.
	ii)	Car enclosure & car panels	:	Stainless Steel
	iii)	Handrails on 3 sides	:	Mirror Stainless Steel
	iv)	False ceiling	:	Powder painted
	v)	Car opening & Hoist way opening	:	Protected by central opening sliding Stainless Steel door
	vi)	CABIN ACCESSORIES	:	The following accessories shall be provided : a) LED light fittings on car floor. b) Car control station c) Emergency stop switch. d) 5/15A, 3 pin plug socket with switch on top of lift car. e) Switches with Braille characters.
	1. AUTOMATIC RESCUE DEVICE (ARD) - (BATTERY DRIVE): Bidder to provide a modern Advanced electronic drive system of "RESCUING Passenger Trapped in a ELEVATOR".			
	2. EMERGENCY SAFETY DEVICES: The lift shall be provided with safety Device attached to the lift car frame and placed beneath the car. The safety device shall be capable of stopping and sustaining the lift car up at governor tripping speed with full rated load in car.			
3. Elevator shall have Floor announcement system & Braille switches				
1.02.01	All steel embedment for fixing landing doors/indicators etc. to the Elevator well shaft and fascia plate shall be supplied by the Bidder.			
1.02.02	Guide rails complete with supporting brackets for the car and counter weights. Bidder to take care of granite tiles (approx 80 kg) to be provided for cabin flooring in selecting counter weights.			
1.02.03	Elevator drive machines complete with electric motor, reduction gear unit, suspension ropes, buffers for the cars and the counter weights and other drive and control mechanism. All			
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800 MW)		TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC. NO.:CS-9585-001-2		SUB-SECTION-A-28 SERVICE ELEVATORS
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CLAUSE NO.	TECHNICAL REQUIREMENTS			
				
	foundation anchor bolts, sleeves, anchoring steel and any item required to complete the job satisfactorily shall be provided by the bidder. The bidder shall also provide for the grouting of anchor bolts, sleeves, anchoring steel, etc. and other anchorages			
1.02.04	Any other steel works as well as all other accessories/components not specified in the specification but necessary for making the Elevator complete.			
1.02.05	All building work including the supply of steel items, associated with installation of equipment in the machine room hoist way, hoist way door, frames and Elevator pit, shall form part of bidders scope of service, Bidder shall also provide the Elevator-well complete with foundation and brick walls around the lift-well together with overhead machine room. The machine room will be provided with R.C.C. floor slab with necessary pockets for anchor bolts and slots.			
1.03.00	OPERATION			
1.03.01	Elevator shall have provisions to meet following operational requirements :			
	a) Selective Duplex collective, automatic operation with or without attendant through illuminated push button station located inside the lift car. b) Door operating shall be automatic door operation and electronic door protection system for opening/closing of car and landing doors. c) Bidder shall provide car operating panel with luminous buttons, car position indication in car (both visual and audio) combined with direction arrows, overload warning indicator, battery operated alarm bell and emergency light and fan & hands free speaker telephone set with suitable battery, charger & controls. d) Bidder shall provide emergency indicator to indicate the location of elevator in case of elevator being stuck up between the floors through automatic flashers (both audio & visual) e) Bidder shall provide electronic door detector (Infra red curtain type). f) Two push buttons, one for upward movement and the other for downward movement at each intermediate landing and one push button at each terminal landing shall be provided in order to call the car. Digital hall position indicator at all floors, tell lights at all floors shall also be provided by the bidder. g) For facilitating the movement of visually & hearing impaired persons, hall lantern and car arrival chimes shall be provided. h) All fixtures shall be in stainless steel face plates. i) Push buttons shall be fixed in the car for holding the doors open for any length of the time required. j) All other safety/protection/operation interlocks as required by IS: 14665 (latest edition).			
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800 MW)		TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC. NO.:CS-9585-001-2	SUB-SECTION-A-28 SERVICE ELEVATORS	PAGE 3 OF 11

CLAUSE NO.	TECHNICAL REQUIREMENTS 
1.04.00	Elevator Electricals:
1.04.01	Electric motor: The driving motors shall conform to IS 325 and suitable for the Variable Voltage Variable Frequency (VVVF) application. All motors shall be squirrel cage induction type, suitable for operation at 415V (+/- 10% variation) , 3 phase, 3 wire, 50HZ (+3% to -5% variation) supply. Motors shall be provided with thermal class 130 (B) or better insulation.
1.04.02	Controls: The controls shall be Variable Voltage and Variable frequency type and shall provide smooth and constant acceleration and retardation under all conditions of operation. Suitable control panel shall be provided in the machine room.
1.04.03	Cables and wiring: All the cables except trailing cables shall be as per IS: 1554-1 or IS-7098-I. The PVC outer sheath of these cables shall be flame retardant, low smoke (FRLS) type with the following FRLS properties. a) Oxygen index of min. 29 (as per IS:10810 Part-58) b) Acid gas emission of max. 20% (as per IEC-754-I). c) Smoke density rating shall not be more than 60% (as per ASTM D-2843). The circular trailing cables shall be either in accordance with IS 4289 Part-I (Elastomer insulated) or IS-4289 Part-II (PVC insulated). The flat type trailing cables if offered shall be in accordance with IEC-60227-6. All wiring / cabling between the equipments in the lift machine room and that between the machine room and equipments in the lift well and at the landings shall be wired in HDP conduits/ galvanized steel conduits to be supplied by the contractor. Alternatively armored cables may be used.
1.04.04	Earthing: The elevator structures and all Electrical equipment, including metal conduits shall be effectively earthed with the earth conductors provided in the machine room as per IS: 3043.
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800 MW)	
TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC. NO.:CS-9585-001-2	
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PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800 MW)		TECHNICAL REQUIREMENTS		एन टी पी सी NTPC	
		DATA SHEET			
		i) Type of services : Passenger			
		ii) Load carrying capacity : As per specification			
		iv) Rated speed One (1) m/s			
		v) Total Travel : TG hall- As per layout			
		Service Building- As per layout			
		ESP Control room (If applicable)- As per Layout			
		Administrative Building-As per layout			
		vi) No. of floor to be served : TG hall, Service Building, Administrative Building & ESP control room (If applicable): - To be decided during detailed engineering.			
		vii) Method of control : Variable voltage variable frequency (VVVF)			
		viii) Position of M/c room : Directly above lift shaft			
		ix) Size of platform : As per IS14665 & manufacturer's standard latest.			
		x) Size of lift well : -do-			
		xiii) Specification code : As per IS: 14665 (5 parts) (Latest Edition).			
		xiv) Design seismic co-efficient : According to the IS 1893-1977			
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800 MW)		TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC. NO.:CS-9585-001-2		SUB-SECTION-A-28 SERVICE ELEVATORS	
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221ES-FLEW-MAX			
CLAUSE NO.	TECHNICAL REQUIREMENTS		
	RACK & PINION ELEVATOR		
1.00.00	GENERAL		
	This specification is intended to cover design, engineering, supply, erection, testing and commissioning of the complete Rack & Pinion type Elevators as specified hereinafter complete in all respects and adequate for safe, efficient and trouble free operation of the elevator.		
1.01.00	CODES AND STANDARD		
	The design, manufacture, inspection and testing of Elevator shall comply with all the currently applicable statutes, regulations and safety codes in the locality where the equipment is to be installed. The Elevator shall conform to the latest edition of standards and codes. Other internationally acceptable standards/ codes, which ensure equal or higher performance than those specified, shall also be accepted. Nothing in this specification shall be construed to relieve the contractor of the required statutory responsibility. In case of any conflict in the standard and this specification, the decision of the Project Manager shall be final and binding.		
1.02.00	DESIGN AND CONSTRUCTION REQUIREMENTS		
1.02.01	GENERAL		
1.02.02	This section covers the design, engineering, fabrication, installation, commissioning and testing of the rack and pinion type vertical lift elevator including required enclosures, hoist, mast and guide rail, cab drive unit machinery buffers, power cable, control cable, mechanical and electrical equipment. The design of the elevator shall be in such a way that the elevator operation will be safe at all times.		
1.02.03	Elevator shall be located as indicated in the relevant tender drawings and shall be capable of operating from the ground floor to the top interior platform with intermediate stops at all interior platforms.		
1.02.04	All mechanical and electrical operating devices and Trailing cable shall be designed for outdoor operation with dusty and high humidity conditions and shall operate equally well in any ambient temperature as per project synopsis. Additionally, all mechanical and electrical components of the elevator shall be designed to withstand a temperature of 50°C ambient.		
1.02.05	ENCLOSURES		
	A three-sided enclosure with one access door shall be provided for ground landing. At each platform landing above ground level, a one sided enclosure with access door shall be provided. Enclosures shall be fabricated from tubular steel and/or other structural shapes expanded metal or wire mesh of suitable height and primer coated with one coat of the manufacturer's standard primer and finish paint. The ground landing shall be provided at a suitable height above the foundation slab to ensure a safety space underneath the cage. The space under the landing shall be surrounded by foundation enclosure. The staircase shall be provided for access to the cage. Enclosure access doors shall be electrically and mechanically interlocked		
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800 MW)		TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC. NO.:CS-9585-001-2	SUB-SECTION-A-28 SERVICE ELEVATORS
			PAGE 6 OF 11

2215-FLW-MAX					
CLAUSE NO.	TECHNICAL REQUIREMENTS				
	so that they remain closed and locked except when the cab is at a landing. Doors shall be bi-parting and swinging type. Base of the three-sided enclosure shall be securely anchored to the ground level floor slab using expansion type anchors.				
1.02.06	Mast	Mast shall be provided in sections of suitable length, consisting of tubular sections and/or structural shapes welded together to form a framework to which the rack is bolted. Mast shall be securely anchored to the building structure.			
1.02.07	Cab				
1.02.08	Cab frame shall be fabricated from tubular steel and/or other structural shapes enclosed with expanded metal or wire mesh.				
1.02.09	Cab floor shall be of 6 mm thick Aluminum chequered plate or approved equivalent. Cab shall be attached to a framed structure and form an integral part with the drive mechanism located atop the cab.				
1.02.10	Framed structure shall include guide rollers and safety hooks to ensure positive engagement of the rack and pinion to prevent cab disengagement in case of roller failure.				
1.02.11	Cab roof shall be provided with an escape hatch electrically interlocked with the hoist control system. Tubular steel handrail shall enclose the cab roof for maintenance operations.				
1.02.12	Cab door and landing level enclosure doors shall be electrically and mechanically interlocked to prevent the cab from being operated unless the cab door and landing level enclosure doors are fully closed and to prevent the doors from being opened while the cab is in motion.				
1.02.13	One cabin fan and LED along with the fittings to be provided with one no. emergency light with battery & battery charger.				
1.03.00	Drive Unit & Safety Device				
1.03.01	Drive unit located on the cab shall be complete with AC squirrel cage induction motor, reduction gear, drive pinion and an over-speed governor. Drive unit shall incorporate an electric disc brake and an external manual brake release. The brake on the electric motor will be self adjusting type. In case of the power failure, the brake will be automatically applied & will stop the cab. A hand lever, which can be operated from the cage, is to be provided to enable the occupants to ease the brake and lower the cage to the bottom level. Motor shall be connected to a reduction gear, which drives the pinion.				
1.03.02	An over-speed governor must be incorporated to protect the cab against over speed during the cab downward motion. At a predetermined speed higher than normal, the brake, mechanism shall be actuated and stop the downward motion of the cab gradually. The brake should remain locked on following this action and has to be manually reset before normal elevator operation can be resumed.				
1.03.03	A remote control shall be provided for testing the safety device. The Contractor shall ensure that no individual is in cab during the test.				
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800 MW)		TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC. NO.:CS-9585-001-2		SUB-SECTION-A-28 SERVICE ELEVATORS PAGE 7 OF 11	

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22215-FLW-MAX			
CLAUSE NO.	TECHNICAL REQUIREMENTS		
	एनटीपीसी NTPC relays, control transformer and MCB's, terminal blocks, and all other accessories required for normal operation of the elevator. (i.) One main control panel shall be furnished and mounted on the top of cab. Panel shall be in enclosure equipped with necessary equipment like rectifier, battery, battery charger, contactors, breakers, control transformer and MCB's, thermal overload relays and all other equipment and accessories required for normal operation of the elevator. (j.) Cab shall be controlled by a semiautomatic control system with push buttons for 'UP' 'Down' and 'Stop next landing'. The cab shall be controlled from inside and shall have painted placard located above the door. Cab shall be furnished with emergency alarm push button, limit switches, and all other necessary control devices required to ensure safe and continuous cab operation, One trailing cable shall connect the cab main control panel to the auxiliary panel at ground level to supply the cab with all power requirements. An extra core of equal size shall be provided for earthing of cab. Cable guides shall be installed every 6 meters to avoid entanglement of this cable. (k.) Each landing assembly shall include a limit switch and push button control station installed and wired to a landing junction box. (l.) All enclosures containing electrical, devices shall be provided with 240 Volts, single phase space heaters with adjustable thermostat control. (m.) Cab shall be equipped with a 220 Volts, 20W fluorescent lights, fan, 5A, 220V, 3 pin receptacle, emergency light, battery & battery charger. (n.) Control cabinets shall be sheet steel enclosed dust, weather and vermin proof. Sheet steel used shall be cold rolled and at least 2.0 mm thick. Degree of protection of control cabinet shall be as per relevant electrical section. Control cabinet shall be provided with hinged doors (s) with pad locking arrangements. All doors, removable covers and plates shall be gasketed all round with neoprene gaskets. Each motor to be controlled from the control cabinet shall be provided with 3-pole isolating switch. HRC fuses, contactors shall be of AC4 duty class with (o.) Thermal overload relays with single phase preventer. The isolating switch and contactor shall be rated at least 20% more than the connected motor full load current. The controller and resistor for motor shall confirm to relevant IS and shall be continuously rated for 150% full load current of the motor. (p.) All fuses shall be of the HRC cartridge type mounted on plug in type of fuse base having a prospective current rating of not less than 80 kA. (q.) All push buttons shall have 2NO and 2NC self reset contacts.		
1.07.00	Electric motor:		
1.08.00	The driving motors shall conform to IS 325 and suitable for the Variable Voltage Variable Frequency (VVVF) application. All motors shall be squirrel cage induction type, suitable for operation at 415V (+/- 10% variation) , 3 phase, 3 wire, 50HZ (+3% to -5% variation) supply. Motors shall be provided with thermal class 130 (B) or better insulation. CABLES Insulated armoured power /control cable shall be FRLS - HR insulated, stranded copper / aluminum conductors and shall be provided in accordance with IS: 1753 (latest edition) and IS: 1554 (Part-I) (latest edition).		
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800 MW)		TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC. NO.:CS-9585-001-2	SUB-SECTION-A-28 SERVICE ELEVATORS
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PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800 MW)		TECHNICAL REQUIREMENTS			
1.09.00	Trailing cables in the elevator shaft should be specially designed for the specific service and shall conform to IS. Trailing cables shall be EPR insulated for 1.1 kV and shall be neoprene jacketed flexible cord. Conductor accessories including terminal materials like glands, lugs etc. markers, tying materials, and cable supports shall be furnished and installed. Earthing (a.) GENERAL Complete earthing system shall be furnished for all equipments and accessories of the elevator as per relevant IS. (b.) MATERIALS The earthing of all electrical items being supplied by the Contractor shall be in his scope. For earthing the various equipment, conductor sizes shall be as listed below : (1.) Motor above 5 kW upto 30 kW 25x6 mm² GI flat (2.) Motors upto 5 kW and misc. small item like conduits, junction boxes etc. 8 SWG GI wire (3.) Cab earthing Additional core of trailing cable The earthing strip/wire shall be connected to the earthing mat by the Contractor. Clamps and other hardware of iron or steel used with the grounding system shall be hot-dip galvanised. Bolts, washers, and nuts shall be hot-dip galvanised steel.				
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800 MW)		TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC. NO.:CS-9585-001-2		SUB-SECTION-A-28 SERVICE ELEVATORS	
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CLAUSE NO.	TECHNICAL REQUIREMENTS		
	DATA SHEET: RACK & PINION ELEVATOR		
1.0.0	GENERAL		
1.1.0	Type of Service	Passenger-Cum-Goods	
2.0.0	DESIGN & CONSTRUCTION		
2.1.0	Carrying capacity	1000 Kg	
2.2.0	Rated speed	Approx 25 - 40 m/min.	
2.3.0	Total Travel	Shall be as per actual dimension of the Building	
2.4.0	No. of floors to be served	As per requirement	
2.5.0	Entrance	As per requirement	
2.6.0	Min. cab Floor size (inside) WxLxH	1.3m x 2.0m x 2.1 m	
2.7.0	Various heights of landing floors to be served	Suitable for working floors as indicated in the tender drawing.	
2.8.0	Drive Motors (AC)	One (1) No.	
2.9.0	Cab Flooring	6 mm thk. Al. Chequered plate.	
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800 MW)		TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC. NO.:CS-9585-001-2	SUB-SECTION-A-28 SERVICE ELEVATORS PAGE 11 OF 11



SUB – SECTION – A-12

SURFACE PREPARATION & PAINTING

EPC PACKAGE FOR
PATRATU SUPER THERMAL POWER STATION EXPANSION
PHASE –I (3X 800MW)

TECHNICAL SPECIFICATION
SECTION-VI
BID DOC. NO.: CS:9585-001-2

22/PS-PEM-MAX				एनटीपीसी NTPC	
CLAUSE NO.		TECHNICAL REQUIREMENTS			
1.00.00		SPECIFICATION OF SURFACE PREPARATION & PAINTING			
1.01.00		Surface preparation methods and paint/primer materials shall be of the type specified herein. If the contractor desires to use any paint/primer materials other than that specified, specific approval shall be obtained by the contractor in writing from the employer for using the substitute material.			
1.02.00		All paints shall be delivered to job site in manufacturers sealed containers. Each container shall be labelled by the manufacturer with the manufacturer's name, type of paint, batch number and colour.			
1.03.00		Unless specified otherwise, paint shall not be applied to surfaces of insulation, surfaces of stainless steel/nickel/ copper/brass/ monel/ aluminum/ hastelloy/lead/ galvanized steel items, valve stem, pump rods, shafts, gauges, bearing and contact surfaces, lined or clad surfaces.			
1.04.00		All pipelines shall be Colour coded for identification as per the NTPC Colour-coding scheme, which will be furnished to the contractor during detailed engineering.			
1.05.00		SURFACE PREPARATION			
1.05.01		All surfaces to be painted shall be thoroughly cleaned of oil. Grease and other foreign material. Surfaces shall be free of moisture and contamination from chemicals and solvents.			
1.05.02		The following surface preparation schemes are envisaged here. Depending upon requirement any one or a combination of these schemes may be used for surface preparation before application of primer. SP1 Solvent cleaning SP2 Application of rust converter (Ruskil or equivalent grade) SP3 Power tool cleaning SP4 Shot blasting (shot blasting shall be used as surface preparation method for hot worked pipes prior to application of primer) SP4* Shot blast cleaning/ abrasive blast cleaning to SA21/2 (near white metal) 35-50 microns SP5 Shot blasting/ abrasive blasting. SP6 Emery sheet cleaning/Manual wire brush cleaning.			
1.06.00		APPLICATION OF PRIMER/PAINT			
1.06.01		The paint/primer manufacturer's instructions covering thinning, mixing, method of application, handling and drying time shall be strictly followed and considered as part of this specification. The Dry film thickness (DFT) of primer/paint shall be as specified herein.			
1.06.02		Surfaces prepared as per the surface preparation scheme indicated herein shall be applied with primer paint within 6 hours after preparation of surfaces.			
1.06.03		Where primer coat has been applied in the shop, the primer coat shall be carefully examined, cleaned and spot primed with one coat of the primer before applying intermediate and finish coats. When the primer coat has not been applied in the shop, primer coat shall be applied by brushing, rolling or spraying on the same day			
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 - A-12 SURFACE PREPARATION & PAINTING	
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22/PS-PEM-MAX				एनटीपीसी NTPC	
CLAUSE NO.		TECHNICAL REQUIREMENTS			
1.06.04		as the surface is prepared. Primer coat shall be applied prior to intermediate and finish coats.			
1.06.05		Steel surfaces that will be concealed by building walls shall be primed and finish painted before the floor is erected.Tops of structural steel members that will be covered by grating shall be primed and finish painted before the grating is permanently secured.			
1.06.05		Following are the Primer/painting schemes envisaged herein:			
		PS3 - Zinc Chrome Primer (Alkyd base) by brush/Spray to IS104.			
		PS3* - Zinc Chrome primer (Alkyd base) by dip coat.			
		PS4 - Synthetic Enamel (long oil alkyd) to IS2932.			
		PS5 - Red Oxide Zinc Phosphate primer (Alkyd base) to IS 12744			
		PS9 - Aluminium paint to IS 2339.			
		PS9* - Heat resistant Aluminium paint to IS-13183 Gr.-1			
		PS13 - Rust preventive fluid by spray, dip or brush.			
		PS14 - weldable primer-Deoxaluminate or equivalent.			
		PS16 - High Build Epoxy CDC mastic `15' .			
		PS17 - Aliphatic Acrylic Polyurethane CDE134 ,%V=40.0(min.)			
		PS18 - Epoxy based TiO2 pigmented coat			
		PS19 - Epoxy Zinc rich primer (92% zinc in dry film (min.), %VS=40.0(min.)			
		PS-20 - Epoxy based finish paint			
1.06.06		All weld edge preparation for site welding shall be applied with one coat of weldable primer.			
1.06.07		For internal protection of pipes/tubes, VCI pellets shall be used at both ends after sponge testing and ends capped. VCI pellets shall not be used for SS components and composite assemblies.			
1.06.08		SG membrane walls and other Flue gas swept pressure part surfaces shall be applied with appropriate primer for protection of surfaces during transit, storage and erection.			
1.06.09		a) All un-insulated equipments, pipes, valves etc covered in sub-section A-08 (Steam Turbine & Auxiliary system) shall be painted with paint not inferior to Epoxy resin based paints with minimum DFT of 150 micron. The paint shall be applied in three stages i.e. primer, intermediate and finish coats in following manner:			
		Primer coat – Epoxy based zinc phosphate Intermediate - Epoxy based TiO2 pigmented coat Finish coat - Epoxy based finish coat			
		b) Equipment, pipes etc. with high temperature shall be painted with heat resistant aluminum paint (to be selected based on the service condition of component as per IS-13183). Two coats of paint shall be applied with total DFT 40 micron.			
		c) Surface preparation before painting shall be carried out according to requirement indicated in this sub-section and international standard			
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 - A-12 SURFACE PREPARATION & PAINTING	
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22/PS-PEM-MAX		एन टी पी सी NTPC	
CLAUSE NO.	TECHNICAL REQUIREMENTS		
1.06.10	A) Specification for the application of Epoxy coating for internal protection of DM tank & other vessels/tanks (as applicable) shall be as follows:		
	Primer : One coat of unmodified epoxy resin along with polyimide hardener.		
	Paint : Two (2) coats unmodified epoxy resin along with Aromatic adduct hardener.		
	Total thickness of primer and paint should not be less than 400 microns.		
	B) Specification for application of chlorinated Rubber paint for external protection vessel, tanks, piping, valves & other equipments shall be as follows:		
	i) For Indoor vessel, tanks, piping, valves & other equipments:		
	(a) Surface preparation shall be done either manually or by any other approved method.		
	(b) Primer coat shall consist of one coat of chlorinated rubber based zinc phosphate primer having minimum DFT of 50 microns.		
	(c) Intermediate coat (or under coat) shall consist of one coat of chlorinated rubber based paint pigmented with Titanium dioxide with minimum DFT of 50 microns.		
	(d) Top coat shall consist of one coat of chlorinated rubber paint of approved shade and colour with glossy finish and DFT of 50 microns.		
Total DFT of paint system shall not be less than 150 microns.			
ii) For Outdoor vessel, tanks, piping, valves & other equipments:			
(a) Surface preparation shall be blast cleared using non-siliceous abrasive after usual wire brushing, which shall conform to Sa 2-1/2 Swiss Standard.			
(b) Primer coat shall consist of one coat of epoxy resin based zinc phosphate primer having minimum DFT of 100 microns.			
(c) Intermediate coat (or under coat) shall consist of epoxy resin based paint pigmented with Titanium dioxide with minimum DFT of 100 microns.			
(d) Top coat shall consist of one coat of epoxy paint suitable pigmented of approved shade and colour with glossy finish and DFT of 75 microns. Additionally finishing coat of polyurethane of minimum DFT of 25 microns shall be provided.			
The paint may be applied in one coat, in case high built paint is used, otherwise two coats shall be applied.			
Total DFT shall not be less than 300 microns.			
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 - A-12 SURFACE PREPARATION & PAINTING
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1.06.11 Primer/Painting Schedule

Sl. No	Description	Surface Preparation	Primer Coat			Intermediate Coat			Finish Coats			Total Min. Painting DFT (Microns)	Colour Shade
			Type of Primer	No. of Coats	Min. DFT / coat (Microns)	Type of coating	No. Coats	Min. DFT/ Coat (Microns)	Type of coating	No. Coats	Min. DFT/ Coat (Microns)		
A) Power Cycle Piping													
1.	All insulated Piping, fittings/ components, Pipe clamps, Vessels/Tanks, Equipments etc.	SP3/SP4	PS9*	1	20	-	-	-	PS9*	1	20	40	As per NTPC Colour shade/ coding scheme
2.	All un-insulated Piping, fittings/ components, Pipe clamps, Vessels/Tanks, Equipments etc.	SP3/SP4	PS 5	2	25	-	-	-	PS 4	3	35 \$	155 \$	
		SP3/SP4	PS 9*	1	20	-	-	-	PS9*	1	20	40	
		SP3/SP4	PS9*	1	20	-	-	-	PS9*	1	20	40	
3	Constant Load Hanger (CLH) and Variable Load Hanger (VLH)	SP4*	PS19	1	40	-	-	-	PS17	1	30	70	

PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)	BID DOC. NO. CS-9585-001-2	TECHNICAL SPECIFICATIONS SECTION VI, PART-B	TECHNICAL REQUIREMENTS	SUB-SECTION -A-12 Surface Preparation & Painting	Page 4 of 9



4	Piping hangers/ supports (other than (3) above. (un-insulated)	SP4 (SP6 - for cleaning of weld joints after erection.)	PS 5	1	40	PS 4	1	40	PS 17	1	40	120	
	Valves												
5.	Design temperature < or equal to 60 degC	SP1/SP2/S P3	PS4/P S9	1	40	Polyamide Epoxy	1	100	PS17	1	40	180	
	Design temperature above 60 degC and up to 200 degC	SP1/SP2/S P3	PS 9*	1	20	-	-	-	PS9*	1	20	40	
	Design temperature above 200 degC	SP1/SP2/S P3	PS9*	1	20	-	-	-	PS9*	1	20	40	
6.	All auxiliary Structural Steel components for pipe supports	SP4* TG Outside building and in SG envelope	Inorganic Ethyl Zinc Silicate	1	75	PS18	1	75	a))Epoxy coat b)Final coat of paint PS17	2 1	35 30	250	

EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)	BID DOC. NO. CS-9585-001-2	TECHNICAL SPECIFICATIONS SECTION VI, PART-B	TECHNICAL REQUIREMENTS	SUB-SECTION -A-12 Surface Preparation & Painting	Page 5 of 9



		Within building	TG	SP4*	-do-	1	35	PS18	1	35	a) Epoxy coat	2	25	150
											b) Final coat of paint PS17	1	30	
7.	Weld Edges			SP6 (Hand cleaning by wire brushing)	PS13 (Weldable primer)	1	25	-	-	-	-	-	-	25
1. \$ The first 2 finished coats (total min. DFT of 70 microns) shall be done at shop and the 3rd finish coat (min. DFT 35 Microns) shall be applied at site. 2. For valves below 65NB and temperature upto and including 540 DegC, Parkerizing/zinc phosphate corrosion resistant coating as per ASTM F1137 is also acceptable in lieu of Aluminum paint. 3. For corrosion protection of threaded hanger rods and variable spring cages, electro galvanizing in full compliance to minimum Corrosion category C3 as per EN ISO12944 is also acceptable. 4. For spring cages, 2 coats of 30 µm (min) zinc-rich epoxy resin primer with zinc content > 80 weight% in dry film followed by 2 coats of 30 µm (min) top coat of Acrylic resin Co-polymerisate with a total combined minimum DFT of 120µm is also acceptable in lieu of above specified paint scheme. 5. For corrosion protection for all inner parts of the hangers shall be at least in full compliance to Corrosion category C3 as per EN ISO12944.														
B) Steam Generator & Auxiliaries:														
1	All surfaces with temperature 95°C or less and which are insulated	SP3/SP4	PS 5	2	30	-	-	-	-	-	PS 4	2	20	100
2	All surfaces with temperature above 95°C and which are insulated	SP3/SP4	PS9*	1	20	-	-	-	-	-	PS9*	1	20	40

EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		BID DOC. NO. CS-9585-001-2	TECHNICAL SPECIFICATIONS SECTION VI, PART-B	TECHNICAL REQUIREMENTS	SUB-SECTION -A-12 Surface Preparation & Painting	Page 6 of 9



Note: 1) SG membrane walls and other Flue gas swept pressure part surfaces shall be applied with appropriate primer for protection of surfaces during transit, storage and erection.
 2) For valves below 65NB and temperature upto & including 545 Deg.C, Parkerizing/zinc phosphate corrosion resistant coating as per ASTM F1137 is also acceptable in lieu of Aluminum paint.

C) LOW PRESSURE PIPING

1	All Pipes, components, Equipments etc.	fittings / valves,	SP3/SP5	PS3/PS5	2	25	PS 4	1	30	PS 4	2	35	150	As per NTPC Colour shade/coding scheme
2	Stainless steel surface, Galvanized steel surface and gun metal surface.													No Painting
3	On the internal surface for pipes 1000 Nb and above													A coat of primer followed by hot coal-tar enamel or coal tar epoxy painting (cold) shall be applied.

EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)	BID DOC. NO. CS-9585-001-2	TECHNICAL SPECIFICATIONS SECTION VI, PART-B	TECHNICAL REQUIREMENTS	SUB-SECTION -A-12 Surface Preparation & Painting	Page 7 of 9



D) Fire Detection & Protection System, Compressed air system, Hydrogen generation plant and Air-conditioning & Ventilation System												
For Fire Detection & Protection System, Surface preparation and painting of Fire Water Storage Tanks, all Steel Surfaces (external) exposed to atmosphere (outdoor & indoor installation), Deluge Valves, Alarm Valves, Foam monitors, Water monitors, Foam Proportioning equipments, Foam makers, etc. should be as per the Part-B, Sub Section-A-18, Fire Detection & Protection System												
For Air Conditioning System, Surface preparation and painting of all the steel surfaces (external) exposed to atmosphere (outdoor & indoor installation), centrifugal fans – Casing etc. should be as per the Part-B, Sub Section-A-17, Air Conditioning System.												
For Ventilation System, Surface preparation and painting of all the steel surfaces (external) exposed to atmosphere (outdoor & indoor installation), centrifugal fans – Casing etc. should be as per the Part-B, Sub Section-A-30, Ventilation System.												
For compressed air system, Surface preparation and painting of all the steel surfaces should be as per the Part-B, Sub Section-A-16 compressed air system.												
For hydrogen generation plant, Surface preparation and painting should be as per the Part-B, Sub-Section-A-19 hydrogen generation plant.												
E) ESP												
1	All surfaces with surface temperature 95°C or less (with insulation)	SP3/SP4	PS3/PS5	1	25	-	-	-	PS 4	1	30	55
2	All surfaces with surface temperature above 95°C (with or without insulation)	SP3/SP4	PS5	2	30	-	-	-	-	-	-	60

General Notes (Applicable for all above points A to E)

- i) Painting specification for all surfaces with surface temperature 95°C or less (un-insulated) that are not covered above shall be same as that given in Civil Sub-section, Part-B, Section-VI for corrosion protection of steel structures.

EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)	BID DOC. NO. CS-9585-001-2	TECHNICAL SPECIFICATIONS SECTION VI, PART-B	TECHNICAL REQUIREMENTS	SUB-SECTION -A-12 Surface Preparation & Painting	Page 8 of 9



- ii) Painting specification for inside surfaces (such as inner surfaces of ducts/ tanks/ mills/ dampers/ ESP etc.) that are not covered specifically in above clauses, shall be provided with 2 coats of suitable primer i.e. PS5/ PS9 (Total DFT 60/40 micron) based on the temperature.

F) FGD System	(i) Surface preparation shall be blast cleaned conforming to Sa 2-1/2 Swiss Standard. (ii) Primer coat shall consist of epoxy resin based zinc phosphate primer having minimum DFT of 100 microns. (iii) Intermediate coat (or under coat) shall consist of epoxy resin based paint pigmented with Titanium dioxide with minimum DFT of 100 microns. (iv) Top coat shall consist of one coat of epoxy paint suitable pigmented of approved shade and colour with glossy finish and DFT of 75 microns. Additionally finishing coat of polyurethane of minimum DFT of 25 microns shall be provided.

EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)	BID DOC. NO. CS-9585-001-2	TECHNICAL SPECIFICATIONS SECTION VI, PART-B	TECHNICAL REQUIREMENTS	SUB-SECTION -A-12 Surface Preparation & Painting	Page 9 of 9

SUB-SECTION VI

MANDATORY SPARES

EPC PACKAGE FOR
PATRATU SUPER THERMAL POWER STATION
EXPANSION PHASE-1 (3x800 MW)

TECHNICAL SPECIFICATION
SECTION-VI PART-A
BID DOC NO: CS-9585-001-2

CLAUSE NO.	MANDATORY SPARES			
1.00.00	SPARES The Bidder shall include in his scope of supply all the necessary Mandatory spares, start up and commissioning spares and recommended spares and indicate these in the relevant schedules of the Bid Form and Price Schedules. The general requirements pertaining to the supply of these spares is given below:-			
1.01.00	MANDATORY SPARES (a) The list of mandatory spares considered essential by the Employer is indicated in Section VI, Part-F chapter. The bidder shall indicate the prices for each and every item (except for items not applicable to the bidders design) in the 'Schedule of mandatory Spares' whether or not he considers it necessary for the Employer to have such spares. If the bidder fails to comply with the above or fails to quote the price of any spare item, the cost of such spares shall be deemed to be included in the contract price. The bidder shall furnish the population per unit of each item in the Bid Forms and Price Schedules. Whenever the quantity is mentioned in "sets" the bidder has to give the item details and prices of each item. (b) The Employer reserves the right to buy any or all the mandatory spares parts. (c) The prices of mandatory spares indicated by the Bidder in the Bid Proposal sheets shall be used for bid evaluation purposes. (d) All mandatory spares shall be delivered at site at least two months before scheduled date of initial operation of the first unit. However, spares shall not be dispatched before dispatch of corresponding main equipments. (e) Wherever quantity is specified both as a percentage and a value, the Bidder has to supply the higher quantity until and unless specified otherwise. (f) In case specified spares are not applicable to a particular design offered by the bidder, functionally equivalent applicable spares pertaining to the offered design shall be provided in quantities as per specified spares.			
1.02.00	RECOMMENDED SPARES (a) In addition to the spare parts mentioned above, the contractor shall also provide a list of recommended spares for 3 years of normal operation of the plant and indicate the list and total prices in relevant schedule of the Bid Form and Price Schedules. This list shall take into consideration the mandatory spares specified in this Section-VI, part-F and should be independent of the list of the mandatory spares. The Employer reserves the right to buy any or all of the recommended spares. The recommended spares shall be delivered at project site at least two months before the scheduled			
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-1 (3X800 MW)		TECHNICAL SPECIFICATION SECTION-VI PART-A BID DOC. NO. CS-9585-001-2	SUB-SECTION-VI MANDATORY SPARES	PAGE 1 OF 3

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CLAUSE NO.		MANDATORY SPARES		एन टी पी सी NTPC	
7.00.00		enclosed. All cases, containers and other packages must be suitably marked and numbered for the purposes of identification.			
8.00.00		All cases, containers or other packages are to be opened for such examination as may be considered necessary by the Employer.			
9.00.00		The contractor will provide the Employer with all the addresses and particulars of his sub suppliers while placing the order on vendors for items/components/equipments covered under the contract and will further ensure with his vendors that the Employer, if so desires, will have the right to place order for spares directly on them on mutually agreed terms based on offers of such vendors.			
10.00.00		The Contractor shall warrant that all spares supplied will be new and in accordance with the contract Documents and will be free from defects in design, material and workmanship.			
11.00.00		In addition to the recommended spares listed by the contractor, if the employer further identifies certain particular items of spares, the contractor shall submit the prices and delivery quotation for such spares within 30 days of receipt of such request with a validity period of 6 months for consideration by the Employer and placement of order for additional spares if the Employer so desires.			
12.00.00		The Contractor shall guarantee the long term availability of spares to the Employer for the full life of the equipment covered under the contract. The Contractor shall guarantee that before going out of production of spares parts of the equipment covered under the Contract, he shall give the Employer at least 2 years advance notice so that the latter may order his bulk requirement of spares, if he so desires. The same provision will also be applicable to sub-contractors. Further, in case of discontinuance of manufacture of any spares by the Contractor and/or his sub contractors, Contractor will provide the Employers, two years in advance, with full manufacturing drawings, material specifications and technical information including information on alternative equivalent makes required by the Employer for the purpose of manufacture/procurement of such items.			
		The bidder to provide datasheets/assembly drawings of the manufacturer/ any other relevant document showing Bill of Material(s), Make, Model Number, Part Number etc. through which the mandatory spares to be supplied can be uniquely identified. This would facilitate the Employer to assign a unique code to each of the mandatory spare as brought out in GCC.			
		The bidder shall extend all necessary assistance in this regard.			
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-1 (3X800 MW)		TECHNICAL SPECIFICATION SECTION-VI PART-A BID DOC. NO. CS-9585-001-2		SUB-SECTION-VI MANDATORY SPARES	
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SUB – SECTION – A-29

PRE-COMMISSIONING & COMMISSIONING ACTIVITIES

EPC PACKAGE FOR
PATRATU SUPER THERMAL POWER STATION EXPANSION
PHASE –I (3X 800MW)

TECHNICAL SPECIFICATION
SECTION-VI
BID DOC. NO.: CS:9585-001-2

CLAUSE NO.	TECHNICAL REQUIREMENTS			
	PRE-COMMISSIONING ACTIVITIES, COMMISSIONING OF FACILITIES AND INITIAL OPERATIONS			
1.00.00	GENERAL			
1.01.00	The pre-commissioning and commissioning activities including Guarantee tests, checks and initial operations of the equipment furnished and installed by the Contractor shall be the responsibility of the Contractor as detailed in relevant clauses in Technical Specification. The Contractor shall provide, in addition, test instruments, calibrating devices, etc. and labour required for successful performance of these operations. If it is anticipated that the above test may prolong for a long time, the Contractor's workmen required for the above test shall always be present at Site during such operations.			
1.02.00	It shall be the responsibility of the Contractor to provide all necessary temporary instrumentation and other measuring devices required during start-up and initial operation of the equipment systems which are installed by him. The Contractor shall also be responsible for flushing & initial filling of all oils & lubricants required for the equipment furnished and installed by him so as to make such equipment ready for operation. The Contractor shall be responsible for supplying such flushing oil and other lubricants unless otherwise specified elsewhere in these specifications & documents.			
1.03.00	The Contractor upon completion of installation of equipments and systems, shall conduct pre-commissioning and commissioning activities, to make the facilities ready for sustained safe, reliable and efficient operation. All pre-commissioning/commissioning activities considered essential for such readiness of the facilities including those mutually agreed and included in the Contractors quality assurance program as well as those indicated in clauses elsewhere in the technical specifications shall be performed by the Contractor.			
2.00.00	TESTING / COMMISSIONING PROCEDURES			
	The contractor shall submit his testing / commissioning check lists and procedures for various equipments / systems covered under the contract at least 18 months before the actual commissioning of the equipments / systems for review and approval of employer.			
	The testing / commissioning procedures are to be of a standard format in order to maintain consistency of presentation, content and reporting. The list of commissioning check lists and procedures to be submitted and their content details shall be agreed upon during preaward discussions.			
	An indicative list of Testing / Commissioning procedures/schedules and Standard Checklists and the details regarding the contents of testing/commissioning are enclosed as annexure at the end of this sub-section of section-VI, Part B. The actual list of such equipments / systems shall depend on the equipments / systems being supplied by the contractor.			
	i) Annexure-I : Standard Checklist of items			
	ii) Annexure-II : Testing / Commissioning Procedure/schedules			
	iii) Annexure-III : Commissioning procedures requiring approval of Employer.			
	iv) Annexure – IV : Demonstration/Acceptance test procedures during Commissioning/Initial operation			
	v) Annexure – V : Brief write up on Contents of Testing / Commissioning Procedures			
	Procedure/schedules shall be approved by the employer.			
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO.: CS-9585-001-2	SUB-SECTION- A-29 PRE-COMMISSIONING & COMMISSIONING ACTIVITIES	PAGE 1 OF 14

CLAUSE NO.	TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
3.00.00	PRECOMMISSIONING & COMMISSIONING ACTIVITIES			
3.01.00	General The pre-commissioning activities including some of the important checks & tests for certain major equipment/ systems (as a minimum) are described below, although it is the Contractor's responsibility to draw up a detailed sequential & systematic list of checks / tests and various activities / procedures connected with pre-commissioning of the complete facilities with all systems, sub-systems and equipment supplied and installed by him and get the same approved by the Employer.			
3.02.00	PRE-COMMISSIONING ACTIVITIES/TESTS:			
	Steam Generator			
3.02.01	Hydraulic Testing of Pressure Parts On completion of installation of the Steam Generator pressure parts and high pressure boiler external piping & non boiler external piping a hydraulic test in accordance with the requirements of the Indian Boiler Regulations, shall be performed by the Contractor. However, making use of valves/control valves supplied by others and installed on the contractor's piping system during hydraulic testing shall be subjected to the acceptance of respective valve supplier otherwise hydraulic cap/blanking arrangement as required shall be used. The procedure adopted for hydraulic test and preservation shall have the prior approval of the Employer. The detailed schemes and procedure for carrying out hydraulic testing shall be prepared and furnished by the contractor and it shall be discussed and finalized during detailed engineering stage. The water for hydraulic test shall be made alkaline by addition of suitable chemicals. After the test, the Steam Generator and high pressure external piping shall be suitably drained and preserved. All blank flanges, removable plugs, temporary valves, pipes & fittings, spools, other accessories and services required for carrying out hydraulic testing of boiler external pipings & non boiler external pipings and boiler & its pressure parts shall be furnished by the Contractor. The pressurization equipment including water piping and any chemicals for preservation, needed for the above test shall also be furnished by the Contractor. Any defect noticed during the testing shall be rectified and the unit shall be retested by the Contractor. In the case of branch connections/ tap-off piping (in others scope) from contractor's scope of piping are not ready or not erected at the time of hydrostatic testing of piping in contractor's scope, then the contractor to supply/use necessary blanking arrangement as required at these tap-off /branch connections. The hydraulic test shall be considered successful only on certification to that effect by the concerned inspecting authority as per the provision of the IBR and the Project Manager.			
3.02.02	Air & Gas Tightness Test After completion of installation of furnace tubes and/or inner skin casing wherever applicable ducts and airheaters, and before commencement of application of thermal insulation a test shall be performed on the Steam Generator by the contractor to prove or to establish the tightness of the erected equipments from the outlet of FD fan through Steam Generator to the stack. Such test shall be done, as far as possible, with all mountings like soot blowers etc. installed in position. The procedure adopted for such tests shall have the prior approval of the Employer. Normally physical leak detection method by pressurising the section under test by running FD Fan / PA Fan / Temporary blower, as the case may be, is adopted. The contractor may adopt any other better method of testing.			
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO.: CS-9585-001-2	SUB-SECTION- A-29 PRE-COMMISSIONING & COMMISSIONING ACTIVITIES	PAGE 2 OF 14

CLAUSE NO.	TECHNICAL REQUIREMENTS			
3.02.03	All equipments including any temporary blanking, if required, for the above test shall be provided by the Contractor. The Contractor's air and gas tightness test procedure shall be such that it shall enable conductance of air/gas tightness test on the ducts in segmented manner (as and when these duct segments are ready), so that these duct segments can be immediately released for application of insulation after their air/gas tightness tests. Contractor shall made all necessary arrangement for conducting tests in this manner. Any blanking etc. on the duct side required for testing of duct segments shall be provided by Contractor. Contractor shall bring fan / blower (s) of adequate size / capacity and other necessary instruments so that these tests can be conducted without necessity of FD / PA fans. The above equipment shall be brought to site by the Contractor on temporary basis and shall be taken back after successful completion of air / gas tightness test.			
	Chemical Cleaning of Pressure Parts			
	The Contractor shall perform thorough and efficient cleaning operations of all the internal parts of the boiler, like economiser, water wall / evaporator, separator, feed water line, piping, start-up recirculation lines and associated piping and all other pressure parts and associated high pressure piping covered under these specifications (except those portions which are to be steam blown).			
	The cleaning operation shall consist of De-mineralised (DM) water flushing, the chemical cleaning using acids like hydrofluoric acid or as recommended by the manufacturer, DM water rinsing, DM water flushing, nitrogen capping etc. Complete chemical cleaning procedure, the scheme and layout including parameters of the pumps, size of tanks, materials of construction, the rate of consumption and total requirements of steam and water for such cleaning process shall have the approval of the Employer.			
	The Contractor shall furnish all labour, materials such as the required chemicals and other consumables, all equipment such as acid/chemical transfer and acid/chemical circulating pumps complete with drive motors, acid storage and acid/chemical mixing tanks, all temporary piping, valves and specialities and local instruments for pressure, temperature and flow measurements and any other items needed to carry out the process. All equipment required for chemical cleaning of Steam Generator shall be supplied by the contractor.			
	The Contractor shall take care to dispose off the used chemicals and the effluents from the cleaning operations, after neutralisation, meeting all the statutory regulations and in a manner acceptable to the Project Manager and which would comply with the norms of the State Pollution Control Board. This includes construction of suitable neutralization pit, channels, disposal equipments etc.			
	The Contractor shall specifically make all necessary arrangements for prevention of any fire accidents, explosions etc. during the performance of the chemical cleaning operations. The Contractor shall ensure that during the cleaning process the procedure adopted shall be such as to consume minimum demineralized water.			
The cleaning procedure shall include final flushing and draining of the boiler under a nitrogen gas cap and/or filling the boiler with inhibited water or any other proven procedure recommended by the manufacturer for the preservation of the boiler which is acceptable to the Employer. The Contractor shall furnish a detailed procedure for boiler preservation during detailed engineering for Employer's approval.				
All equipment needed for such preservation including the nitrogen cylinders, interconnecting piping and any regulating equipment for N2 cap and other preservatives shall be provided by the Contractor for the Steam Generator and the same shall also become the property of the Employer after completion of the chemical cleaning.				
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO.: CS-9585-001-2	SUB-SECTION- A-29 PRE-COMMISSIONING & COMMISSIONING ACTIVITIES	PAGE 3 OF 14

CLAUSE NO.	TECHNICAL REQUIREMENTS			
3.02.04	The Contractor shall provide adequate safety and protective equipment for all his employees and ensure that they are worn at all times of danger. Specialized treatment equipment (such as required for first aid when using hydrofluoric acid/chemical) must be provided at the place of handling acid/chemical. An acid/chemical cleaning report and log of each cleaning must be provided by the Contractor to the Employer, immediately after the cleaning operation.			
	Steam Blowing			
	Steam blowing of complete Superheaters, Reheaters and various boiler external piping and non boiler external piping shall be carried out by the Contractor as per requirements/scope of work (indicated in Part-A & Part-B, Section-VI) of this specification. Temporary materials as required for steam blowing of these piping systems shall be supplied by the contractor.			
	Steam blowing of contractor's scope of piping systems shall be performed without valves/control valves supplied in steam blowing circuit otherwise valve supplier's acceptance to include these valves for steam blowing operation is to be submitted by the contractor. Based on the above the Contractor shall give recommended procedures, method of blowing and scheme for steam blowing indicating clearly additional system, if any, to be cleaned by steam blowing and furnish data/ write-up/ layouts/ drawings to that effect to the Employer for approval.			
	The Contractor shall furnish his recommendations regarding use of various test equipments and instruments and termination/acceptance criteria for steam blowing, which in any case shall meet the steam turbine-generator requirements.			
	The systems which should be ready and operational before steam blowing shall be made ready/operational by the Contractor by the scheduled date for starting of steam blowing.			
	For equipments/components installed on high pressure external piping, such as various thermo-wells, flow meter, control valves, HP/LP Bypass valves etc., the Contractor shall comply with guidelines to be followed during steam blowing, with respect to removal / blanking / replacement of such items their internals etc. by spool pieces as given by the respective manufacturer/sub-contractor.			
	Supply of all such spools (as above) and/or blanks, temporary piping and supports etc. as required, cutting / welding / edge preparation and rewelding required for blanking, temporary piping connection and/or for replacements by spool pieces shall be the responsibility of the Contractor. After steam blowing removal of spool pieces & temporary piping and reinstallation of various components, shall also be the responsibility of the Contractor.			
	In the case of branch connections/ tap-off piping are not ready or not erected at the time of steam blowing operation then the contractor to supply/use necessary blanking arrangement as required at these tap-off / branch connections.			
	It will be the responsibility of the Contractor to operate the Steam Generator and its accessories equipment to generate adequate steam at the parameter and quality in line with the requirements of steam blowing procedure. The Contractor shall make adequate provisions for temporary enhancement of fuel oil firing capacity of the steam generators by changing oil gun tips etc. as may be required so as to be able to conduct complete steam blowing operation by oil firing alone. All necessary precautions to avoid fires and cold end corrosion of Air preheater, during such oil firing at enhanced SG loads, shall be taken by the Contractor.			
The Contractor shall ensure successful and timely completion of steam blowing of all systems and will render all help/services as required including:				
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO.: CS-9585-001-2	SUB-SECTION- A-29 PRE-COMMISSIONING & COMMISSIONING ACTIVITIES	PAGE 4 OF 14

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CLAUSE NO.	TECHNICAL REQUIREMENTS			
3.02.07.02	All pre-commissioning tests & activities as indicated in Annexure-I, II & III and elsewhere in the technical specification shall be performed by the Contractor.			
3.02.08	Any other pre-commissioning activity such as floating of safety valves etc. as considered essential for readiness of facilities for commencement of commissioning activities shall also be undertaken by the Contractor.			
3.03.00	Demonstration/Acceptance tests during Commissioning/Initial Operation The following tests shall be demonstrated during commissioning for which the bidder has to furnish the procedure and get the approval of the employer:			
3.03.01	Start-up, Loading, Unloading and Shutdown Capabilities (For Turbine Generator) (i) Unit Start Up Start-up time (upto full load), and loading capabilities for the Turbine Generator together for cold start conditions (greater than 36 hours shutdown), warm start conditions (between 8 and 36 hours shutdown) and hot start conditions (less than 8 hours shutdown) as indicated by the Contractor in the offer and accepted by the EMPLOYER shall be demonstrated, ensuring that the various turbine operational parameters like vibration, absolute and differential expansion, eccentricity and steam-metal temperature mismatch etc. are within design limits. (ii) Sudden Total Loss of External Load On occasions, the steam turbine generator unit may experience sudden total loss of all external load. Under these conditions, the steam turbine generator unit shall not trip but shall continue to be in operation under the control of its speed governor to supply power for the plant auxiliary load with HP-LP bypass in operation while staying within the agreed limits of steam to metal temperature mismatch, exhaust hood temperature, absolute and differential expansion, vibration and eccentricity. The same shall be demonstrated. Further, the provisions of Part-B, Section-VI, shall also be complied with. (iii) Steam Metal Temperature Mismatch Limitation The steam-metal temperature differential for cold, warm and hot start up, loading / unloading and shutdown conditions shall be within the permissible limits indicated by the Bidder in the offer and accepted by the Employer.			
3.03.02	Turbine Generator Set Capability The steam turbine generator unit shall be capable of delivering at generator terminals the output as indicated by the BIDDER in the heat balances submitted along with his bid, under the following condition. (a) Maximum continuous output at generator terminals corresponding to both strings of HP heaters out of operation, under rated steam conditions, at a specified ambient temperature and 3% make up. NOTE: While conducting the tests of (a) above the condenser pressure measurement shall be done at 300mm downstream of low pressure turbine last stage bottom blade tip.			
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO.: CS-9585-001-2	SUB-SECTION- A-29 PRE-COMMISSIONING & COMMISSIONING ACTIVITIES	PAGE 6 OF 14

CLAUSE NO.	TECHNICAL REQUIREMENTS			
3.03.03	Turbine Auxiliaries			
	(i)	H.P./L.P. Bypass Capabilities		
	The HP & LP Bypass system should satisfy the following functional requirements under automatic interlock action. It should come into operation automatically under the following conditions: (a) Generator circuit breaker opening. (b) HP - LP stop valves closing due to turbine tripping. (c) Sudden reduction in demand to house load. Under all these conditions, while passing the required steam flows as per the relevant heat balances, the condenser should be able to swallow the entire steam without increasing the exhaust hood temperature and condenser pressure beyond the maximum permissible value indicated by the BIDDER in his offer and accepted by the EMPLOYER. The same shall be demonstrated.			
	(ii)	Steam Condensing Plant for main turbine		
	(a)	Temperature of condensate, at outlet of condenser, shall not be less than saturation temperature corresponding to the condenser pressure at all loads.		
	(b)	Oxygen content in condensate, at condensate collection tank outlet, shall not exceed 0.015 CC per litre over the entire load range and shall be determined according to calorimetric Indigo - Carmine method.		
	(c)	Air leakage in the condenser under full load condition shall not exceed more than 50% of design value taken for sizing the condenser air evacuation system.		
	(e)	The capacity of each vacuum pump in free dry air under standard conditions at a condenser pressure of 25.4 mm Hg (abs) and sub cooled to 4.17 deg.C below the temperature corresponding to absolute suction pressure shall not be less than as specified elsewhere. Correction curves for establishing the capacity at site conditions shall also be furnished.		
	(f)	The air and vapour mixture from air cooling zone of condenser shall be 4.17 deg.C below the saturation temperature corresponding to 25.4 mm Hg (abs) suction pressure. Correction curves for establishing the same at site conditions shall also be furnished.		
	(iii)	Feed water heaters & Deaerator		
	(a)	TTD's and DCA's of feed water heaters in line with 800 MW heat rate guarantee heat balance shall be demonstrated.		
	(b)	Dissolved O2 content in Deaerator effluent at deaerator outlet without chemical dosing at all loads, not to exceed 0.005 CC/ litre determined as per D5543-09 Indigo Carmine method.		
	(c)	Difference between saturation temperature of steam entering the deaerator and temperature of feed water leaving deaerator.		
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO.: CS-9585-001-2		SUB-SECTION- A-29 PRE-COMMISSIONING & COMMISSIONING ACTIVITIES
PAGE 7 OF 14				

CLAUSE NO.	TECHNICAL REQUIREMENTS			
3.03.04	(iv)	Condensate Extraction Pumps		
	(a)	Each CEP set shall be capable of delivering flow & total dynamic head corresponding to runout point as specified.		
	(b)	The vibration, noise level and parallel operation of any two of the three pumps shall be demonstrated.		
	(v)	Drip Pumps (if envisaged)		
	(a)	Each drip pump shall be capable of delivering flow & total dynamic head corresponding to design point as specified.		
	(b)	The vibration and noise level shall be demonstrated.		
	(vi)	Boiler feed pumps		
	(a)	Each boiler feed pump set shall be capable to deliver flow and total dynamic head corresponding to runout point as specified elsewhere.		
	(b)	The vibration, noise level and parallel operation of any two of the three pumps shall be demonstrated as per specification requirements.		
	(c)	Cold start up / hot start up of the unit using TDBFP with motive steam from auxiliary steam header.		
3.03.05	Balance Pumps, Blowers, Fans, Compressors and rotating equipment.			
3.03.06	a)	The vibration, noise level and parallel operation, wherever applicable, of the pumps, blowers, fans, compressors and rotating equipment shall be demonstrated.		
	b)	Pumps, blowers, fans, compressors and rotating equipment shall be capable of delivering flow and head corresponding to design point as specified.		
3.03.07	Balancing of Coal/Primary air flow			
3.03.08	Contractor shall balance the primary air as well as coal flows in the pulverised fuel pipes such that the minimum PF and PA flow imbalance in the PF pipes from each coal pulveriser does not exceed 5% of average flows.			
	The above balancing shall be checked by the Contractor by carrying out both clean air test and dirty air test (using dirty pitot tubes).			
3.03.09	Demonstration of boiler operation, rate of change of load and sudden load change withstand capability			
3.03.10	Refer Sub section-A-02 and A-03 ,Part-B(Mechanical), Section VI of Technical Specification..			
3.03.11	Steam Temperature Imbalance			
3.03.12	The Contractor shall demonstrate that at SH and RH outlets (in case of more than one outlet) the temperature imbalance between the outlets does not exceed 10 deg C under all loads including transients.			
	No fuel oil support shall be required above 40% BMCR			
3.03.13	Contractor shall demonstrate that oil support for flame stabilization shall not be required beyond 40% of BMCR load when firing the coals from the range identified. The Contractor			
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO.: CS-9585-001-2		SUB-SECTION- A-29 PRE-COMMISSIONING & COMMISSIONING ACTIVITIES
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CLAUSE NO.	TECHNICAL REQUIREMENTS			
	shall demonstrate that with any combination of mills/ adjacent mills in service (to Employer's choice) the Steam Generator does not require any oil firing for stable and efficient boiler operation at and above 40% BMCR loads.			
3.03.09	Capabilities of all drives After completion of installation of drives, contractor shall demonstrate the capability of all drives as specified elsewhere in Section VI Part B of Technical Specifications.			
3.03.10	Margin on Fans After completion of installation of fan drives, Fans, inlet and outlet ducting, measuring equipments etc. contractor shall demonstrate the margin on seal air fans, primary fans, Forced draft fans and induced draft fans as specified elsewhere in Section VI Part B of Technical Specifications.			
3.03.11	Cold Air Velocity Test (CAVT) A CAVT shall be conducted on each Steam Generator during commissioning before its initial operation to establish the average cold air velocity and the velocity distribution at minimum three predetermined sections (Employer's Choice) of steam generator. The data obtained from the CAVT will be used to compute the actual flue gas velocities as well as their distribution at the test sections during actual operation by correlating the CAVT data with the test/computed data from Thermal Performance Test as per Clauses 1.03.04 (iii) sub section-IV, Section-VI- Part-A. Should the CAVT results after this correlation with TPT data indicate actual localized high flue gas velocity zones/ mal-distribution of gas flow and/or flue gas laming, suitably designed stainless steel screens at required SG cross sections shall be provided by the Contractor to bring the deviation of the localized gas velocity within $\pm 20\%$ of average gas velocity specified. Through this test the Contractor shall also demonstrate the compliance with the specification requirements regarding the maximum allowable flue gas velocities at various sections of the Steam Generator, refer sub-sectdion-A-03, Part-B of Technical Specifications. The detailed CAVT procedure shall be to Employer's approved. The Contractor shall submit a detailed CAVT report and the computations of actual velocities after correlating CAVT data with TPT data to the Employer for approval.			
3.03.12	Capabilities of firing of 30% imported coal Contractor shall demonstrate the capability of Steam generator and its auxiliaries to operate at rated parameters safely and on sustained basis at TMCR load while firing range of Indian coal(s) as specified in Table-1(A), Annexure-IV-2 ,sub section-IB ,Part-A of Section-VI blended with imported coal up o 30% by weight specified in Table-4, Annexure-IV-4, sub section-IB ,Part-A, Section-VI. Such demonstration shall be for 72 hours of continuous operation			
3.03.12 a)	Performance characteristic of fans (PA/FD/ID fan capacity, head developed, etc.)			
3.03.13	Passenger & good elevators for steam generator – overload tests, travel and hoist speed checks.			
3.03.14	Auxiliary Boiler Rating Contractor shall demonstrate the rated parameters of Auxiliary Boiler, its steam generating capacity as per Clause 1.05.20 of Sub-section A-02.			
3.03.15	ESP Air in Leakage			
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CLAUSE NO.	TECHNICAL REQUIREMENTS			
3.03.16	Contractor shall demonstrate that ESP air in leakage shall be limited to 1% of the total gas flow under guarantee point condition. Pressure Drop Across ESP			
3.03.17	Contractor shall demonstrate that the maximum flue gas pressure drop across the ESP under specified guarantee point condition shall not exceed 20 mmwc. FGD System (i) Performance characteristics of fans (capacity, head developed, etc.) and margins on fans in case Booster Fan, as specified in Part-B of technical specification, is provided by the Contractor. (ii) Capabilities of all drives (Refer Part B of Technical Specifications) (iii) Passenger cum Goods Elevator for FGD absorber & Limestone Grinding Building: Over load tests, travel and hoist speed checks.			
3.03.17	Hydrogen Generation Plant a) Parallel operation of two streams shall be demonstrated at site. Purity level and moisture contents of Hydrogen shall also be demonstrated at site. b) Hydrogen Generation Plant capacity of each stream shall be demonstrated at site.			
3.04.00	Pre-commissioning & Commissioning activities requiring approval of the employer: (a) Hydraulic Test for STG integral piping, heat exchangers, condenser tubes & condenser, equipment cooling water system pipes and associated equipment etc. shall be done. The hydraulic test of other piping system as per statutory requirement and specified elsewhere shall also be carried out. All equipment needed for the tests shall be furnished by the Contractor. (b) Oil flushing of lube oil system, control & jacking oil system, etc. for turbines shall be done. Entire flushing oil requirement & refilling with fresh oil and other consumables along with flushing equipment shall be met by the Contractor. (c) High Pressure/Low Pressure (HP/LP) bypass tests, vacuum tightness test as per approved procedures shall be done by the Contractor after arranging & lining up of all the necessary equipment by him. (d) Steam blowing & chemical cleaning, as applicable of integral piping of the turbo-generator, Low pressure piping, Power cycle piping & other piping in the scope of the Contractor shall be done by the Contractor. (e) Steam blowing & chemical cleaning, as applicable of integral piping of CEP sets & other piping in the scope of the Contractor shall be done by the Contractor. (f) All tests and activities pertaining to the CEP and its drive as per manufacturer's recommendations and as given in the chapter and covered in the specification. (g) Steam blowing & chemical cleaning, as applicable of integral piping of Drip Pump sets & other piping (if applicable) shall be done by the Contractor.			
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO.: CS-9585-001-2	SUB-SECTION- A-29 PRE-COMMISSIONING & COMMISSIONING ACTIVITIES	PAGE 10 OF 14

CLAUSE NO.	TECHNICAL REQUIREMENTS			
	(h)	All tests and activities pertaining to the Drip Pump and its drive (if applicable) as per manufacturer's recommendations and as given in the chapter and covered in the specification.		
	(i)	Steam blowing & chemical cleaning, as applicable of integral piping of the Heaters & other components shall be done by the Contractor.		
	(j)	All tests and activities pertaining to the Heater as per manufacturer's recommendations and as given in the chapter and covered in the specification.		
	(k)	Oil flushing of lube oil system, control & jacking oil system, for BFP sets shall be done. Entire flushing oil requirement & refilling with fresh oil and other consumables along with flushing equipment shall be met by the Contractor.		
	(l)	Steam blowing & chemical cleaning, as applicable of integral piping of BFP sets & other piping shall be done by the Contractor.		
	(m)	All tests and activities pertaining to the BFP and its drive as per manufacturer's recommendations and as given in the chapter and covered in the specification.		
	(n)	Hydraulic Test for all low and high pressure piping, equipment cooling water system pipes and associated equipment etc. shall be done as per statutory requirement and specified elsewhere shall be carried out. All equipment needed for the tests shall be furnished by the Contractor.		
	(o)	All tests and activities pertaining to the Generator and Excitation as per manufacturer's recommendations and covered in the specification.		
	(p)	All tests and activities pertaining to the Generator Auxiliaries viz Primary water system, Seal oil system, Gas system etc., as per manufacturer's recommendations and covered in the specification.		
	(q)	Any other pre-commissioning checks/ tests and activities as described below and also those mutually agreed between the Contractor & the Employer shall be undertaken.		
3.05.00	COMMISSIONING OF FACILITIES			
	General			
	Upon completion of pre-commissioning activities/test the Contractor shall initiate commissioning of facilities. During commissioning the Contractor shall carryout system checking and reliability trials on various parts of the facilities.			
	Contractor shall carry out these checks/tests at site to prove to the Employer that each equipment of the supply complies with requirements stipulated and is installed in accordance with requirements specified. Before the plant is put into initial operation the Contractor shall be required to conduct test to demonstrate to the Employer that each item of the plant is capable of correctly performing the functions for which it was specified and its performance, parameters etc. are as per the specified/approved values. These tests may be conducted concurrently with those required under commissioning sequence.			
	The Contractor shall finalize the protocol of check lists, after erection of the system and equipment, as per International Codes/Standard with the Employer.			
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO.: CS-9585-001-2		SUB-SECTION- A-29 PRE-COMMISSIONING & COMMISSIONING ACTIVITIES
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CLAUSE NO.	TECHNICAL REQUIREMENTS			
3.05.01	The Contractor shall furnish requisite no. of copies of procedures and list of start up, pre-commissioning, commissioning and initial operation tests for Employer's approval.			
	The Contractor shall also demonstrate the performance of all C&I equipment, the tests on main equipment or prior to that as the case may be.			
	Other tests shall be conducted, if required by the Employer, to establish that the plant equipments are in accordance with requirements of the specifications.			
	The Commissioning tests/checks shall specifically include but will not be limited to following:			
	(a) Checks on the operation of all controls of isolating gas and air dampers.			
	(b) Checks on operation of all fans and all rotating equipment to ascertain level of noise and vibration.			
	(c) Test running of all pumps.			
	(d) Checks on operation of all air heaters and adjustment of seals, if necessary when each heater is upto its working temperature.			
	(e) Checks on operation of all soot blowers and retraction gear and the sequences control.			
	(f) Check run on the Pulverised Fuel (P.F.) Mills including clean air flow test.			
3.05.02	(g) Standard commissioning tests and procedures as per Contractor's practice for Steam Generator, SCR System, FGD System and other equipment / auxiliaries.			
	(h) Checks on operation of all individual control loops in the Steam Generator control loops in the Steam Generator control system including SCR & FGD System.			
	(i) Checks on inter-relation between each control loop in the Steam Generator control system including SCR & FGD system. Checks on inter-relation between each control loop in the turbine generator control system.			
	(j) Checks on correct functioning of the Burner Management System (BMS).			
	(k) Calibration tests of orifice, flow nozzles, instruments and control equipment to the extent included in these specifications.			
	(l) Tests on Control & Instrumentation (C&I) Equipments:			
	LIST OF TEST / ACTIVITIES TO BE PERFORMED ON TG & AUXILIARY (but not limited to folowing)			
	A) COMMISSIONING TESTS/CHECKS			
	1. Test running of all pumps			
	2. Condenser vacuum test, feed water heater operational tests for establishing correct cascaded flow, heater water levels etc. & checking of all parameters as per approved heat balance diagrams.			
3. Test for HP/LP bypass valves operation & their control system.				
4. Test for operation of governing control system for turbines.				
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO.: CS-9585-001-2	SUB-SECTION- A-29 PRE-COMMISSIONING & COMMISSIONING ACTIVITIES	PAGE 12 OF 14

CLAUSE NO.	TECHNICAL REQUIREMENTS			
	5. Standard commissioning tests and procedures as per Contractor's practice for steam turbine generator and other equipment / auxiliaries within the Contractor's scope of work. 6. Checks on operation of all individual control loops in the turbine generator control system. 7. Checks on correct functioning of the Turbine Protection System (TPS), Turbine Supervisory Control System (TSCS) for main turbine, Automatic Turbine Run-up System (ATRS), Automatic Testing of Turbine (ATT). 8. Standard commissioning tests and procedures as per Contractor's practice for CEP and other equipment / auxiliaries within the Contractor's scope of work. 9. Checks on operation of all individual control loops in the CEP control system. 10. Standard commissioning tests and procedures as per Contractor's practice for Drip Pump (if applicable) and other equipment / auxiliaries within the Contractor's scope of work. 11. Checks on operation of all individual control loops in the Drip Pump control (if applicable) system. 12. Feed water heater operational test for establishing correct cascaded flow, heater water levels and checking of all parameters as per approved heat balance diagram. 13. standard commissioning tests and procedures as per contractor's practice for heaters and de-aerator and other equipment/auxiliaries within the contractor's scope of work. 14. Checks on operation of all individual control loops in the heater and deaerator control system. 15. Test for operation of governing control system for BFP turbines. 16. Standard commissioning tests and procedures as per Contractor's practice for BFP and other equipment / auxiliaries within the Contractor's scope of work. 17. Checks on operation of all individual control loops in the BFP control system. 18. Checks on correct functioning of the BFP Turbine for Turbine Protection System (TPS), Turbine Supervisory Control System (TSCS) for main turbine, Automatic Turbine Run-up System (ATRS), Automatic Testing of Turbine (ATT). 19. Calibration tests of orifice, flow nozzles, instruments and control equipment to the extent included in these specifications. 20. Checks on operation of all rotating equipments to ascertain level of noise and vibration 21. Checks on operation of all static equipments to ascertain level of noise and vibration 22. Standard commissioning tests and procedures as per manufacturer's practice for Generator, Excitation and its auxiliaries within the Contractor's scope of work.			
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO.: CS-9585-001-2	SUB-SECTION- A-29 PRE-COMMISSIONING & COMMISSIONING ACTIVITIES	PAGE 13 OF 14

CLAUSE NO.	TECHNICAL REQUIREMENTS			
3.06.00	Balance of Plant equipment & systems All pre-commissioning tests & activities as required for successful running of the equipment or as mentioned in the technical specification elsewhere shall be performed by the contractor.			
4.00.00	INITIAL OPERATION Upon completion of system checking/tests and as a part of commissioning of facilities, complete plant/facilities shall be put on initial operation for a period of thirty (30) days or 720 hours as stipulated in General Technical Requirements.			
5.00.00	The Contractor shall conduct all the commissioning tests and undertake commissioning activities pertaining to all other auxiliaries and equipments including all Electrical & C&I equipment/systems not specifically brought out above but are within the scope of work and facilities being supplied & installed by the Contractor and follow the guidelines indicated above or elsewhere in these technical specifications (Section-VI).			
6.00.00	The Contractor shall conduct the comprehensive guarantee tests on the Steam Generator in co-ordination with the Steam Generator to establish the functional guarantee values at stipulated conditions as per Sub-section-IV, Part-A, Section-VI.			
7.00.00	The Contractor shall conduct all the commissioning tests and undertake commissioning activities pertaining to all other auxiliaries and equipments including all Electrical & C&I equipment/systems not specifically brought out above but are within the scope of work and facilities being supplied & installed by the Contractor and follow the guidelines indicated above or elsewhere in these technical specifications (Section-VI).			
8.00.00	COMMISSIONING SPARES			
8.01.00	It will be the responsibility of the Contractor to provide all commissioning spares including consumable spares required for initial operation till the Completion of Facilities. The Contractor shall furnish a list of all commissioning spares within 60 days from the date of Notification of Award and such list shall be reviewed by the Employer and mutually agreed to. However, such review and agreement will not absolve the Contractor of his responsibilities to supply all commissioning spares so that initial operation do not suffer for want of commissioning spares. All commissioning spares shall be deemed to be included in the scope of the Contract at no extra cost to the Employer.			
8.02.00	These spare will be received and stored by the Contractor at least 3 months prior to the schedule date of commencement of initial operation of the respective equipment and utilized as and when required. The unutilized spares and replaced parts, if any, at the end of successful completion of guarantee tests shall be the property of the Contractor and he will be allowed to take these parts back at his own cost with the permission of Employer.			
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO.: CS-9585-001-2	SUB-SECTION- A-29 PRE-COMMISSIONING & COMMISSIONING ACTIVITIES	PAGE 14 OF 14

CLAUSE NO.	TECHNICAL REQUIREMENTS			
	ANNEXURE-I			
	<u>STANDARD CHECKLIST</u> This is an indicative list of items. The actual list shall depend on the Equipment / System being supplied by the contractor. <u>MECHANICAL</u> <u>VALVES</u> 1. Manually Operated Valve 2. Electrically Operated Valve 3. Pneumatically Actuated Valve 4. Hydraulically Actuated Valve 5. Safety Valve 6. Electromatic Relief Valve 7. Steam Trap 8. Non Return Valve (including Hydraulic/ Pneumatic QCNRVS) 9. Control Valve 10. Relief Valve 11. Differential Pressure Regulating Valve 12. Butterfly valve (Electrically Operated) 13. Butterfly valve (Manually Operated) 14. Butterfly valve (Fourway -Electrical) 15. One spare EOTV for steam blowing <u>TANKS & PRESSURE VESSELS</u> 1. Tanks (metal) up to 20 M³ 2. Tanks (Large Storage) 3. Pressure Vessel (Below 17 bars) 4. Air Receiver 5. Pressure Vessel – Access Door <u>PUMPS</u> 1. Pump-Low Pressure Centrifugal (Motor driven) 2. Pump-Up to 350HP 3. Pump-Sump installation 4. Gear Pump/Screw pump 5. Slurry Pumps 6. Vacuum Pumps <u>PIPE WORK SYSTEM</u> 1. Steam services			
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATION SECTION-VI,PART-B BID DOC NO CS-9585-001-2	ANNEXURE-I OF SUB-SECTION- A-29 PRE-COMM. & COMM. ACTIVITIES	PAGE 1 OF 6

CLAUSE NO.	TECHNICAL REQUIREMENTS			एन टी पी सी NTPC
	2. Water services 3. Slurry Services 4. Oil / Fire Resistant fluid system 5. Air services (Compressor) 6. High pressure services 7. Constant load support 8. Spring supports 9. PF Coal 10. Hangers and other Supports <u>STRAINER AND FILTER</u> 1. Strainer / Filter Basket Type 2. Strainer Rotary (Low Pressure) 3. Filter & Strainers Centrifugal Separators 4. Filter & Strainer Y-Type 5. Filter & Strainer (Plate Type) 6. Purifier 7. Filter – Compressed Air Line <u>HEAT EXCHANGER</u> 1. Heat Exchanger (General) 2. Heat Exchanger – Oil / Water 3. Rotary Air Heater <u>FANS & COMPRESSORS</u> 1. Fans –Non-Pressure Lubricated 2. Fans – Axial Flow pressure Lubricated 3. Compressors-General including H2 gas compressor 4. Blowers <u>DAMPERS & GATES</u> 1. Manually Operated Damper 2. Pneumatically Operated Damper 3. Electrically Operated Damper 4. Manually Operated Gates 5. Pneumatically Operated Gate 6. Electrically Operated Gate <u>DUCT WORK</u> 1. Air & Flue Gas Ducting 2. Expansion Joints 3. Observation & Access Door			
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATION SECTION-VI,PART-B BID DOC NO CS-9585-001-2	ANNEXURE-I OF SUB-SECTION- A-29 PRE-COMM. & COMM. ACTIVITIES	PAGE 2 OF 6

CLAUSE NO.	TECHNICAL REQUIREMENTS			
	<u>CRANES AND ELEVATORS</u> 1. Auxiliary Overhead Crane 2. Travel Support Structure for Crane 3. Long Travel & Cross Traverse Motion of Crane 4. Main Aux. Hoist Motion (Crane) 5. Crane Electric Hoist 6. Passenger cum goods elevator <u>POWER TRANSMISSION</u> 1. Power Transmission Gear Box 2. Bearings 3. Fluid Couplings <u>BOILER & AUX.SYSTEM</u> 1. Soot Blower Long Retractable 2. Wall Deslagger/Soot Blower 3. Bottom Ash Hopper 4. Fly Ash Hopper 5. Lubricator –Compressed Air Lines 6. Wind Box Assembly 7. Mixer / Stirrer 8. Compressed Air Breathing Apparatus 9. Oil Burner 10. Ignitors 11. Scanner 12. Manual Lubricators 13. Air Motor 14. Driers-Non Regenerative /Regenerative 15. Coal Bunker <u>FGD & AUX.SYSTEM</u> 1. Agitators 2. Air Motor 3. Process trestle 4. Limestone feeder 5. Vacuum belt filter			
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATION SECTION-VI,PART-B BID DOC NO CS-9585-001-2	ANNEXURE-I OF SUB-SECTION- A-29 PRE-COMM. & COMM. ACTIVITIES	PAGE 3 OF 6

CLAUSE NO.	TECHNICAL REQUIREMENTS	एनटीपीसी NTPC		
	6. Limestone ball mill 7. Limestone Hydrocyclones 8. Primary Hydrocyclones 9. Secondary Hydrocyclones 10. Absorber internals 11. Absorber Auxiliaries ELELCTRICAL 1. D.C. Motor 2. HV Squirrel Cage Induction Motor 3. 415 V Squirrel Cage Induction Motor 4. Motor Operated Actuators 5. Soot Blower (Deslagger) 6. Soot Blower (Long Retractable) 7. Soot Blower (Air Heater) 8. Aux. Control and Relay Panel Desk 9. LT SWITCHGEARS/MCC a) STANDARD CHECLISTS FOR ALL TYPES OF RELAYS USED IN SWITCHGEARS PROTECTION SYSTEM B) PT CARRIAGE AND CUBICLES C) CABLE/BUS DUCT/BUS BARS D) CONTRACTOR MODULE E) SWITCH FUSE MODULE F) MASTER PANEL OF LUBE OIL PANEL G) FEEDER PANEL OF LUBE OIL PANEL H) SPACE HEATER AND CABLE MODULE I) HT CIRCUIT BREAKER J) 415 V CIRCUIT BREAKER K) POWER CABLE L) AUXILIARY CABLE M) D.C. CABLE N) EXPLOSION PROOF ELECTRICAL EQUIPMENT O) JUNCTION BOX P) CONTROL TRANSFORMER MODULE Q) BRUSH GEAR ASSEMBLY R) AUX. CONTROL AND RELAY PANEL DESK S) INDICATING INSTRUMENT T) RECORDING INSTRUMENT u) INTEGRATING INSTRUMENT CONTROL & INSTRUMENTATION 1. Conductivity Measuring Equipment Including Test Procedures 2. pH Analyser Including Test procedure			
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATION SECTION-VI,PART-B BID DOC NO CS-9585-001-2	ANNEXURE-I OF SUB-SECTION- A-29 PRE-COMM. & COMM. ACTIVITIES	PAGE 4 OF 6

CLAUSE NO.	TECHNICAL REQUIREMENTS	एनटीपीसी NTPC		
	3. Silica Analyser 4. Level Switch (Float Actuated) 5. Level Switch (Electrode Type) 6. Level Switch (Displacer Actuated) 7. Transmitter (Float Operated Pneumatic Output including Testing procedures 8. Level indicator (Float/Pulley Type) 9. Local Temperature Indicator Including Test Procedure 10. Resistance Thermometer Element Including Test procedure 11. Thermocouple Element and Connecting Cable 12. Thermocouple and Resistance Thermometer Convertor/Transmitter Including Test Procedures 13. Temperature Switch Including Test Procedure 14. Cold Junction Boxes 15. O₂Analyser 16. O₂ in Hydrogen including Test procedures 17. Pressure and Vacuum Gauge 18. Pressure and Vacuum Switch Including Test procedures 19. Differential Pressure Transmitter including Test Procedures 20. Differential pressure switch including Test procedures 21. Flow indicator (Variable Area) 22. Orifice plate 23. Flow Switch 24. Nozzle 25. Flow Integrator (pneumatic input) including test procedure 26. Flow indicator (Float Operated) Including Test Procedure 27. Venturi (Fluid) 28. Flow Switch (Magnetic Type) 29. Limit Switches 30. Turbine Supervisory Measuring System 31. Position Measurement & Indication Including Test procedures 32. Vibration Measurement 33. Digital Indicator 34. Moving Coil Indicator Including Test Procedures 35. Recorder Including Test procedure 36. Flame Scanner 37. Electrical Auto Manual Control Station 38. Push Button Module			
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATION SECTION-VI,PART-B BID DOC NO CS-9585-001-2	ANNEXURE-I OF SUB-SECTION- A-29 PRE-COMM. & COMM. ACTIVITIES	PAGE 5 OF 6

CLAUSE NO.	TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
	39. Test Procedure for Electronic Modules of DDCMIS 40. Alarm Annunciator Equipment Including Test Procedure 41. Test procedure for Adjustment of Modulating Controller-PID Term 42. Test Procedure Indicating Controller-Electrical Input & Pneumatic Output			
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATION SECTION-VI,PART-B BID DOC NO CS-9585-001-2	ANNEXURE-I OF SUB-SECTION- A-29 PRE-COMM. & COMM. ACTIVITIES	PAGE 6 OF 6

CLAUSE NO.	TECHNICAL REQUIREMENTS			एनटीपीसी NTPC																																										
	ANNEXURE-II																																													
	TESTING / COMMISSIONING PROCEDURES																																													
	Following is an indicative list of equipments / systems for which Testing / Commissioning procedures are to be submitted. The actual list will depend on the equipment / system being supplied by the Contractor.																																													
	<table><tr><th>S. No</th><th>DESCRIPTION</th></tr><tr><td colspan="2">Boiler</td></tr><tr><td>1.</td><td>ID Fan</td></tr><tr><td>2.</td><td>FD Fan</td></tr><tr><td>3.</td><td>PA Fan</td></tr><tr><td>4.</td><td>Air Heater</td></tr><tr><td>5.</td><td>Scanner Air Fans</td></tr><tr><td>6.</td><td>Fuel Firing System</td></tr><tr><td>7.</td><td>Milling System</td></tr><tr><td>8.</td><td>Soot Blower System</td></tr><tr><td>9.</td><td>Aux. Steam System</td></tr><tr><td>10.</td><td>Mill Reject Handling System</td></tr><tr><td>11.</td><td>HP Bypass System</td></tr><tr><td>12.</td><td>S.A.D.C. and its control</td></tr><tr><td>13.</td><td>Boiler Chemical Analysis Equipment</td></tr><tr><td>14.</td><td>SH / RH Spray system</td></tr><tr><td>15.</td><td>Chemical Dosing System</td></tr><tr><td>16.</td><td>Boiler Air and Gas System -Interlock Operation</td></tr><tr><td>17.</td><td>Boiler Start-up Re-Circulation Pump</td></tr><tr><td>18.</td><td>Coal Feeders</td></tr><tr><td>19.</td><td>Electrostatic Precipitator</td></tr></table>				S. No	DESCRIPTION	Boiler		1.	ID Fan	2.	FD Fan	3.	PA Fan	4.	Air Heater	5.	Scanner Air Fans	6.	Fuel Firing System	7.	Milling System	8.	Soot Blower System	9.	Aux. Steam System	10.	Mill Reject Handling System	11.	HP Bypass System	12.	S.A.D.C. and its control	13.	Boiler Chemical Analysis Equipment	14.	SH / RH Spray system	15.	Chemical Dosing System	16.	Boiler Air and Gas System -Interlock Operation	17.	Boiler Start-up Re-Circulation Pump	18.	Coal Feeders	19.	Electrostatic Precipitator
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	LIST OF TEST / ACTIVITIES TO BE PERFORMED ON TG & AUXILIARY (BUT NOT LIMITED TO THE FOLLOWING) A) TESTING SCHEDULES 1. TURBINE ON BARRING GEAR 2. BEARING AND JACKING OIL INITIAL CIRCULATION 3. HP BYPASS SYSTEM 4. LP BYPASS SYSTEM 5. GOVERNOR OIL CONTROL SYSTEM 6. VACUUM RAISING PLANT 7. CENTRAL OIL PURIFICATION PLANT . HYDRAULIC TEST PROCEUDRE FOR A) LUB OIL SYSTEM B) CONTROL OIL & JACKING OIL SYSTEM C) GENERATOR SEAL OIL SYSTEM D) GENERATOR STATOR WATER SYSTEM E) GENERATOR GAS SYSTEM (Alternatively, pneumatic test with suitable leak detection method shall also be acceptable subject to owner's approval)																				
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CLAUSE NO.	TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
	F) HEATERS 9. OIL FLUSHING OF LUB OIL SYSTEM 10. OIL FLUSHING OF CONTROL & JACKING OIL SYSTEM 11. OIL FLUSHING OF GENERATOR SEAL OIL SYSTEM 12. ALKALI FLUSHING FOR CONDENSATE SYSTEM 13. HP/ LP BYPASS SYSTEM 14. CONDENSER VACUUM TIGHTNESS TEST 15. STEAM BLOWING OF GLAND SEAL PIPE LINES, AUX. STEAM PIPELINE 16. CEP 17. Drip Pump (if applicable) 18. HEATER 19. DEAERATOR 20. BFP 21. BEARING AND JACKING OIL INITIAL CIRCULATION 22. GOVERNOR OIL CONTROL SYSTEM 23. HYDRAULIC TEST PROCEDURE FOR A) LUB OIL SYSTEM B) CONTROL OIL & JACKING OIL SYSTEM C) WATER SYSTEM D) HEAT EXCHANGERS 24. OIL FLUSHING OF LUB OIL SYSTEM 25. OIL FLUSHING OF CONTROL & JACKING OIL SYSTEM 26. STEAM BLOWING OF GLAND SEAL PIPE LINES, AUX. STEAM PIPELINE 27. HT MOTORS B) COMMISSIONING SCHEDULE 1. Turbine Gland sealing system for Main Turbine 2. HP-LP Bypass system 3. Turbine Initial Run up for Main Turbine			
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATION SECTION-VI,PART-B BID DOC NO CS-9585-001-2	ANNEXURE-II SUB-SECTION- A-29 PRE-COMM. & COMM. ACTIVITIES	PAGE 3 OF 4

CLAUSE NO.	TECHNICAL REQUIREMENTS		एन टी पी सी NTPC															
	4. Lube Oil / Governing Oil System for Main Turbine 5. LP HEATERS 6. HP HEATERS 7. DEAERATOR STEAM OPERATION 8. Turbine Gland sealing system for BFP turbine 9. Turbine Initial Run up for BFP turbine 10. Lube Oil / Governing Oil System for BFP turbine 11. Generator and excitation system 12. Generator seal oil system 13. Generator stator water system 14. Generator gas system <table><tr><th colspan="2">Other Systems</th></tr><tr><td>1.</td><td>Compressed Air System</td></tr><tr><td>2.</td><td>Hydrogen Generation/ Bottling Plant</td></tr><tr><td>3.</td><td>Fire Protection & Detection System</td></tr><tr><td>4.</td><td>Air Conditioning and Ventilation System</td></tr><tr><td>5.</td><td>Ash Handling System - Bottom Ash System - Coarse Ash System(Economiser Ash) - Fly Ash System (ESP and APH) - Ash Slurry Disposal System - Ash water System </td></tr><tr><td>6.</td><td>Fuel Oil Pressurizing System</td></tr></table>				Other Systems		1.	Compressed Air System	2.	Hydrogen Generation/ Bottling Plant	3.	Fire Protection & Detection System	4.	Air Conditioning and Ventilation System	5.	Ash Handling System - Bottom Ash System - Coarse Ash System(Economiser Ash) - Fly Ash System (ESP and APH) - Ash Slurry Disposal System - Ash water System	6.	Fuel Oil Pressurizing System
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CLAUSE NO.	TECHNICAL REQUIREMENTS			
	ANNEXURE-IV Demonstration/Acceptance tests during Commissioning/Initial Operation The following tests shall be demonstrated during commissioning for which the bidder has to furnish the procedure and get the approval of the employer: 1. Start-up, Loading, Unloading and Shutdown Capabilities (For Turbine Generator) 2. Turbine Generator Set Capability 3. Turbine Auxiliaries 4. Balance Pumps, Blowers, Fans, Compressors and rotating equipment. 5. Balancing of Coal/Primary air flow 6. Demonstration of boiler operation, rate of change of load and sudden load change withstand capability 7. Steam Temperature Imbalance 8. No fuel oil support shall be required above 40% BMCR 9. Capability of all drives 10. Margin on Fans 11. Cold Air Velocity Test (CAVT)			
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)	TECHNICAL SPECIFICATION SECTION-VI,PART-B BID DOC NO CS-9585-001-2	ANNEXURE-IV SUB-SECTION- A-29 PRE-COMM. & COMM. ACTIVITIES	PAGE 1 OF 1	

CLAUSE NO.	TECHNICAL REQUIREMENTS			
	ANNEXURE-V			
	BRIEF WRITE UP ON THE CONTENTS OF TESTING / COMMISSIONING PROCEDURE			
	Testing / Commissioning Procedure is required to be of a standard format in order to maintain consistency of presentation, content and reporting. These should contain the following sections to make the document a self contained one.			
	1. Plant Details / Design data 2. Objective 3. Proposal 4. Services Required 5. Safety Precautions 6. Emergency Procedures 7. State of the Plant (Status in respect of erection completion of Mech, Elect and C&I items) 8. Method 9. Completion / Acceptance Criteria 10. Appendix • Result • Log sheet • Drawing etc.			
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATION SECTION-VI,PART-B BID DOC NO CS-9585-001-2		ANNEXURE-V SUB-SECTION- A-29 PRE-COMM. & COMM. ACTIVITIES
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e-Learning Package:

e-learning packages shall be supplied for the equipment / system for the complete CHP Run Off Treatment Plant along with associated electrical and C&I system.

These packages shall be installed on the Learning Management Server (LMS) of Power Management Institute (PMI) , NTPC located at Noida . The Engineer- In-Charge (EIC) for the e-learning modules shall be from PMI.

1. The objective of the e-Learning package consisting of courses for erection, commissioning, operation and maintenance of equipment / system as specified above is to facilitate the employees to have first hand information / requirement with respect to above activities for the supplied equipment / system .
2. The bidder shall submit e-learning courses each for erection, commissioning, operation and maintenance of each of the equipment / system supplied as above.
 - a. The erection course(s) should include instructions on pre-checks, prerequisites, erection strategy, erection procedure etc.
 - b. The commissioning course(s) should include instructions on pre-commissioning, commissioning, initial operation etc.
 - c. The operation course(s) should include instructions on the permissive, interlocks, physical check ups, start up, shutdown and protections etc.
 - d. The maintenance course(s) should include instructions on predictive, preventive, breakdown and overhauling.

Depth of coverage of above courses shall be as specified for “**Instruction Manuals**” in General Technical Requirement Part-C, Section-VI of technical specification. A literature on caution / safety while handling equipment / system for the above modules shall follow the description of the said equipment /system.

3. The e-Learning packages on equipment / system shall be installed by the vendor and shall be successfully test run in the presence of EIC or representative before acceptance by NTPC. The vendor will also give the master copy in form of Flash Drive/CD/DVD. The respective module for erection & commissioning shall be delivered and successfully test run at least three months before the scheduled start of the corresponding activity at site. The respective module for operation & maintenance shall be delivered and successfully test run at least three months before scheduled first synchronization of first unit.

4. e-Learning course broad requirements:

- a. The courses shall be web based and mobile based Application type. It shall run on all possible versions of web browser like Internet Explorer, Google Chrome, Firefox etc. on Laptop/Desktop and shall be Smartphone/Tablet/Mobile responsive. The Mobile responsive courses shall run on Android, Windows Mobile, Blackberry, iOS etc.
- b. The courses shall support liquid/fluid page layout so that the entire screen gets adjusted to PC, Laptop, Smartphone/Mobile, Tablet and any other display devices.
- c. Course content text shall be in English language and be associated with a voiceover in English language with Indian accent.
- d. Courses shall be SCORM (Sharable Content Object Reference Model) compliant, version 1.2 which is compatible with LMS at PMI.
- e. Each course shall have every physical and functional detail of the equipment / system supplied.
- f. Each of the e-Learning course shall be based on multiple web pages and mobile pages with multiple modules.
- g. There shall be option for self-assessment test after every course. In case the user doesn't opt for self assessment test the user shall be able to go to the next course. There shall be no restriction in no. of times for repeating the assessments. All correct answers along with the answers marked by the users shall be displayed at the end of test/quiz.
- h. If Java and Flash, as applicable are not available in the system to run the package, then there shall be a prompt message for updation of the same.
- i. Each course shall have a self-running interactive content with navigation buttons containing forward, backward, pause, bookmark and menu options in the course window.
- j. The course shall contain chapter titled 'Introduction/overview' that explains the purpose of the course.
- k. The course content shall contain descriptive text shall be factual, specific, terse, clearly worded, and simply illustrative, so that the user can understand it.

- l. The system shall provide the user with the ability to select the information with a Cursor.
- m. The course menu should contain table of content linked to concerned pages. The user shall be given the capability to access all of the functions available on the system through a menu system. This shall consist of active buttons, which shall control a hierarchy of pull down/pop up menus. Menu shall appear quickly and exist only while a selection is being made. The user shall be given the capability to position the cursor or pointer on the menu item and use pointer device such as mouse to activate the function.
- n. Every course shall contain the 3D design/drawing/exploded view/360⁰ turn around view of the equipment/system, textual description of the equipment/system and its functionality with video (as applicable), animation and audio.
- o. The users shall be able to control audio sound level associated with the courses.
- p. Drawings / text in the courses shall be scalable (Zoom In/ Out).
- q. The user shall have the capability to record a **bookmark** to mark displayed information for later recall, whenever he accesses the same course next time.

Notes:

- 1. e-learning Package of an equipment / system shall include e-learning courses for each of erection, commissioning, operation and maintenance of that equipment / system.
- 2. e-learning courses on erection, commissioning, operation and maintenance of an equipment / system shall include e-learning lessons/chapters/modules (as required) for erection, commissioning, operation and maintenance respectively of that equipment / system.
- 3. The vendor shall get the approval of one sample course from EIC before proceeding for further courses.

File Formats Supported by SPPID, SPI, SPEL & SP3D

July 16, 2014

PREPARED BY- NEHA BANSAL

BHEL-PEM/ IPDS

SMARTPLANT P&ID (SPPID)

The data import and export facilities of SmartPlant P&ID allow users to populate the system with relevant plant data, such as process data from process simulation databases based on Aspen Basic Engineering from Aspen Technologies, Inc. or equipment and line lists. The user can use to import a spreadsheet in a recognized format to either update data on existing items in the plant database or to create new items in the SmartPlant P&ID Stockpile to use for designing the P&ID.

Aspen Basic Engineering spreadsheets in either Microsoft Excel or XML format are supported. These spreadsheets include the Vessel Equipment List, Pump Equipment List, and Heat Exchanger equipment. During the import process, you can assign the stream and its associated engineering data to the pipe run.

For SmartPlant P&ID Engineering, importing from SmartSketch is not allowed.

Users can save drawings in different formats, including .pid for SmartPlant P&ID, .dwg and .dxf for AutoCAD, .dgn for MicroStation, and .pdf format. SPPID items reports can be saved in Excel worksheet format.



SMARTPLANT INSTRUMENTATION (SPI)

The SPI Import Utility provides inherent support of the following database platforms and database file formats:

- ❖ Oracle (only if you have selected Oracle as your current database platform during Setup)
- ❖ SQL Server (only if you have selected SQL Server as your current database platform during Setup)
- ❖ Sybase Adaptive Server Anywhere (only if you have selected Sybase Adaptive Server Anywhere as your current database platform during Setup)
- ❖ Microsoft Access
- ❖ .dbf files
- ❖ ASCII delimited files
- ❖ Excel worksheets
- ❖ Text files

For text files, the Import Utility uses Microsoft Text drivers (.txt and .csv files).

SmartPlant Instrumentation provides a PowerSoft Report (.psr) file viewer that enables user to retrieve, view, and manage files saved in the .psr format. Reports or specifications can be saved in .psr file format using Save As command.

SmartPlant Instrumentation also enables the users to import/export process datasheets for lines or instruments in .ipd (SmartPlant Instrumentation process data) format for use with the Process Data Editor. In this way, it allows an external party to modify the process data outside of SmartPlant Instrumentation. The .ipd format allows to include multiple tags in a single file.

SmartPlant Instrumentation supports saving specification datasheets in the following formats:

- ❖ .isf (only specs whose item type is Instrument)
 - ❖ .psr (any single-tag spec, multi- tag spec, or a non-instrument spec)
 - ❖ .xls (only specs whose item type is Instrument)
- External Editor (supplied with the SmartPlant Instrumentation software package)- Supports working with spec data saved in .isf format, allows to convert .psr files to .isf format, and import data from .isf files to SmartPlant Instrumentation.
 - InfoMaker- Supports working with spec data saved in .psr format, does not allow to import data from .psr files. First need to convert .psr files to .isf format in External Editor.
 - Excel- Supports working with spec data saved in .xls format, does not allow to import data from Excel files back to SmartPlant Instrumentation.

SMARTPLANT ELECTRICAL (SPEL)

The SPEL Import Manager allows to import data to SmartPlant Electrical from external data files and various database platforms, such as

- ❖ Microsoft Access
- ❖ Microsoft SQL Server
- ❖ Oracle
- ❖ Excel worksheets

Import Manager provides the import of electrical data, association data, select list items, and lookup table values.

SmartPlant Electrical supports the major commercial databases and outputs drawings in common CAD formats including SmartSketch, and generates reports in Microsoft Excel format (For creating a report in Excel, file format of the blank template is XLSM for Office 2007 and Office 2010, for Office 2003, the file format is XLS.) SmartPlant Schematics can be imported and exported to an AutoCAD or MicroStation document.

The ETAP- SmartPlant Electrical interface allows to import ETAP data to SmartPlant Electrical and export data to ETAP. When exporting data to ETAP user can publish single electrical analysis SLDs or a complete set of all the existing electrical analysis SLDs in one set. When retrieving ETAP data, user can retrieve a particular ETAP one-line diagram or publish all project data to SmartPlant Electrical.

SMARTPLANT 3D (SP3D)

External reference 3D models for importing in SP3D can be of the following nature:

- ❖ Smart 3D models published in ZVF and XML format.
- ❖ PDMS models published to RVM and ATT format.
- ❖ PDS model data
- ❖ Plain graphic file formats from other tools such as .dgn files.

User can import 3D model data in SP3D from XML files. The files are created in two ways—XML files generated using the PDS Model Data Exporter, or XML files that are written in XMpLant format. PDS Model Data Exporter exports PDS data into XML files in Intergraph Schema. XMpLant is an industry standard (ISO15926), neutral format that is used to import third-party software data.

PDS Model Data Exporter

-  Creates XML data that is compatible with the Intergraph (Ingr) schema.
-  Mapping files for Intergraph schema XMLs are written in Excel workbooks.
-  The PDS Model Data Exporter utility is delivered separately from SmartPlant 3D.

XMpLant-formatted XML

-  This XML corresponds with XMpLant schema.
-  Mapping files for XMpLant schema XMLs are written in XML format.
-  Also added XMPlant to bring PDMS data into SmartPlant 3D

SmartPlant 3D Model Data can be exported to SmartPlant Review files (ZVF, VUE and XML files) or CAD (SAT) files.

The file types for each SP3D drawing type are described in the following table.

Drawing Type	Target File Types
MicroStation	MicroStation (*.dgn)
Piping Isometric Drawings	Shape2DServer (*.sha) PCF file (*.pcf)
NOTES - For Piping Isometric Drawings, the name of the drawing document becomes the prefix for all of the files. For example, if the drawing document name is <i>My_Pipeline</i>, the saved file names become: <i>My_Pipeline.sha</i>, <i>My_Pipeline.pcf</i>, and so on. - For Piping Isometric Drawings, a file is created for each sheet in the drawing with [<i>drawing name</i>][<i>sheet name</i>] as the filename. For example, if the drawing <i>My_Pipeline</i> contains Sheet1 and Sheet2, two files will be saved with the names <i>My_Pipeline_Sheet1</i> and <i>My_Pipeline_Sheet2</i>.	Both (*.sha & *.pcf) All Files (*.*) - Includes all .sha and .pcf files, as well as all enabled supplementary files. MicroStation (*.dgn) AutoCAD (*.dxf) AutoCAD (*.dwg)
Spreadsheet Reports	Worksheets (*.xls)
Composed Drawings, Volume Drawings, and Orthographic Drawings by Query	Shape2DServer (*.sha) MicroStation (*.dgn) AutoCAD (*.dxf) AutoCAD (*.dwg)

SmartPlant Interop Publisher

SmartPlant Interop Publisher provides the ability to work with a wide range of datasets from Intergraph and non-Intergraph formats such as PDMS and XMpLant.

Different data sources can be:

- ❖ PDS
- ❖ PDMS
- ❖ Tekla
- ❖ AutoCAD
- ❖ MicroStation

Company Formats

Application	Graphic File	Data File	SmartPlant Interop Publisher License	Notes
Intergraph				
Smart 3D v2009.1 and above in an integrated environment	ZVF	XML	No	A license of SmartPlant Interop Publisher is not needed to reference this format in Smart 3D
Smart 3D v2009.1 and above in a non-integrated environment	VUE	XML	No	
Smart 3D Pre v2009.1	VUE	XML	No	
Smart 3D using SmartPlant Review Direct	VUE	MDB2	Yes	
PDS, FrameWorks® Plus	DRI, DGN	DRV, TAG	Yes	
ISOGEN® (IDF, PCF, POD)	IDF, PCF, POD	IDF, PCF	Yes	

CADWorx Equipment, CADWorx Plant, CADWorx Plant Professional	DWG	DRV	Yes	
AVEVA				
PDMS	RVM	ATT, DRV	Yes	
Autodesk				
AutoCAD v2011 and earlier	DXF, DWG	DRV	Yes	AutoCAD proxy-enabled objects are supported.
Bentley				
MicroStation J MicroStation V8 MicroStation V8i MicroStation XM AutoPlant PlantSpace i-model	DGN, PRP, DTM	DRV	Yes	Data limited to MicroStation level and tag information. Requires MicroStation. SmartPlant Interop Publisher supports data files containing smartsolids that were created or reformatted in MicroStation V8.
Industry-Standard Formats				
Open Standards				
Industry Foundation Classes (IFC)	IFC	DRV	Yes	
XmPLant	XML	DRV	Yes	

CIS/2 (design model data from products such as SP3D, SDS/2, StruCAD, Tekla Structures, and ProSteel, among others)	STP	DRV	Yes	
Mechanical Applications				
Products exporting ACIS (such as SolidEdge, SolidWorks, Pro/Engineer)	SAT	N/A	Yes	Graphics only
Products exporting IGES; Smart 3D using SmartPlant Review Direct	IGES, IGS	N/A	Yes	Graphics only
Generic Formats				
System	Format		Notes	
BOCAD	CIS/2		SDNF exports can be converted into CIS/2 FrameWorks Plus.	
SACS	CIS/2 or ACIS (SAT)		SDNF to CIS/2 Conversion via FrameWorks Plus. Export SAT directly from SACS	
AutoPLANT, PlantSpace	AutoCAD, ISOGEN			
ANSYS Workbench	ACIS (SAT)			
SolidEdge, SolidWorks, AutoCAD Inventor, CREO Parametric (formerly Pro/Engineer), Siemens, Catia	ACIS (SAT)			

SmartPlant Spoolgen, SmartPlant Isometrics	ISOGEN	
JT Open	SAT	JT Open to SAT conversion by Theorem
Speedikon, Tribon M2 / M3	MicroStation	
ShipConstructor	AutoCAD	Graphics only

Notes:

- ❖ Smart 3D applications require a license of SmartPlant Interop Publisher for conversion and reference of all formats.
- ❖ Laser scanning applications require the SmartPlant Review Point Cloud module to support the display of laser data inside SmartPlant Review.
- ❖ For ACIS and IGES files, the DRV and MDB2 files generated by SmartPlant Interop Publisher during translation are created with empty label data. This can also apply to MicroStation V7 DGN files that do not have tag data.
- ❖ Smart 3D applications require a license of SmartPlant Interop Publisher for translation and reference of all foreign or third-party formats.
- ❖ Both SmartPlant Review and Smart 3D applications require licenses from Leica, Z+F or Quantapoint to display laser data.

1098305/2022/PS-PEM-MA



TECHNICAL SPECIFICATION FOR
COAL HANDLING PLANT
RUN-OFF WATER TREATMENT SYSTEM
3X800 MW PATRATU STPP EXT.PH-I

BHEL DOCUMENTS NO.: PE-TS-434-157-A001

VOLUME-II-B

SECTION-D

REV. NO. 00

DATE:

FORMAT FOR OPERATION AND MAINTENANCE MANUAL

1098305/2022/PS-PEM-MAA



TECHNICAL SPECIFICATION FOR
COAL HANDLING PLANT
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3X800 MW PATRATU STPP EXT.PH-I

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VOLUME-II-B

SECTION-D

REV. NO. 00

DATE:

FORMAT FOR OPERATION AND MAINTENANCE MANUAL

Project name :
Project number :
Package Name :
PO reference :
Document number :
Revision number :

Sl.no. & Sections	Description	Tick (√)if included in Manual			Remarks
		Yes	No	Not Applicable	
1.	<u>Cover page</u>				
1.1	Project Name				
1.2	Customer/consultant Name				
1.3	Name of Package				
1.4	Supplier details with phone, FAX ,email address , Emergency Contact number				
1.5	Name and sign of prepared by , checked by & approved by				
1.6	Revision history with approval Details				
2.0	<u>Index</u>				
2.1	showing the sections & related page nos All the pages should be numbered section wise				
3.0	<u>Description of Plant/System</u>				
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 , Actual photograph of items/system (Drawings of A2 & bigger sizes are to be attached in the last)				
3.7	Single line/wiring diagrams				
3.8	Control philosophy /control write-ups				
4.0	<u>Commissioning Activities (if not covered in separate document i.e. erection manual, commissioning manual)</u>				
4.1	Pre-Commissioning Checks				
4.2	handling of items at site				
4.3	Storage at site				
4.4	Unpacking & Installation procedure				
5.0	<u>Operation Guidelines for plant personal/user/operator</u>				
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.				

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**TECHNICAL SPECIFICATION FOR
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5.2	Start up, normal operation 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	<u>Maintenance guidelines for plant personal</u>				
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. Storage/handling requirement of consumables/self-life.				
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.				
8.0	List of reference documents				
9.0	Binding as per requirement				

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.

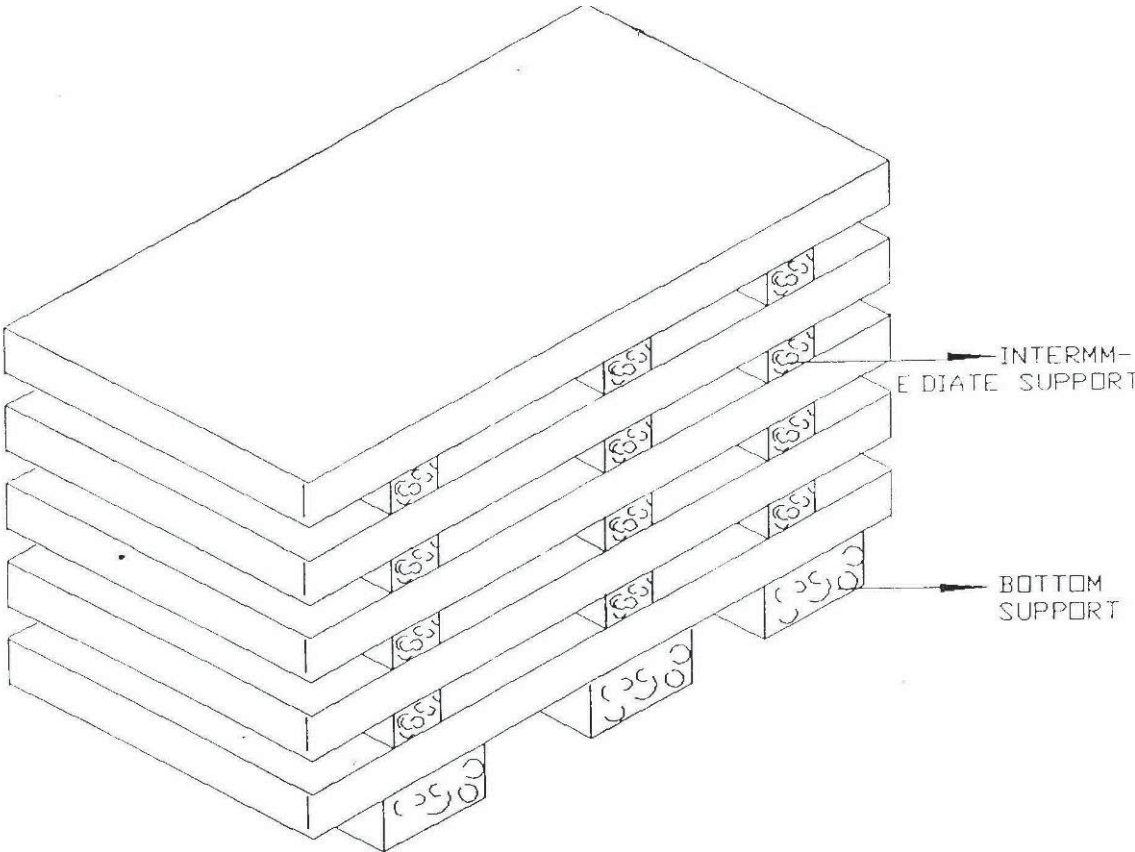


Figure – 1 – PLATE STACKING ARRANGEMENT

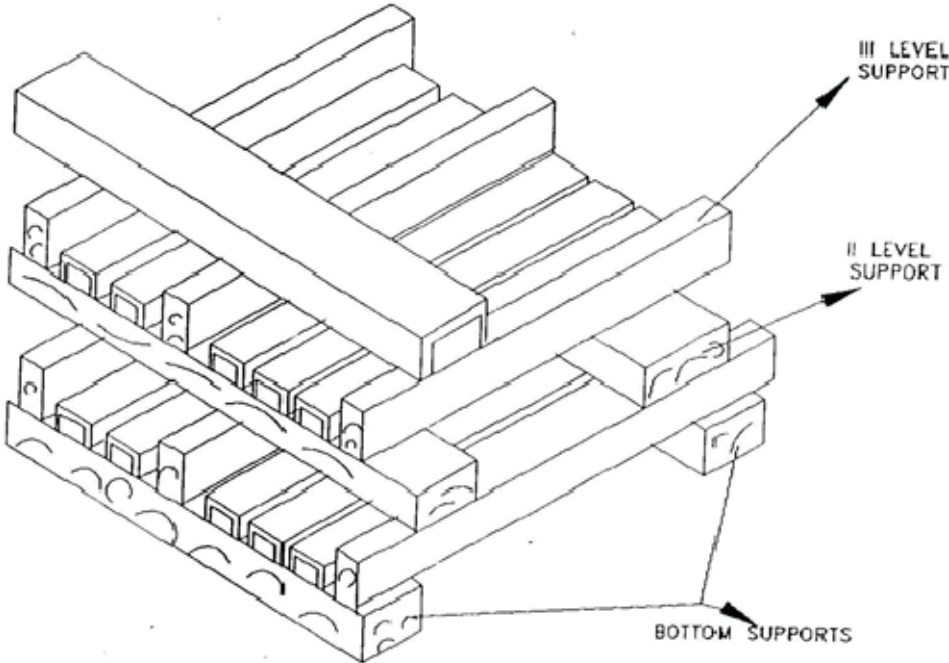


Figure – 2 – STRUCTURAL STEEL STACKING ARRANGEMENT

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BHEL DOCUMENTS NO.: PE-TS-434-157-A001	
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**TECHNICAL SPECIFICATION FOR
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LIST OF DOCUMENTS TO BE SUBMITTED ALONG WITH BID

1.0 Bidder to furnish following documents/information along with the bid (For Electrical And C&I Please Refer The Respective Section Of The Specification).

- Deviation if any strictly in the enclosed Schedule of deviation with cost of withdrawal only with mention of specification clause for which deviation is being asked. (Stamped & Signed). In case of No Technical Deviation, bidder to furnish the same format stating "No Deviation" duly Stamped & Signed.
- Compliance certificate.(Stamped & Signed)
- Schedule of Declaration. (Stamped & Signed)
- Un Price Schedule duly filled in. (Stamped & Signed)
- List of Start-up & commissioning spares if any. (Stamped & Signed)

Any other documents submitted by bidder except as asked in the bid's specification shall not be evaluated & considered as null & void.

NOTES:

- 1) Any item/work either supply of equipment or erection material which have not been specifically mentioned but are necessary to complete the works for trouble free and efficient operation of the plant shall be deemed to be included within the scope of this specification. The bidder without any extra charge shall provide the same.
- 2) All drawings/documents shall be approved by BHEL/Customer during detailed engineering stage. Successful Bidder shall comply with the comment of the customer/BHEL without any price & delivery implication.

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REV. NO. 00

DATE:

COMPLIANCE CUM CONFIRMATION CERTIFICATE

The bidder shall confirm compliance with following by signing/ stamping this compliance certificate and furnishing same with the offer:

1. The scope of supply, technical details, construction features, design parameters etc. shall be as per technical specification & there are no exclusions/ deviations with regard to same.
2. QP/ test procedures shall be submitted in the event of order based on the guidelines given in the specification & QP enclosed therein.
3. QP will be subject to BHEL/Customer approval in the event of order & 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. The charges for 3rd party inspection (Lloyds, TUV or equivalent) for imported components shall be included in the base price of the equipment by the bidder.
4. All drawings/data – sheets etc. to be submitted during contract shall be subject to BHEL/Customer review/ approval. GA drawings, as submitted with offer at tender stage are for reference purpose only and shall be subject to approval during contract stage.
5. There are no other deviations with respect to specification other than those furnished in the 'Schedule of Deviations'.
6. The offered materials shall be either equivalent or superior to those specified. Also for components where material is not specified it shall be suitable for intended duty, materials shall be subject to approval in the event of order.
7. The commissioning spares (if any) are supplied on 'As Required Basis' & prices for same included in the base price (If bidders reply to this is "No commissioning spares are required" and if some spares are actually required during commissioning same shall be supplied by bidder without any cost to BHEL and Customer).
8. All sub vendors shall be subject to BHEL/CUSTOMER approval.
9. Any special tools & tackles, if required, shall be in bidder's scope.
10. Performance guarantee test parameters shall stand valid till the satisfactory completion of Performance guarantee test and its acceptance by BHEL and Customer.

1098305/2022/PS-PEM-MAK



TECHNICAL SPECIFICATION FOR
COAL HANDLING PLANT
RUN-OFF WATER TREATMENT SYSTEM
3X800 MW PATRATU STPP EXT.PH-I

BHEL DOCUMENTS NO.: PE-TS-434-157-A001

VOLUME-III

SECTION-

REV. NO. 00

DATE:

PRE BID CLARIFICATION SCHEDULE

All clarification from the Technical Specification shall be filled in by the BIDDER clause by clause in this format only.

VOLUME	SECTION	CLAUSE NO.	PAGE NO.	SPECIFICATION REQUIREMENT	CLARIFICATION	REASONS FOR CLARIFICATION

PARTICULARS OF BIDDER / AUTHORISED REPRESENTATIVE				COMPANY SEAL
NAME	DESIGNATION	SIGNATURE	DATE	

1098305/2022/PS-PEM-MAX



**TECHNICAL SPECIFICATION FOR
COAL HANDLING PLANT
RUN-OFF WATER TREATMENT SYSTEM
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BHEL DOCUMENTS NO.: PE-TS-434-157-A001

VOLUME-III

SECTION-

REV. NO. 00

DATE:

SCHEDULE OF DECLARATION

I certify that all the technical data and information pertaining to this specification are correct and are true representation of the equipment/system covered by our format proposal number Dated and there is no deviation to the specification.

I hereby certify that I am duly authorized representative of the Bidder's company whose name appears above my signature.

Bidders Company Name

Authorized Representative's
Signature

Name

Bidder's Name

The bidder hereby agrees to fully comply with the requirements and intent of this specification for the price indicated.

THIS IS A PART OF TENDER TECHNICAL SPECIFICATION PE-TS-434-157-A001 R00

 <u>SCHEDULE OF DEVIATIONS WITH COST OF WITHDRAWAL</u>									
<u>PROJECT:- 3X800 MW PATRATU STPP EXT.PH-I</u>									
<u>COAL HANDLING PLANT</u>									
<u>RUN-OFF WATER TREATMENT SYSTEM</u>									
<u>TENDER ENQUIRY REFERENCE:-</u>									
<u>NAME OF VENDOR:-</u>									
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
<u>TECHNICAL DEVIATIONS</u>									
<u>COMMERCIAL DEVIATIONS</u>									
<u>PARTICULARS OF BIDDERS/ AUTHORISED REPRESENTATIVE</u>									
NAME		DESIGNATIONS				SIGN & DATE			
<u>NOTES:</u>									
1. 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.									
2. For directly dispatchable items, cost of withdrawal of deviation will be applicable on the basic price including taxes, duties & freight.									
3. All the bidders have to list out all their Technical & Commercial Deviations (if any) in detail in the above format.									
4. Any deviation not mentioned above and shown separately or found hidden in offer, will not be taken cognizance of.									
5. 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.									
6. Bidder shall furnish price copy of above format along with price bid.									
7. The final decision of acceptance/ rejection of the deviations quoted by the bidder shall be at discretion of the Purchaser.									
8. Bidders to note that any deviation (technical/commercial) not listed in above and asked after Part-I opening shall not be considered.									
9. 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.									
10. Any deviation mentioned in priced copy of this format, but not mentioned in the un-priced copy, shall not be accepted.									
11. 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.									
12. 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.									
13. In case nature of cost of withdrawal (positive/negative) is not specified it shall be assumed as positive.									
14. In case of discrepancy in the nature of impact (positive/ negative), positive will be considered for evaluation and negative for ordering.									